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EXPLORING INFORMATION SERVICES AND LIBRARY TECHNOLOGIES

(Proceedings of the 8th I-LISS International Conference on Exploring Information Services and Library Technologies for the Next Generation – ICEISLT- 2024)

Volume - II

Editor-in-Chief
Prof. Dong - Geun Oh

Editors

Prof. B. Ramesh Babu
Dr. P. Rajendran

Associate Editors

Dr. S. Vivekanandhan
Dr. N. Siva

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FOREWORD



Prof. Dr. Beongkee Lee
Professor
Dept. of Library and Information Science
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I am happy to contribute the Foreword for the pre-conference proceedings of the 8th I-LISS International Conference on "Exploring Information Services and Library Technologies for the Next generation" being organized by the Central Library SRM Institute of Science and Technology (SRM IST), Chennai in association with the International Library and Information Science Society (I-LISS) during 19-20 July 2024 at Kattankulathur campus of SRM IST. I profusely thank the organizers and especially I-LISS President Prof. Dong-Geun Oh of Keimyung University, South Korea, Dr B Ramesh Babu, Co-President, I-LISS and Dr P Rajendran, Secretary- General, I-LISS for inviting me to write the Foreword to the volume.

I understand that the host institute is the head- quarters of I-LISS and has organized a number of conferences / workshops in the last two decades. The theme of the conference is reflecting the contemporary issues in the Libraries in the context of emerging technologies and its impact on the next generation of LIS education and the provision of information services.

On perusing the table of contents, I understand that the pre-conference proceedings include about 119 research papers which have been grouped under nine sub-themes as Emerging Technologies and Innovation, Artificial Intelligence and Libraries, Knowledge Organisation and Technology, LIS Repositories and Security, Informetrics and Metric Studies, Future of LIS, LIS Services and Practices, LIS Education, Information Seeking Behaviour & User Studies.

The contributors representing 9 countries such as South Korea, Thailand, Singapore, Vietnam, Philippines, Qatar, Nigeria & Czech Republic including India. I understand that the contributors are experienced LIS faculty and also practicing professionals including researchers. Their experiences are reflected in the contents of the papers presented in this volume. I wish this volume would pave the way for new knowledge, innovative approaches and transformative ideas that will shape the future of LIS in the context of emerging technologies.

I thank all the contributors for sharing their intellectual thoughts and rich experiences. The relentless efforts of the Organizing Secretary and his team of this conference deserve appreciation. The team of Editors has endeavored much in maintaining the quality of the publication. I am of the opinion that this volume is certainly a good and valuable addition to the LIS literature.

I congratulate the organizers of this conference on choosing a timely and appropriate topic. I also thank the paper presenters for sharing their thoughts and experiences on such an important subject. I hope the two-day international conference would discuss, debate and deliberate these issues that would benefit the library community. I am sure the I-LISS team, the delegates and the invitees will find this platform more conducive environment for their brain storming technical sessions and generate feasible and workable resolutions for the development of the profession in the direction of providing information services especially in the present post-COVID times and in the utilization of emerging technologies suitable for the next generation of the professionals.

I wish the Conference a Grand Success

Prof. Dr. Beongkee Lee

PREFACE

The modern librarianship is shaped by a diverse, highly skilled, and qualified workforce that is better equipped to uphold and advance the profession's fundamental principles. Users of today interact with technology in an environment that is characterized by rapid innovation, strong teamwork, and unparalleled individual contribution via digital media such as social media and e-publishing. Because of the impact of developing technologies, libraries have seen substantial changes in terms of resources and services in recent years. Technology is growing more and more interwoven with society as it continues to evolve. The way we live, work, study, and communicate is changing as a result of the Internet, World Wide Web, mobile phones, digital television, and many other new electronic information and communication technologies (ICTs). Will the way we manage our lives be impacted by technology, and how will it impact the management of libraries? The employment of new, cutting-edge technologies in libraries is one of the biggest developments we anticipate. An international conference has been contemplated to address information services supply for the next generation libraries in the context of emerging library technologies, taking into account these advancements and their effects on libraries. The theme of the International Conference is on "Exploring Information Services and Library Technologies for the Next generation" scheduled during 19-20 July 2024.

A total of about 119 papers have been included in the pre-conference proceedings grouped under the following sections:

Section I	Emerging Technologies and Innovation
Section II	Artificial Intelligence and Libraries
Section III	Knowledge Organisation and Technology
Section IV	LIS Repositories and Security
Section V	LIS Services and Practices
Section VI	Future of LIS
Section VII	Informetrics and Metric Studies
Section VIII	LIS Education
Section IX	Information Seeking Behaviour & User Studies

Articles have been contributed by the distinguished and experienced Library and Information Science professionals, both teaching and practicing, Computer Science professionals, research scholars from various countries such as South Korea, Thailand, Singapore, Vietnam, Qatar, Philippines, and Nigeria & Czech Republic including India.

This conference provides a platform to all stakeholders in the field of libraries and information professions with the objective to promote innovation, augmentation, and utilization of ICT technologies to provide right information to the right user at the right time in a right way.

The Editors thank and congratulate all the contributors and resource persons who have responded spontaneously by contributing the articles in spite of the hardships prevailed during the post- Covid Pandemic environment. Further the Editors states that the views expressed in these papers are of the respective authors only. The I-LISS, SRM IST, Keimyung University, JISTaP or the Editors are no way responsible for the thought content of the articles. The Editors take this opportunity to thank the Organizers of this conference for entrusting the Editorial responsibility of the pre-conference volume.

The Editors profusely thank the Chief Patrons Dr T R Paarivendhar, Founder Chancellor, Mr Ravi Pachamuthu, Pro-Chancellor (Admin), and Dr P Satyanarayanan, Pro-Chancellor (Academic), Patrons Dr C Muthamizhchelvan, Vice-Chancellor and Dr S Ponnusamy, Registrar of SRM IST and other officers for giving permission to I-LISS to host this conference and making this mega event more remarkable in the annals of Librarianship.

The Editors record their deep sense of gratitude and thanks to Prof. Dong-Guen Oh, Professor and Chairman, Keimyung University, South Korea, and President of I-LISS for his continuous support both academically, professionally and also financial support.

The Editors also thank Prof. Dr Beongkee Lee, Professor & Dean, Department of Library and Information Science, Kongju National University, South Korea who contributed the Foreword to this pre-conference volume.

The Editors have taken all the possible efforts to maintain the standard and quality of the conference volume without affecting the thought process and ideas of the contributors. Finally, the Editors thank all the organisers, international and national committee members for their support and encouragement and make this international conference a successful event. It is hoped that, this pre-conference volume will be a valuable addition to the literature in Library and Information Science and Computer Science.

Finally, the printers M/s. New Pioneer Printers, Royapuram, Chennai deserves special thanks for undertaking the job systematically and completing on time.

It is earnestly hoped that the deliberations at this international conference would be promising and rewarding for the delegates and more particularly the pre-conference volume would be a useful source of reference to the LIS professionals including students, faculty and researchers. Editors/ Organisers wishes to have pleasant and stimulating interactions and fruitful meeting with the delegates during the conference. Let us work collectively to explore information services and library technologies suitable for the next generation LIS professionals and make the Information Science profession / Librarianship a thriving, dynamic and noble profession to achieve the blissful and bright future.

12-07-2024
Chennai

Editors

CONTENTS

Forward iii

Preface v

VOLUME - 1

Section I - Emerging Technologies and Innovation

1 Information Ecosystems: Trends and Strategies for Libraries 2
Krishnamurthy M & Saurabh Kumar Rai

2 Development of a Thai Speech Synthesis Model Using Tacotron2 13
Saengkaew, Chakkrit & Talasee, Jinnawat

3 Application of Emerging Technologies in Agricultural University Libraries in India 19
Veeranjaneyulu, K. (Invited Talk)

4 Beyond the Shelves; Tomorrow's Libraries at the nexus of Emerging Technologies 31
Abitha Shekar

5 Cloud Computing & Its Application in Libraries: An Overview 39
Venkateswarlu, Y Ch

6 ChatGPT: An Opportunity for Library Professionals 47
Smruti Rekha Swain & Puspanjali Jena

7 Blockchain-Enabled Smart Library Model for Secured Library Operations in Digital Environments 55
Manjari A, Uma Swarna, Palanivel K & Prabakaran T

8 Assessment of Knowledge, Perceptions, and Challenges on the Use of Artificial Intelligence Tools among Academic Fraternity 71
Panduranga Swamy M, Gnanasekaran D & Vineeta Jain

9 The Transformative Power of AI: Reimagining Libraries in the Digital Age 81
Seshaiah O

10 Enhancing Research with AI: Tools for Improved Efficiency and Accuracy 89
Vidya Vinod, Jeyshankar, R. & Seeja K. R

11 Advancements and Challenges in Scholarly Publishing within Artificial Intelligence Ecosystems 99
Mandira Bairagi & Shalini R Lihitkar

12 Evaluation of outcomes and impacts of AI tools in Academic Libraries 109
Sethukkarasi.R & Yesu Nesa Joy Singh P.J

13 Implementation of Radio Frequency Identification (RFID) Technology in Academic Libraries - A Case Study of Stella Maris College Library 119
Mahalakshmi M

14	Utilization of emerging technologies in library services at the Technical Campus of Karaikudi *Muthuvennila S, Anandu G, Muthuman M & Harikanan P*	127
15	Use of Electronic Resources through Mobile Technology in Academic Libraries *Geetha. N & Kothainayaki. S*	137
16	Mobile Technology in Libraries: Applications, Services, Benefits and Drawbacks *Anandu, Ganesamoorthy & Selvakamal*	145
17	Implications of Chat GPT in Academic Libraries *Srilakshmi, B, Grace, M & Madasami, R.*	153
18	Implementation of Self-services system in University Central Library, SRMIST: A Technical study *Senthilkumar M K S*	163

Section II - Artificial Intelligence and Libraries

19	The Determination and Benefits of Artificial Intelligence-Based Utility Tools for Academic Research A. Study *Bagavathi. A*	171
20	Emergence of Generative AI - Metamorphosing libraries from a theoretical construct into an immediate reality *Deepalakshmi. R & Lakshmi V*	183
21	Impact of Artificial Intelligence on Future Libraries *Shivarama. J, Sneha Kamble & Sunil M V*	197
22	Impact of Ethical Issues of Artificial Intelligence on Libraries: Opportunity and Challenges *Mahapatra, R K & Shri Priya Ranjan Mahalik*	205
23	Artificial Intelligence Transforms the Library: Enhancing Services and User Experience *Ganesh P & Vivekanandhan S*	211
24	Augmenting Education with AI: Exploring AI-Powered Tools for Classroom Support *Vidya Vinod, Seeja. K. R & Jeyshankar R*	221

Section III - Knowledge Organization and Technology

25	Ontological Biblio Representation in Knowledge Organization: A Study *Krishnamurthy M, Ananya H V & Yashaswini H.L.*	231
26	Application of Metaverse in Manuscript Libraries: A Case Study of Mahamahopadhyaya Dr. U. V. Swaminatha Iyer Library, Chennai *Kala N & Baskar K*	241

27 Application of Security Mechanism with feature selection techniques in Internet of Things based library digital infrastructure environment using Machine Learning algorithms 249
Daksh Rupani, Granth Pal, Kushagra Soni, Suraj Kumar & Kishoreraja, P C

28 A Study on academic libraries: transitioning from traditional to digital formats incorporating cutting-edge ICT technologies into their daily operations 263
Ramakrishna N, Srinivasa Rao V, Jagadeesh K & Baburao P

29 Transforming Library Services with Data Analytics: Strategies and Outcomes 273
Ahammed & Mini Devi B

30 Development of Monographs Management System 281
Khushboo Kumari & Bansal, Alka

31 A review of studies on how academics and researchers use social networking platforms for learning - *Krishnamoorthy P & Raja L. A* 287

32 Comparative Analysis of Academic Social Networking Platforms in the Digital Era 293
Vikas Kumar & Krishnamurthy, M

33 Navigating Double Edged Sword: Uncovering The Hazards of AI Enhanced Social Networking Sites that Impact Library Usage 305
Meena Priya Dharshini, P, Gnancy Subha G & Dharuman, Muthumathi

34 The Role of Fact-Checking Tools in Countering Misinformation 313
Vrindha K A & Rekha R V

35 Financial Implications for University Libraries: A Study on Digital Library and Automation 327
Rajini Chagantipati & Venkat Ragavender B

Section – IV LIS Repository & Security

36 Applying Text Analysis Tools in Thai Digital Archive 337
Namtip Wipawin & Duangkaew Ngernpoolsap

37 Proactive Strategies of Libraries for Addressing the Digital Divide among People with Disabilities 345
Kim, Hyunsoo & Oh, Hyo-Jung

38 Digital Transformation Readiness Among Public Librarians: A Case Study In Vietnam 355
Huyen, Ngo Thi

39 Awareness and Use of Electronic Thesis and Dissertations with special reference to Guidelines of Uploading and Copy Right Regulations: A Study of Scientific Community Library Users of Tamilnadu University Libraries - 369
Bagavathi, A

40 Intellectual Property Rights and Copyright In Digital Environment 381
Ramesh R & Asok Kumar, S K

41 Role of Digital Preservation and Institutional Repositories in the Age of Open Access for Innovative Research 389
Jenny, Prisca Barla & Shivarama, J

42 Institutional Repositories and Metadata 403
Yashashwini, H L

43 Library 3.0: Connected Devices Powering Modern Information Hubs 409
Abhijith R S & Mini Devi B

44 Disaster and Digital Preservation of Print Collections for Future Library Collection Building: A Study in University Libraries of Assam. 415
Gohain, Anjan & Tariang, Bikika Laloo

45 The Evolving Landscape of Digital Preservation: Addressing Cyber Security Threats in the Archival Context 425
Greeshma, S S & Alka Raj G

46 Preservation and Conservation Measures and Techniques for Manuscripts and Rare Materials in Libraries 435
Goswami, Sadhana & Ahmed, Zabeen

47 Overcoming Barriers in Digital Libraries and Driving Digital Transformation: Strategies for Success 443
Nakum Jignesh K & Vipul Banker

48 Mastering Data Carpentry for Open Access Publications Unlocking the OA Research Potential 451
Sudhier K. G.

Section V - LIS Services and Practices

49 Experiences as an International Open Access Journal in LIS: The Case of 11 Years of JISTaP 463
Oh. Dong-Geun Kim, Eungi & Yeo, Jisuk

50 Libraries as Catalyst for Social Change in Building Innovative Real-Time Libraries 475
Suresh Jange & Savitri Krishna

51 Research Clinic Support Services In Federal University Dutsin-Ma Library, Katsina-Nigeria: A Composition and Way Forward 491
Hamza Musa Ukashatu, Ladan Abubakar, Hassan Usman & Sirajo Danzangi Abubakar

52 The Current Status and Future Directions of Digital Inclusion Services for the Elderly in Public Library 507
Baek, Ji-Won & Oh, Hyo-Jung

53 A Survey on User Usage and Satisfaction Levels with regard to Digital Resources and Services in Veterinary Science College Libraries of Andhra Pradesh 515
Srinija, Bathinapatla & Doraswamy, M

54 Libraries as Catalysts for Sustainable Development: Advancing the SDGs through Access, Education, and Community Engagement 525
Hemavathi B N

55 Big Data and Information Services in Academic Libraries: An Insight 533
Sukula, Shiva Kanaujia (Invited Talk)

56 An Analytical Study of Collection Development and Management: Special Reference to Medical College of Indore Division 543
Hasina Begum & Suresh Babu, M

57 Collection Development in Autonomous College Libraries: A Special reference to Government Degree Colleges in Andhra Pradesh, India. 559
Md. Gouse Riajuddin

58 Building Library Collection for Future 571
Ashtamy, L & Mini Devi, B

59 Impact of Traditional Art Education on Societal Development: Insights from Kerala Kalamandalam 579
Suja.K

60 Libraries as Protagonists of Progress in Achieving Sustainable Development Goals: A 2030 Narrative 587
Gone Rangappa Naidu & Keshava

VOLUME - II

Section VI - Future of LIS

61 Improving the Efficiency of Content-Based Image Retrieval using Deep Supervised Learning with Locality Sensitive Hashing 601
Talasee, Jinnawat & Nilati, Patorn

62 Northeastern Thai Silk Pattern Classification Using Deep Learning with SWIN Transformer 611
Saengkaew, Chakkrit

63 Literature Review on Changes in Librarian and Information Professionals Skills in the post-COVID-19 Era 619
Kandawan Kunanonvithaya, Rungtiwa Klibngern, Sakon Muangsun & Jutatip Chanlun

64 Assessing the Skills, Knowledge and Attributes required for LIS Professionals in the Digital Environment 627
Geetha N & Babusankar S.

65 Transmogrification of Knowledge: Libraries Morphing for the Future 637
Nazar, Shinsa & Mini Devi B

66 Government Initiatives Towards Virtual Learning With Special Reference To Kerala 643
Abique, Mohammed & Alok, V N

67 Machine Learning - The Prospects for Human life 653
Dhanalakshmi, S

68 The Transmogrification of Libraries; adapting to digital dynamics 661
Abitha Shekar

69 Impact of Ranganathan's Five Laws to DBT Research Institutions and its Libraries 671
Lal D. D

70 The Role of Libraries in Traditional Learning and Virtual Learning Environments 683
Swetha, R

71 Skills and Competencies for new Era Librarians 691
Prabu,R & Sujatha, R

Section VII - Informatics and Matric Studies

72 Towards The Realization of Sustainable Development Goals (SDG) Through Health / Medical Informatics 699
Ramesh Babu, B & Butdisuwan, Sujin (Invited Talk)

73 Evaluating Paid and Open access articles published in Scientometrics: A Case Study 713
Siva N, Rajendran P & Vishnu Prasad N

74 Visualizing Research Trends in Environmental Science at The Central University of Himachal Pradesh: A Bibliometric Analysis of Cited Keywords 723
Muruli, N & Harinarayana, N.S

75 Global Publications on Heat Waves: A Scientometrics Analysis 737
Iranna M. Shettar, Manjunath Kaddipujar & Gururaj S. Hadagali

76 Retraction in Neuroscience Research Papers of G20 Countries in Scopus Database 751
Hima K & Jeyshankar R

77 Analysis of the Literature in the Field of Pulmonary Tuberculosis 765
Ramakrishnan, Ravi Sankar G & Thavamani K

78 Bibliometric Analysis of the Scientific Research on Information Literacy: A Global Perspective 783
Ravichandran P, Ramesh R & Abraham Prakash

79 A Social Network Approach to Scientometrics 797
Nishavathi E

80 Evaluating Digital Inclusivity: Accessibility Assessment of Library Websites of Central Universities in India 809
Arya Asok A.R & Rekha R V

81 The Role of Elsevier in University of Kerala's Scholarly Evolution: A Scientometric Perspective 821
Rajesh Kumar, K & Padma P

82	Uncovering the Online Audience of Pondicherry University Research: A Study Based on Mendeley and Altmetrics *Ghazzali N N & Sevukan, R*	835
83	Bibliometric Analysis of KL University's Doctoral Theses in Mathematics through INFLIBNET: Shodhganga *Sai Prasad, G & Dhanalakshmi, B*	849
84	Research productivity in Expert system literature during 2014-2023 with HitsCite : A Bibliometric approach *Hemavathy. C & Prabhu R*	855
85	Ph.D. Theses of Chemical Engineering Awarded the Universities in Andhra Pradesh: A Bibliometric Study *Kodanda Ramaiah, Kangundi and Surendra Babu, K*	867
86	Half a Century of Machine Learning: A Scientometric Analysis (1972-2022) *Muthuraj,A & Bakkiyaraj, N*	875
87	Scholarly Impact of University faculty Publications on Academic Social Networking Sites: A Special Reference to Research Gate *Mahalakshmi K R & Rajendra Babu, H*	887
88	Big Data in Libraries its Research Trends between 2001-2020: *Das, Jitu Mani & Amrita Devi*	895
89	Mapping Growth Trends and the Global Landscape of Millets Research: A Publication Analysis (2000-2023) *Anandraj K.C& Aravind, S*	909
90	Topic Modelling and Bibliometric Approach of Strategic Management in Academic Libraries Research *Hazarika, Rima & Sudhier, K. G*	921
91	Global Research on Health Literacy: A Bibliometric Analysis *Rahul K.P & Rekha R V*	939
92	NIRF India Rankings 2023: A Study with Special Reference to Tamil Nadu State Universities - *Mohanathan, P & Radhakrishnan, S*	949
93	Digital Information Services in the Universities in Kerala: A Webometric Analysis *Adeena M.K. & Rekha R V*	957
94	Visualization of Keywords in Tea Research (2016-2020): A Study Based on the Web of Science Database Using VOSviewer *Pranjal Deka & Mukut Sarmah*	971
95	Medical Negligence: By means of Scientometric Analysis with Special Reference to the Judgments of SCC Online and research output of SCOPUS *Prabakar S, Vivekanandan S, Siva N & Visvanathan*	981
96	Bibliometric Analysis of the Application of Artificial Intelligence in Agriculture *Murugan S & Natarajan N O*	991

97 Growth of Block Chain Technology research output from SCOPUS database during 2015- 2023: A Scientometric Analysis 997
Vivekanandhan S Ganesh P & Kalaimani S.

98 Global Research on Spice: A Scientometric Analysis 1007
Ravichandran S. & Ganesh

99 Artificial Intelligence, Machine Learning and Deep Learning Research study on Education: A Bibliometric Analysis 1015
Socrates C, Sugunaraj O & Prabhakaran M

Section – VIII LIS Education

100 LIS Education for the Next Generation in India: Some Random Thoughts 1027
Ramesh Babu B (Invited Talk)

101 Proposal of a Framework for Multi Literacy Education in School Libraries 1041
Lee, Beongkee (Invited Talk)

102 Changing Landscape of Scientific Research 1051
Elango B & Rajendran P

103 Library Instruction, AI Literacy and Academic Integrity: A Reflexive Stance 1063
Terzi, Paschalia & Alenzuela, Reysa

104 Managing Work Experience Learning in Information Science Undergraduate Programs in Thailand 1081
Kittiya Suthiprapa, Theeradej Manakul, Vispat Chaichuay & Kulthida Tuamsuk

105 Massive Open Online Courses (MOOCs) and Libraries: Opportunities or persisting Challenges for survival 1099
Joshi, Neha M

106 Digital Literacy Practices and E-Government Services: Role of the Libraries 1107
Sarin M. S & Pavithra, K

107 Awareness of Digital Information Literacy Among PG Students and Research Scholars of Kumaun University, Uttarakhand: A Study 1115
Hema Adhikari

108 Examining the Utilization of ChatGPT Among Students at Sri Venkateswara University, Tirupati: A Study 1121
Prasantha Kumari,M

109 Impact of Traineeship Program on Professional and Personal Development of LIS students 1129
Arunima Baiju & Rekha R V

110 Assessment of Information Research Literacy among Research Scholars in Pondichery University 1139
Jithin K.S, Atheena V & Indraji C

111 Researcher Perception on use of Social Media as a Research Collaborative Tools by Social Science Research Scholars at selected universities of Tamil Nadu 1147
Pitchaipandi P & Baskaran C

Section – IX Information Seeking Behaviour and User Studies

112 Usage Patterns of Library Resources & Services among PG Students in Vignan Group of Institutions in Guntur: A Survey 1159
Srinivasa Rao V & Doraswamy M

113 Exploring the Reader's Realm: Understanding User Feedback and Satisfaction in the Departmental Library of Mahatma Gandhi University, Kottayam 1167
Ajayan, Aswathy; Thanuskodi, S & Saritha R

114 The Gap between User Expectations and Perceptions of Engineering Students: A Case Study on NAAC Accredited Engineering College Libraries in Guntur District of Andhra Pradesh 1171
Madhavi Ch & Kusuma Kumari K

115 Mobile Technology and Learning Behaviour of University Faculty Members in Chennai City – A Study 1179
Kasirao, V & Dilli Babu, K

116 Healthcare Information Seeking Behaviour of Students of Central University of Tamil Nadu: A Survey 1187
Ramu Naik, P & Dhanyasree, V K

117 Digital Learning in Medicine: Investigating Online Resource Use Among Mandya Institute of Medical Sciences Students 1201
Pramila M. C & Ananthnag K

118 Use of E-Journals among the Research Scholars of MarIvanios College (Autonomous), Trivandrum 1211
Akarsh R.

119 Social Media Literacy among Transgender People of Puducherry – A Study 1219
Manikandan C & Indraji

SECTION VI

FUTURE OF LIS

IMPROVING THE EFFICIENCY OF CONTENT-BASED IMAGE RETRIEVAL USING DEEP SUPERVISED LEARNING WITH LOCALITY SENSITIVE HASHING

Jinnawat Talasee[1] & Patorn Nilati[2]

Introduction

The challenges in retrieving images, considering the large and complex characteristics of the data, have been comprehensively addressed in existing literature. The main difficulties arise from the enormous volume of data, the variety of data types, the need for high-speed processing, and accurate retrieval results. The objective is to address various obstacles in image retrieval, including efficient indexing, handling large data volumes, and highlighting the crucial role of integrating information extraction algorithms to enhance retrieval accuracy (Qiu, 2022). It explores key topics such as scalability, feature extraction, and diverse data formats crucial for effective image retrieval in big data environments (Li et al., 2021). Furthermore, experiments are conducted on approaches for obtaining image representations to enhance retrieval efficiency, alongside an exploration of methods for content-based image retrieval (CBIR) within the realm of the extensive volume of images generated by the internet and social platforms. Importance is attributed to the influence of both local and global characteristics in improving retrieval performance (Srivastava et al., 2023).

The domain of image retrieval has experienced significant transformation with the advent of Convolutional Neural Networks (CNNs) and deep learning technologies. CNNs excel in precise feature extraction and similarity measurement, crucial for achieving high accuracy in image retrieval. Despite numerous proposed techniques, CBIR remains challenging, mainly due to the "semantic gap" between low-level image features understood by machines and high-level semantic concepts perceived by humans (Dubey, 2021). Research suggests that deep learning methods, like convolutional neural networks, have notably boosted CBIR system accuracy and efficiency by learning hierarchical feature representations from extensive datasets. Nevertheless, ongoing research focuses on optimizing these models to bridge the semantic gap and enhance retrieval performance in diverse and complex real-world scenarios (Soni & Kumar, 2023).

1,2 Department of Information Science, Faculty of Informatics, Mahasarakham University, Thailand

Our research introduces a novel method called deep supervised learning with locality-sensitive hashing, aimed at generating compact hash codes for efficient image retrieval and discriminative features for precise semantic label classification. Initially, we utilize a convolutional neural network to extract high-dimensional deep features from raw images. Subsequently, we seamlessly integrate a hash layer into the network to convert these features into low-dimensional hash codes. Additionally, a fully connected layer with a softmax function is applied to the hash layer to establish a class distribution. Finally, we employ a loss function to train the CNN, considering both label information for each image and similarity data for image pairs concurrently, thereby enhancing the feature representation capability. **The paper is structured as follows:** Section 2 provides a review of the literature on image retrieval. Section 3 details our proposed method, which employs deep supervised learning combined with locality-sensitive hashing. Section 4 presents the experimental results and comparisons. Finally, Section 5 discusses and concludes the proposed image retrieval method.

Literature Review

This review explores the fundamental components, methodologies, and recent advancements in image retrieval, with a focus on the significant application of deep learning. A typical CBIR system encompasses various crucial components: an image database, feature extraction, feature representation, query processing, similarity measurement, and retrieval and ranking mechanisms. These components collaborate to ensure the efficiency and performance of image retrieval in response to user queries (Zhang & Liu, 2023). Feature extraction entails identifying and quantifying the visual characteristics of images. Traditional approaches primarily focused on global features such as color histograms and texture descriptors, whereas recent methods prioritize local features and representations based on deep learning. Deep learning methods have proven particularly effective in extracting high-level, semantically meaningful features from images (Sikandar et al., 2023). CNNs have undergone notable advancements since their inception, with transfer learning and fine-tuning emerging as indispensable techniques in image retrieval. Utilizing pre-trained models such as AlexNet, GoogLeNet, and ResNet on large datasets enables researchers to adapt these models to new tasks, thereby significantly improving the performance of image retrieval tasks, even with limited labeled data (Angadi & Purad, 2023). These architectures have continually pushed the boundaries of feature extraction and image retrieval performance.

Recent research on locality-sensitive hashing (LSH) in image retrieval underscores its widespread adoption for effective similarity searching by converting high-dimensional features into low-dimensional hash codes (Wu et al., 2019). Comparative studies have evaluated various hashing methods, including Hashnet (Cao et al., 2017), improved deep hashing with soft pairwise similarity (Zhang et al., 2019), and deep polarized network (Fan et al., 2020), demonstrating the efficacy of these approaches in image retrieval tasks. Furthermore, recent studies have investigated deep hashing techniques such as locality sensitive, approximate nearest neighbor with locality-sensitive hashing, and the utilization of random hash functions to map high-dimensional data points into lower-

dimensional buckets hashing (Tan et al., 2023). This process enhances the likelihood of similar points being placed in the same bucket compared to dissimilar points. Various LSH functions have been developed to accommodate different similarity measures, including Hamming distance, norm, angular similarity, Jaccard similarity, and maximum inner product.

The deployment of hashing methods in content-based image retrieval systems varies based on the architecture used, whether traditional or deep learning-based, showcasing the versatility and adaptability of these techniques (Xu et al., 2022). Notably, studies have highlighted the crucial role of locality-sensitive hashing in efficiently retrieving similar images by mapping points to low-dimensional spaces and grouping similar images for quick retrieval (Luo et al., 2023). In addition to discussing system evaluation, the paper delves into system architecture, offering a formal definition of the image search problem and exploring techniques such as integrating attention mechanisms and reinforcement learning (Bai et al., 2023). Future research directions include exploring novel architectures, addressing medical imaging to aid in retrieving similar cases for diagnosis and treatment planning (Owais et al., 2019), and utilizing cross-language information retrieval in digital libraries to organize and retrieve historical documents, artworks, and photographs (Nie, 2022).

Proposed Method For Image Retrieval

In this paper, we aim to leverage the strengths of deep supervised learning and locality sensitive hashing to improve feature representation. Our method ensures that images of the same class are positioned close to each other by transforming them into this innovative feature space. In contrast, images from different classes are displayed with more separation. This section presents a concise overview of the fundamental principles of deep supervised learning and locality sensitive hashing which form the basis of our proposed methodology.

Deep Supervised Learning

The deep supervised learning is particularly in the context of deep convolutional neural networks (deep CNNs) which have achieved major advances in many fields, including image classification, image recognition, and image retrieval. Unlike fully connected networks, Deep supervised learning utilizes local connections to extract image features, significantly reducing network parameters through the weight-sharing mechanism. In the development of deep supervised learning models, it is normal to organize the architecture with alternating convolutional layers and subsequent pooling layers. This arrangement concludes at the final layer, which typically consists of several fully connected layers.

In recent years, several robust deep CNNs architectures such as AlexNet, CaffeNet, GoogLeNet, VGG and ResNet that have been developed. Although these networks are trained on natural image datasets, the features they extract exhibit robust generalization capabilities on image datasets. Given the limited availability of training samples and the

difficulty of labeling unknown samples in datasets, we adapt these existing deep CNNs to deep supervised learning with locality sensitive hashing to minimize the need for extensive training samples.

In the domain of image retrieval, the availability of training samples is often limited, and labeling unknown samples is both expensive and time consuming. To address this issue, we utilize a pre-trained model and the uniform convolutional layers of AlexNet, renowned for their effectiveness in capturing complex image features, to demonstrate the technique of deep feature extraction. AlexNet is a convolutional neural network that includes five convolutional layers and two fully connected layers. The convolutional layers employ filters to identify features like edges and textures, with stride and padding managing filter movement and spatial dimensions. Local response normalization normalizes neuron responses, while max-pooling reduces spatial dimensions by selecting maximum values within a specified window. The fully connected layers, each with 4096 neurons, utilize dropout to avoid overfitting, while the rectified linear unit activation function introduces non-linearity and accelerates training. Furthermore, AlexNet's network parameters can be transferred to other models, utilizing pre-trained knowledge to improve performance through transfer learning. This architecture and its techniques enhance feature extraction, prevent overfitting, and increase classification accuracy.

Utilizing a pre-trained AlexNet model allows for a significant reduction in the demand for extensive training data, leading to robust feature extraction capabilities in image retrieval applications. This strategy not only saves time and resources but also enhances our method's performance when dealing with limited training samples. Figure 1 illustrates a representative architecture of our proposed method in deep supervised learning.

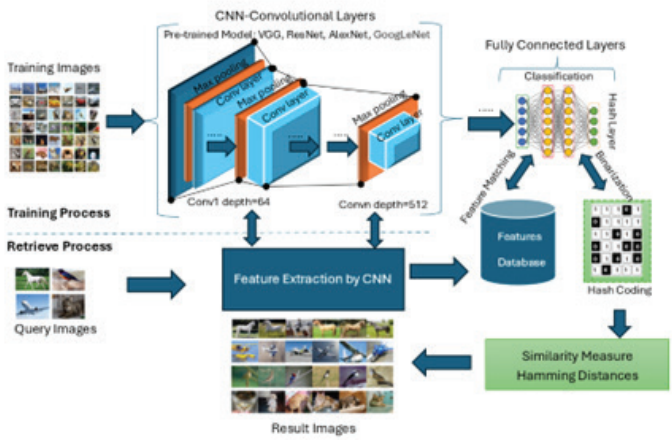


Fig. 1. The network architecture of our proposed method

The proposed method, outlined in Figure 1, comprises two key processes. Initially, the network parameters are initialized. Subsequently, the method fine-tunes the network

using labeled datasets. Finally, upon completing the training process, binary codes are generated from the network's outputs through input image quantization. The proposed method aims to enhance result quality and optimize bit size by enforcing specific criteria on the generated binary codes: (1) Ensuring similar images are encoded into similar binary codes, while dissimilar images receive distinctly different codes. (2) Minimizing quantization error from Hamming to Euclidean space by maintaining evenly distributed hash bits. Our model's primary network is AlexNet, with the hash layer replacing the final classification layer. The number of units in the hash layer determines the hash bits. During training, an image batch serves as input to the network. By encoding similar images with identical binary patterns and minimizing quantization errors, we achieve an even distribution of hash bits.

Locality Sensitive Hashing

Approximate similarity search is a significant research field that aims to relax the distance threshold and accept a small proportion of false negatives. A crucial technique used in this area is Locality Sensitive Hashing, which employs a collection of hash functions that are more likely to map similar points to the same bucket compared to dissimilar points (Andoni et al., 2018). For example, in Hamming space, an LSH family might select k random coordinates from {1, 2, ..., d} and project a vector onto these k-bit coordinates.

In similarity join or clustering algorithms, LSH can reduce running time through filtering. The algorithm builds several hash tables using different hash functions from an LSH family and then only compares points hashed to the same bucket. The method's accuracy improves with more hash tables. Generally, hashing the dataset multiple times is much faster than making many comparisons, which is particularly advantageous for Approximate Near Neighbor Search.

Definition 1. Consider a dataset within a metric space . The -Approximate Nearest Neighbor problem, where and, involves efficiently preprocessing to quickly respond to the following query: Given, either find such that or indicate that no such point exists.

The algorithm is aware of the approximation and the threshold rrr in advance. Therefore, our focus is on data structures parameterized by and . An essential tool for this purpose is an LSH family.

Definition 2. Consider parameters and along with where . A hash family within a metric space is deemed -sensitive if the following conditions hold:

1. For all such that, the probability that is at least .
2. For all such that, the probability that is at most . These probabilities are calculated by randomly selecting h from H.

LSH-based Approximate Nearest Neighbor Search for Hamming distance operates with a set of input parameters and a preprocessing step before querying. Initially, the algorithm takes a dataset X, where each point is represented as a binary vector in, a distance

threshold r within the range of d, and an approximation parameter c. These parameters guide the construction of hash functions and hash tables. During preprocessing, the algorithm selects L hash functions,, by independently choosing k bit positions for each function, where k is determined as, and L is calculated as . The dataset P is then hashed using these L hash functions, resulting in the partitioning of X into L hash tables.

Upon receiving a query point, the algorithm hashes q using the L hash functions . Subsequently, it compares q against all points x in P that share the same hash value for each hash function, where i=1, 2, …, L. If a point y is found in P such that the Hamming distance between q and y is less than or equal to cr, y is returned as the nearest neighbor for q. However, if after comparing against 100L input points, no sufficiently close point to q is found, the algorithm terminates and reports "no close pair to q" in X.

Experimental Setup and Results

In this section, we set up a comprehensive set of experiments to evaluate the effectiveness of deep supervised learning combined with locality sensitive hashing for content-based image retrieval tasks. Initially, we examine the performance of the deep supervised learning model on the image dataset it was trained on. Next, we assess the model's ability to retrieve images from new domains that differ significantly from the original training data, and then compare its performance with various deep hashing methods.

Datasets

We conducted several experiments on two public standard image datasets to validate the effectiveness of the proposed method, referred to as the National University of Singapore-Web Image Dataset (NUS-WIDE) and the Canadian Institute for Advanced Research (CIFAR-10).

The NUS-WIDE dataset is a large collection of multi-label images compiled by the NUS research laboratories. It contains 269,648 images, each labeled with multiple tags, resulting in 5,018 unique labels within the dataset. Images in this dataset can belong to multiple categories simultaneously and are manually categorized into 81 categories. In this study, we focus on the 21 most common categories, each containing approximately 5,000 images. This selection process resulted in 149,736 images being included in the dataset. In our study, we randomly selected 2,100 images with 100 images per class to form the query set. The remaining images in the dataset were allocated to the training set. In this dataset specifically, if two images share at least one common label, they are considered to have similar semantics.

The CIFAR-10 dataset is a standard benchmark image dataset consisting of 60,000 color images, each measuring 32x32 pixels. These images are categorized into ten different classes which encompass common objects and animals such as airplanes, cars, birds, cats, deer, dogs, frogs, horses, ships, and trucks. Each class in the CIFAR-10 dataset includes 6,000 images, with 5,000 images used for training and 1,000 for testing.

For research purposes, a query set was created by randomly selecting 1,000 images (100 per class), while the remaining images were retained as part of the dataset.

Image Retrieval Metrics

Evaluating the effectiveness and efficiency of retrieval methods is essential for obtaining diverse insights into their performance. Several retrieval metrics are widely used in the literature to evaluate these methods, including Mean Average Precision (MAP), precision and recall.

The Mean Average Precision (MAP) evaluates how precise a retrieval system is across a set of query images. It is calculated by finding the average precision for each relevant image that is retrieved. This metric provides a comprehensive measure of the system's ability to rank relevant images higher, which is defined as where Q denotes the number of query images, N represents the number of sample images in the searching database, and P(k) indicates the precision of retrieving the top k ranked images.

$$MAP@k = \frac{1}{Q}\sum_{j=1}^{Q}\frac{1}{N}\sum_{k=1}^{N}P(k)$$

Precision is defined as the ratio of relevant images retrieved to the total number of images retrieved. It highlights the accuracy of retrieval outcomes by showing the proportion of retrieved images that are truly relevant, which is defined as where denote the number of true positive relevant images retrieved, and indicates the total number of retrieved images.

Recall complements precision by measuring the ratio of relevant images retrieved to the total number of relevant images available in the dataset. Recall emphasizes the system's ability to retrieve all relevant images, ensuring that the system does not miss any important results, which is defined as where denote the number of true positive relevant images retrieved, and indicates the total number of relevant images in database.

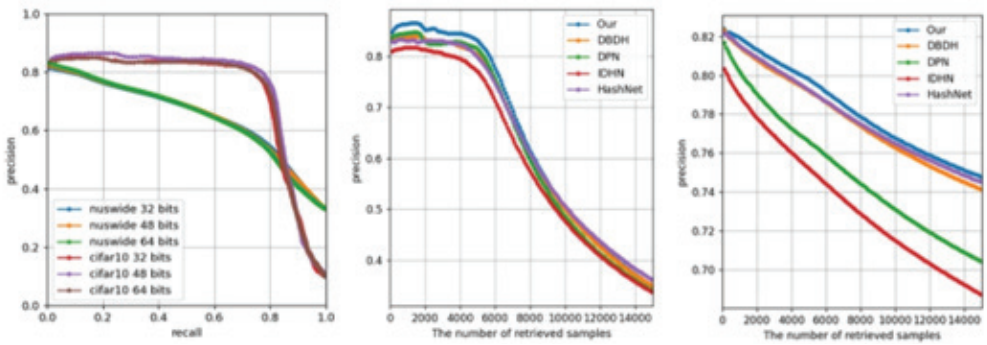
Results

The experimental results, as shown in Table 1, highlight the superiority of the proposed method over all other methods with different lengths of hash codes. This superiority stems from the method's ability to solve the discrete optimization problem through simultaneous feature learning and hash-code learning. Table 1 presents the MAP values for all compared baselines, where our proposed method consistently outperforms competitors across various datasets with different hash code lengths. Specifically, our method achieved notable improvements of 2.47% compared to other methods. For the CIFAR-10 and NUSWIDE datasets, our method yielded MAP values of 0.8566 and 0.8140, respectively, at 48 bits, surpassing those obtained by other methods. These results highlight the effectiveness of our approach.

Table 1. Image retrieval results (MAP) with different lengths of hash codes on the CIFAR-10 and NUS-WIDE dataset.

Methods	CIFAR-10			NUS-WIDE		
	32-bits	48-bits	64-bits	32-bits	48-bits	64-bits
Our (with AlexNet)	0.8420	0.8566	0.8417	0.8081	0.8140	0.8199
DBDH (Zheng et al., 2020)	0.8191	0.8325	0.8258	0.8028	0.8080	0.8143
DPN (Fan et al., 2020)	0.8330	0.8378	0.8239	0.7773	0.7914	0.7917
IDHN (Zhang et al., 2019)	0.8036	0.8125	0.8396	0.7714	0.7791	0.7821
HashNet (Cao et al., 2017)	0.8161	0.8316	0.8464	0.7822	0.8102	0.8180

The retrieval performance on the CIFAR-10 and NUS-WIDE datasets is depicted in terms of precision-recall curves and precision curves for different numbers of top returned samples. Figures 2(a) show precision-recall curves compared with various methods on the CIFAR-10 and NUS-WIDE dataset across different hash code lengths, 2(b) display the precision curve for the CIFAR-10 dataset with respect to top-N at 48 bits, and 2(c) illustrate the precision curve for the NUS-WIDE dataset with respect to top-N at 48 bits. Our method surpasses comparison methods by significant margins, especially showing higher precision at lower recall levels or when the number of top results is small.



(a) Comparison of precision-recall curves at varying hash code lengths.

(b) Precision curve for the CIFAR-10 dataset at 48 bits for top-N values.

(c) Precision curve for the NUS-WIDE dataset at 48 bits for top-N values.

Fig. 2. Precision-recall curves and precision curves for different numbers of top returned samples

Conclusion

The proposed method integrates deep supervised learning with locality-sensitive hashing techniques, resulting in significant improvements. This hybrid approach generates high-quality binary codes while preserving the underlying similarity structure of the original feature space. It has demonstrated state-of-the-art performance in image retrieval tasks. The fusion of features from enhanced pre-trained deep learning models like AlexNet has led to substantial improvements in mean average precision and recall,

underscoring the advantages of incorporating locality-sensitive hashing, which has been shown to significantly boost retrieval performance in standard benchmarks.

Additionally, in-depth studies on deep supervised learning for content-based image retrieval highlight the superiority of deep learning feature representations compared to traditional methods. Despite these advances, challenges remain in deep learning for image retrieval. Addressing these challenges emphasizes the need to further explore advanced techniques and diverse datasets. Future research should focus on improving retrieval performance and unlocking the potential of deep learning to revolutionize image retrieval methodologies.

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NORTHEASTERN THAI SILK PATTERN CLASSIFICATION USING DEEP LEARNING WITH SWIN TRANSFORMER

Chakkrit Saengkaew[1]

Introduction

The unique silk patterns of each province in Northeastern Thailand represent an important part of the country's cultural heritage. Each province has its own distinctive silk designs that highlight the region's rich traditions. This research aims to compare the performance of different deep learning architectures in classifying 20 distinct silk patterns from 20 provinces in Northeastern Thailand. The dataset comprises a total of 11,007 images, with each class containing between 432 and 612 images. For this study, five leading architectures have been selected for comparison: ResNet50, EfficientNet, ConvNeXt, Swin Transformer, and Vision Transformer (ViT). To enhance the learning capability and generalization of the models, data augmentation techniques and a dropout rate of %50 have been applied. The models are evaluated using stratified -10fold cross-validation, ensuring that each fold maintains a consistent class distribution, thereby providing a comprehensive assessment of each model's ability to classify the intricate and diverse silk patterns accurately. This research will identify the most effective model for classifying the traditional silk patterns of Northeastern Thailand, which can be applied to preserve and promote this cultural heritage through modern technological means.

Literature Review

Image classification has a rich history that spans several significant milestones:

- Early Developments (2005): In 2005, PASCAL VOC introduced a dataset comprising 20,000 images categorized into 20 different object classes. This marked an important step towards advancing the field.
- ImageNet Project (2006): The year 2006 saw the collaboration between Fei-Fei Li and PASCAL VOC in the development of the ImageNet project. ImageNet revolutionized the field by providing a vast image database with over 14 million images and more than 20,000 categories. This resource became instrumental in training AI algorithms.
- Recognition at CVPR (2009): In 2009, ImageNet gained recognition by presenting a poster on Computer Vision and Pattern Recognition (CVPR) at a conference held

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in Florida. This acknowledgment further solidified its importance in the research community.

- ILSVRC Competition (2010): In 2010, the annual software competition called ILSVRC (ImageNet Large Scale Visual Recognition Challenge) was launched. It focused on the classification and detection of objects using ImageNet's vast image collection and 1,000 predefined categories. Notably, it included 90 dog breeds out of a total of 120.
- Breakthrough with AlexNet (2011): In 2011, significant progress was made when AlexNet achieved a remarkable 16% error rate, outperforming others in the top 5 error rate that stood at 25%. This breakthrough demonstrated the effectiveness of deep learning models.
- Error Rate Reduction (2012): By 2012, the top 5 error rate had significantly decreased to just a few percentage points, showcasing the continuous advancements in object classification accuracy.
- Growing Participation (2014): In 2014, the ILSVRC competition witnessed an increasing number of institutions, with over 50 joining the challenge. This demonstrated the expanding interest and involvement in the field.
- CNN Dominance (2017): In 2017, during the competition involving 38 teams, it was observed that 29 teams achieved an impressive accuracy of over 95% using Convolutional Neural Networks (CNN). This highlighted the effectiveness of CNN-based approaches in object classification tasks.
- Rise of Vision Transformers (2020): In 2020, Vision Transformers (ViT) were introduced, utilizing the Transformer architecture from NLP for image classification tasks. ViT splits an image into patches and processes them similarly to sequences of words in text, significantly improving accuracy.
- Self-Supervised Learning (2020s): The 2020s have seen a surge in self-supervised learning methods, allowing models to learn useful features without labeled data, which has significantly advanced the field of image classification.
- Swin Transformer (2021): Building on ViT, the Swin Transformer was developed in 2021, introducing a hierarchical approach by shifting window-based attention, leading to better performance in image classification and dense prediction tasks.

Experiments

This section describes the experimental setup, including dataset preparation, model architectures, training protocols, and evaluation metrics used in this study.

Dataset Preparation

The dataset used in this research comprises 11,007 images of traditional silk patterns from 20 provinces in Northeastern Thailand. Each class represents a unique silk pattern from a specific province, with the number of images per class ranging from 432 to 612. Data augmentation techniques, such as random rotations, flips, and color adjustments, were applied to enhance the robustness and generalization of the models.

Table 1. List of Traditional Silk Patterns from Northeastern Thailand

No	Pattern Name	Province	Qty	No	Pattern Name	Province	Qty
1	ผ้าไหมแพรวา Pha Mai Praewa	กาฬสินธุ์ Kalasin	540	11	ลายสาเกต Lai Saket	ร้อยเอ็ด Roi Et	585
2	แคนแก่นคูน Khaen Kaen Khun	ขอนแก่น Khon Kaen	594	12	ดอกฝ้ายเมืองเลย Dok Fai Mueang Loei	เลย Loei	558
3	หมี่คั่นขอนารี Mi Khan Khon Nari	ชัยภูมิ Chaiyaphum	432	13	ผ้าเหยียบลายลูกแก้ว Pha Yiap Lai Luk Kaeo	ศรีสะเกษ Si Sa Ket	576
4	ผ้ามุกนครพนม Pha Muk Nakhon Phanom	นครพนม Nakhon Phanom	594	14	ลายสะเก็ดธรรม Lai Saket Tham	สกลนคร Sakon Nakhon	558
5	อัตสีแดงอิฐ Atsadueang It	นครราชสีมา Nakhon Ratchasima	468	15	ผ้าโฮล Pha Hol	สุรินทร์ Surin	513
6	หมากเบ็ง Mak Beng	บึงกาฬ Bueng Kan	549	16	ลายนาคใหญ่ Lai Nak Yai	หนองคาย Nong Khai	567
7	หางกระรอกคู่ Hang Kra Rok Khu	บุรีรัมย์ Buriram	558	17	ผ้าขิดสลับหมี่ Pha Khit Salap Mi	หนองบัวลำภู Nong Bua Lamphu	522
8	สร้อยดอกหมาก Soi Dok Mak	มหาสารคาม Maha Sara-kham	603	18	ลายตะขอสลับเอื้อ Lai Takhaw Salap Uea	อำนาจเจริญ Amnat Charoen	612
9	แก้วมุกดา Kaeo Mukda	มุกดาหาร Mukdahan	468	19	ผ้าไหมหมี่ขิด Pha Mai Mi Khit	อุดรธานี Udon Thani	585
10	ลายยศสุนทร Lai Yot Sunthon	ยโสธร Yasothon	585	20	ผ้ากาบบัว Pha Kab Bua	อุบลราชธานี Ubon Ratchathani	540

Model Architectures

The study compares the performance of five state-of-the-art deep learning architectures:

1. ResNet50: A widely used convolutional neural network known for its deep residual learning capabilities.
2. EfficientNet: A model that balances accuracy and efficiency by scaling depth, width, and resolution.
3. ConvNeXt: A modernized version of convolutional neural networks with enhanced performance.
4. Swin Transformer: A hierarchical Transformer model with shifted windows, designed for image classification and dense prediction tasks.

5. Vision Transformer (ViT): A model that applies the Transformer architecture from natural language processing to image classification, treating images as sequences of patches.

Training Protocols

Each model was trained using a stratified 10-fold cross-validation approach to ensure a consistent class distribution across all folds. This method helps in obtaining a reliable estimate of model performance by reducing the variance associated with the train-test split. The models were trained with a dropout rate of 50% to prevent overfitting. The learning rate, batch size, and other hyperparameters were optimized for each model to ensure the best possible performance. The training and evaluation were conducted using two Nvidia GeForce 1080Ti GPUs running in parallel to expedite the computational process and handle the large dataset efficiently.



Fig 1: Sample Images of Traditional Thai Silk Patterns from Provinces in Northeastern Thailand Dataset

Evaluation

The evaluation of the models in this study focuses on measuring their performance in classifying provincial silk patterns from Thailand, using the following key metrics:

Accuracy

Accuracy measures the number of correct predictions compared to the total number of predictions. It is calculated as:

$$Accuracy = \left(\frac{Number\ of\ Correct\ Prediction}{Total\ Number\ of\ Predictions}\right)$$

Precision

Precision measures the percentage of true positive predictions out of all positive predictions made by the model. It is calculated as:

$$Precision = \left(\frac{True\ Positives}{True\ Positives + False\ Positives}\right)$$

Recall

Recall measures the model's ability to identify all true positive instances within a class. It is calculated as:

$$Recall = \left(\frac{True\ Positives}{True\ Positives + False\ Negatives}\right)$$

F1 Score

The F1 Score is a balance between precision and recall, providing a single metric that combines both. It is calculated as:

$$F1\ Score = 2 \times \left(\frac{Precision \times Recall}{Precision + Recall}\right)$$

Consistency

Using stratified 10-fold cross-validation ensures a consistent distribution of classes in each fold. This technique allows for a reliable evaluation of model performance by reducing the variance associated with different train-test splits.

Inference Time

Inference time measures the amount of time required for the model to process each image. This metric is crucial for comparing the efficiency and speed of each model.

Training Time

Training time is a key metric for evaluating the efficiency of each model. It measures the time taken to train each model per fold during the stratified 10-fold cross-validation process. Considering training time helps to understand the resource requirements and operational efficiency of each model.

Table 2. Model Performance and Training Time Summary

Model	Accuracy (mean ± std)	Precision (mean ± std)	Recall (mean ± std)	F1 Score (mean ± std)	Training Time seconds / fold
ResNet50	99.85% ± 0.02%	0.9985 ± 0.0002	0.9985 ± 0.0002	0.9985 ± 0.0002	300.15 ± 2.10
EfficientNet	99.83% ± 0.03%	0.9983 ± 0.0003	0.9983 ± 0.0003	0.9983 ± 0.0003	298.75 ± 1.95
ConvNeXt	99.88% ± 0.01%	0.9988 ± 0.0001	0.9988 ± 0.0001	0.9988 ± 0.0001	305.80 ± 2.25
Swin Transformer	99.90% ± 0.01%	0.9990 ± 0.0001	0.9990 ± 0.0001	0.9990 ± 0.0001	310.45 ± 2.30
ViT	99.87% ± 0.02%	0.9987 ± 0.0002	0.9987 ± 0.0002	0.9987 ± 0.0002	308.55 ± 2.20

Based on the performance evaluation of the five models in image classification, the Swin Transformer demonstrated the highest efficiency, with an average accuracy of 99.90% and precision, recall, and F1 scores of 0.9990 ± 0.0001. Following this, ConvNeXt achieved an average accuracy of 99.88% and precision, recall, and F1 scores of 0.9988 ± 0.0001. The ViT model ranked next, with an average accuracy of 99.87% and precision, recall, and F1 scores of 0.9987 ± 0.0002. ResNet50 and EfficientNet

showed similar performance, with ResNet50 having an average accuracy of 99.85% and precision, recall, and F1 scores of 0.9985 ± 0.0002, while EfficientNet had an average accuracy of 99.83% and precision, recall, and F1 scores of 0.9983 ± 0.0003. Despite Swin Transformer taking the longest training time per fold, it remains the model that delivers the best results when considering overall performance.

Table 3. Model Efficiency Based on Inference Time

Rank	Model	Parameters	Inference Time (seconds)
1	ResNet50	23549012	0.0124
2	ViT	85814036	0.0182
3	EfficientNet	4033168	0.0186
4	ConvNeXt	87586964	0.0273
5	Swin Transformer	86763724	0.0325

Based on the evaluation of various models in terms of their inference time, it is evident that ResNet50 exhibits the highest processing efficiency, with an inference time of only 0.0124 seconds per image. This makes ResNet50 the most suitable model for tasks requiring the fastest processing speeds. Following ResNet50, the ViT model has an inference time of 0.0182 seconds, and EfficientNet closely follows with an inference time of 0.0186 seconds. Despite EfficientNet having significantly fewer parameters than ViT, their inference times are quite similar. Next in line is ConvNeXt, with an inference time of 0.0273 seconds, and Swin Transformer, with an inference time of 0.0325 seconds. Although ConvNeXt and Swin Transformer have a high number of parameters, they also require more processing time compared to the other models, making them more suitable for tasks that demand high accuracy and detail but are not as time-sensitive.

Conclusion

The research findings indicate that the Swin Transformer model demonstrates the highest performance in classifying provincial silk patterns in Northeastern Thailand among the five evaluated models. It achieved an average accuracy of 99.90% and precision, recall, and F1 scores of 0.9990 ± 0.0001, surpassing ConvNeXt, ViT, ResNet50, and EfficientNet. ConvNeXt followed closely with an average accuracy of 99.88% and precision, recall, and F1 scores of 0.9988 ± 0.0001. The ViT model ranked next, with an average accuracy of 99.87% and precision, recall, and F1 scores of 0.9987 ± 0.0002. ResNet50 and EfficientNet showed similar performance, with ResNet50 achieving an average accuracy of 99.85% and EfficientNet 99.83%, both having corresponding precision, recall, and F1 scores. Despite the Swin Transformer having the longest training time per fold, it remains the most effective model overall when considering performance metrics.

Applications of Research Findings

These research findings can be applied to several areas within library operations to enhance efficiency and service quality. The Swin Transformer model can be employed

for automated cataloging and classification of books and other materials based on their covers, facilitating quicker and more accurate organization. Additionally, it can be used for digital archiving of rare and historical documents, ensuring that digital copies are accurately classified and easily retrievable. Library search systems can also be improved by integrating the model, enabling features such as visual search where users can find books by uploading images of covers or related visual content. Interactive kiosks or mobile applications using image recognition can assist users in locating books, accessing information about materials, or receiving recommendations based on visual inputs. Lastly, the model can aid in collection management by identifying and categorizing new acquisitions, aiding in inventory management, and ensuring that library collections are up-to-date and well-organized.

Applying these research findings will significantly enhance library operations and user experience, promoting the preservation and promotion of provincial silk patterns from Northeastern Thailand through modern technology.

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LITERATURE REVIEW ON CHANGES IN LIBRARIAN AND INFORMATION PROFESSIONALS SKILLS IN THE POST-COVID-19 ERA

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Introduction

The COVID-19 pandemic had an impact on the entire world and its communities. It is no different in information organizations, whether they are libraries, data centers, or information centers that provide information services. The influence compelled libraries and information centers to adjust, including personnel, which is a crucial component of their performance. Throughout the spread of the epidemic, libraries and information centers changed to handle the situation well. In terms of personnel, there was a modification in work knowledge and skills to fit the setting. As a result, library and information center personnel must train to be able to function in a new environment while still providing information services to users. According to the impact, librarians and staffs working in libraries and information service centers require immediate change. It was crucial for them to develop in all aspects and improve important working abilities in order to respond to the situation instantly, as the operations had to be modified to virtually anything. The organizations gave their employees the option of working from home and offered them a flexible schedule or longer working hours. Some organizations allowed full-time remote work. A few allowed them to take time off without working, but they had to be on call around the clock. (Benita, 2021, p.1; Ishtiaq, Sehar and Shahid, 2020, p.2; Youngsukying, 2021, p.87)

Following the COVID-19 incident, the global population's behavior changed dramatically. As a result, following the conclusion of the COVID-19 epidemic, human behavior changed significantly. The obvious one is "Technology is a life". In other words, technology has become an integral component of daily life. People who have never been interested or never used technology turned to use them and prefer technology to manual systems and prefer online to offline systems. This was to avoid the risk of meeting people who might be a carrier of diseases such as financial transactions through the internet banking, buying tickets for the mass rapid transit system via credit card rather than standing in line to pay with cash, and ordering food or shopping through online applications. (Wolf, 2021)

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In addition, the work process has shifted to remote work and virtual meetings. During the COVID-19 epidemic, several countries transitioned to increased long-distance work, particularly in the United States, where many people began working remotely practically almost every day of the week. It was believed that this type of work would continue indefinitely, but the outbreak of COVID-19 terminated due to actual benefits: (1) financial savings for the organization, (2) increased productivity, and (3) greater flexibility. In some nations, it was discovered that people with flexibility had twice as good mental health as those who did not work in such a way three times as much due to improved Work-Life Balance. Another development was automation and artificial intelligence system. Prior to the COVID-19 epidemic, there was concern that the usage of automated technologies would replace humans. It was projected that robots would replace between 400 and 800 million workers worldwide. When the COVID-19 occurred, it encouraged the usage of more automated systems, such as in food production, where robots were expected to grow by more than 56% by 2020 due to cleanliness concerns that affected manpower in the stated section. Although the automated system displaced work in some branches, it also contributed to the creation of new jobs. During the COVID-19 pandemic, it was projected that the deployment of automated systems resulted in the creation of more than 6.1 million jobs worldwide, ranging from data management (data and AI) to marketing and content. More people began using e-commerce platforms. The COVID-19 outbreak resulted in the implementation of city lockdowns and social distancing measures, causing people to decrease their travel and services provided by restaurants around the world. Currently, it has not recovered to normal levels. It was in contrast to the number of internet buyers who surpassed two billion in 2020. Even in Thailand, the number of people using online shopping apps climbed by more than 60% during the city lockdown. Independent work (Self-Employed / Gig Workers) has expanded rapidly. Many countries, including the United States, England, Netherlands, Belgium, France, Australia, and Thailand, have seen an increase in the shift from single jobs to many jobs or the transition to independent labor. It was projected that this tendency would continue since this set of workers was very adaptable, allowing companies to select high-potential people for each project. Labor must now rely on new talents due to the changing work model. While long-term work and independent labor become increasingly common. Both labor and employers must accelerate to keep up with the work in the new, changing environment. (Bank of Thailand, 2023) According to the changing working environment in all businesses, the information organization was required to pay attention to the technology that came to play a role in the user's life, implying that as the user's behavior changed, so did the environment of information services. Skills, knowledge, and ability all need to change.

Research Objectives

This study aims to review the literature on the post-COVID-19 skills of librarians and information professionals.

Research Method

This study examined research and academic articles that investigated the competencies of librarians and information professionals during and post-COVID-19 pandemic. The content of research and academic articles was examined to identify pertinent concerns and summarized as an important skill set for librarians and information professionals in the post-COVID-19 age.

Research Results

According to the preliminary research results regarding the skills and knowledge of people in the overall after the COVID-19 situation, it was discovered that there were concepts of workmanship that can be summarized as a guideline, divided into 10 skills that must be developed in 2025, including (TDRI, 2021)

1. Problem-solving through analytical and innovative thinking skill
2. Complex problem solving skill
3. Problem-solving through critical thinking skill
4. Problem-solving through creative thinking skill
5. Problem-solving through reason-based thinking skill
6. Self-management through self-learning skill
7. Self-management in dealing with pressure and flexibility skill
8. Collaboration skill
9. Technology usage and follow-up skill
10. Design and programming technology skill

In addition to professional skills, significant skills required by organizations since the pandemic, as opposed to prior periods, include English language skills, digital abilities, and critical thinking skills. Furthermore, according to a survey of entrepreneurial needs, the majority of employers need personnel with soft skills such as communication ability, cooperation, creativity, professionalism, and rapid adaptation. Importantly, many firms required additional people with English communication abilities in a variety of fields. This research, in addition to highlighting the changes in the work and skills that must adapt to the world's economic structure following the COVID-19, provides information that organizations and workers should use as part of a review and analysis for development and adjustment to keep up with the changes that arise.

According to the study, librarians and information professionals' skills are divided into two parts:

During the COVID-19 pandemic, librarians and information professionals had to learn new skills in order to continue working. The needed abilities were digital skills, which included the ability to use digital devices, communication apps, and communication networks to acquire and manage data, as well as producing digital media and urgent infographics. They were also required to know how to use electronic devices for work, such as computer equipment and peripherals, cameras, webcams, and so on. In addition to professional talents, there was a demand for life skills that could be used in everyday situations. (Chanlun, 2021, pp.301-302; Lobo and Dhuri, 2021, p.13)

When the COVID-19 situation settled down, the provision of information and user behavior altered. Libraries expanded their online offerings as part of their COVID-19 management strategy. The most viable answer was digital media services, which were appropriate for online services and lessen the risk of touching and being close to each other in a restricted space. However, there were still restrictions surrounding trade laws, copyright issues, and online distribution, it caused many libraries were unable to achieve the full efficiency expected. (Thai Health Promotion Foundation, 2021)

Post-COVID-19 Era

Libraries and information centers had to adjust in the post-COVID-19 age in the following ways (Libraryhub, 2020)

From "reading" to "learning" (To move beyond books to facilitate learning). The library is about more than just reading; it also provides an environment that fosters learning for its users. Learning requires a facility that caters to the unique demands of each user. (Personalized learning). Furthermore, there is a significant movement toward lifelong learning and learning to live in the future.

From "books" to "learning activities" (To move beyond books to curating programs). Books in libraries (physical) may no longer be what users want. There are so many books in the world. It is critical to select a book that is appropriate for each reader and allows readers to readily acquire the information they seek. However, in order to make that content more helpful and reliable, a "librarian" must develop a means to express and communicate engaging content to users, such as the S.U.R.E. campaign in Singapore libraries, which promotes the idea of discovering the truth by reading literature.

From the "collecting" to "engagement with community" (To move beyond collecting to engagement with community). Libraries are unable to purchase every book on the market and have collection constraints (The area does not correspond with the number of books). Thus, reading and books are transformed into learning and activities.

From the "physical" to "omni-channel modalities" (To move beyond physical to omni-channel modalities). Some customers have moved to the online platform, while others are still waiting for the library. If the latter users are persuaded to use an unfamiliar platform and integrate both physically and digitally, the consequence will be improved libraries service.

However, internet services can effectively address the issue of service delivery. In the post-COVID-19 age, the library continues to offer online information services and more. It required librarians and information professionals to have adaptable abilities and to grow in order to function in a changing environment. It was discovered that vital and necessary abilities for librarians and information professionals in the post-COVID-19 age could be divided into three categories, as follows.

Literacy includes information literacy, civics literacy, teaching literacy, technology literacy, financial literacy, emergency services literacy. Furthermore, there

are other crucial talents, including communication/presentation skills, leadership skills, management skills, decision making skills, information and communication technology skills, teaching/learning skills, research skills, database management, analytics skills, creativity and innovation. (Mon, 2021; Pretty, Abdala and Calilung, 2022; White, Ahenkorah-Marfo and Borteye, 2023)

Digital Skills include database design, website and webpage design, online reference service, ICT skills pertaining to librarianship, the application of programs in the production of content and online media, using online meeting and communication programs, use of customer management systems with online users and use of communication tools such as emails to send messages in virtual environment. (Aysha, 2023, pp.116-117; White, Ahenkorah-Marfo, and Borteye, 2023)

Upskilling included developing skills related to emerging information technology, designing and developing online media skills, financial skills as well as development of policy making of information service institute. There were also skills in organizing learning spaces including designing and organizing physical learning spaces for the community, universal design idea, collaborative space design and designing and organizing digital learning spaces for communities such as Blackboard program. In terms of production and online media using applications and using communication tools such as emails in the virtual environment, use of customer relationship management system for dealing with online users, digital learning and development include digital learning to develop themselves by learning online, followed by communication. Digital collaboration and participation include digital communication to use communication tools to work, use digital media to distribute the service of the library. Short-term training courses are recommended by librarians and library staff to provide knowledge and skills required in adapting to a changing environment. (Wipawin, et al., 2021, pp. 61-62) In order to have the potential to use technology in working or working online increasing inescapably, although the situation of the COVID-19 has ended already and there are additional suggestions for similar situation, librarians and information professionals should adapt and develop widely to be able to accept the situation, such as the skills related to the information through social medias, selective dissemination of information, digitizing all the printed resources in library, providing online library and information service along with traditional library services, suggesting online services for users and chatting with online users to answer questions on important issues. In addition, they also need the skills of adaptation to the digital environment or the virtual environment. (Aysha, 2023, p.120; Ogungbeni, Sulaiman and Obiamal, 2022, 159; Sukula, et al., 2020)

Conclusion

The COVID-19 epidemic had a significant impact on employees' working conditions and skills. Employees in all types of organizations must adapt and grow in order to keep up with the changes. The librarian and information professionals industries were also affected; all information organizations must adjust to continue providing information services until the crisis is resolved. Change and adjustment have become

an important aspect of information management and information services, which are increasingly changing online. It prompted librarians and information professionals to continually develop themselves, regardless of the situation, in order to provide information services to users rapidly and satisfactorily.

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ASSESSING THE SKILLS, KNOWLEDGE AND ATTRIBUTES REQUIRED FOR LIS PROFESSIONALS IN THE DIGITAL ENVIRONMENT

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Introduction

The rapid development of information technology and communication system has brought a revolutionary change in the organization and management of information. With the technological advancement, severe competition brought in by the forces of globalisation, increased user awareness and expectations both in terms of quality and service which have necessitated a reorientation of the organisations. Hence it is mandatory for any institution that before implementation of any information technology it should be ensured that the employees possess the required skills and competence. In the digital library environment, the LIS professionals have to face different kinds of tuff challenges; so there is the maximum need of the skill enhancement programmes for the library staff. Along with the potential working skills, the library professionals should also have the positive attitude to work for the benefit of institutions for achieving its goals. To cope with the technological changes and challenges, it has become mandatory to reorganize the services in the Library and Information Centres. People Capability assessment model with set of definite strategies used as a framework to assess the skills, knowledge, and attributes required by library and information science professionals (LIS) which helps to manage the changes in the Digital Environment.

Related Literature

As information technology (IT) has become part of everyday life, Dolan & Schumacher (1997) described that the influx of the internet and innovative technologies impacted the LIS professionals that they enable to be qualified in a new variety of technological career. Ashcroft (2004) states that the LIS professionals need to change because of the IT trends, thus their roles, characteristics and skills are set to adjust to the changes. Fourie (2004) indicated that IT has impacted on the future of librarians' work activities and responsibilities. She described how librarians are in the cyberspace world and their roles have to be changed according to the new IT developments.

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The development of new capabilities and an expanded ability to keep pace with and even create new opportunities (Coutu, 2002; Freeman, Hirschhorn, and Maltz, 2004; Jamrog et al., 2006; Maritan 2001; Lengnick-Hall and Beck, 2003; Weick, 1988) in the present competitive environment and creates ability to capitalize on unexpected challenges and change. This goes beyond returning to established benchmarks to see organizational capability as an important factor enabling a firm to leverage its resources and capabilities not only to resolve current dilemmas but to exploit opportunities and build a successful future. In today's digital environment the information professional are need to be good communicators, able to solve problems, familiar with the latest technologies, and be able to embrace, adopt and adapt them as required (Patridge, Lee and Munro, 2010).

The main characteristics of the information society have been defined as "changed perceptions of the importance of the role of information; the growth in the amount of information now available and the wide variety of formats; the size and continued growth of the information sector in modern economies; and the rate of technological change and the impact of technology" (Mullins, Ferguson and Houghton, 2000). Clearly this has implications for libraries and their staff, who must be ready to face new challenges, and devise procedures to manage organisational change. DEST (Department of Education, Employment and Workplace Relations) published a report in 2002 identifying eight key generic skills: communications; team work; problem solving; initiative/enterprise; planning and organisation; self management; and technology (DEST, 2002). Patridge, Lee and Munro (2010) enumerated a complex array of personal traits such as enthusiasm, passion, vision, creativity, leadership, adaptability, flexibility, persistence, and resilience. In turbulent, surprising, continuously evolving marketplace environments only flexible, agile, and relentlessly dynamic organizations will thrive. In fact, firms often must be able to move beyond survival and actually prosper in complicated, uncertain, and threatening environments. Unstable environments create frequent challenges and even relatively stable marketplaces experience occasional jolts or undergo periodic revolutionary shifts. Often these events are viewed negatively, but as Sutcliffe and Vogus (2003) explain, resilient organizations are able to maintain positive adjustments under challenging conditions.

The benefit of better workforce practices has been demonstrated empirically in numerous studies. Those organizations employing an integrated human resources strategy represent a significantly higher proportion of world-class companies. In some cases, even mere reputation signals regarding an organization's human resources practices have been positively associated with increases in share Prices. Institutions with the best workforce practices have been shown to outperform other firms in terms of increased profits, sales, earnings, and dividends. From the Review of related literature it seems that the implementation of P-CMM in Library and Information Centre has not been practiced yet. Therefore, an attempt has been initiated to practice P-CMM among Library and Information Science (LIS) professionals. In this paper an attempt has been taken to adapt the People CMM a workforce focused compatibility maturity model for assessing the capability among Library and Information Science professionals in

their work environment in order to improve their workforce capabilities in the digital environment.

Objectives

- Few of the objectives that were framed for the study are:
- To identify the Professional Skills required in Digital environment.
- To identify the Knowledge and attributes of LIS professionals.
- To recall the people with critical knowledge and skills

Methodology

In order to assess the skills, knowledge, and attributes required by library and information science professionals (LIS) in the Digital Environment, the questionnaires were distributed among all the LIS professionals working in 127 engineering institutions situated in and around Chennai. Out of 364 distributed, 318 were responded, and the response rate is 87.36. The Engineering Institutions were classified based on their nature of management as Government, Self-Financing Minority and Self-Financing Non-Minority.

Out of 318 respondents, 205 (64.46%) are male, 113 (35.53%) are female professionals, 119 (37.42%) are librarians and 199 (62.56%) are assistant librarians, 36 (11.3%) professionals are U.G qualified, 124 (38.99%) are P.G, 146 (45.91%) are M.Phil and 12 (3.77%) professionals with Ph.D qualification, 92 (28.9%) professionals are having less than 5 years of experience, 124 (38.9%) professionals with 6 to 10 years, 73 (22.9%) professionals between 11 to 15 years, 15 (4.71%) professionals with 16 to 20 years and 14 (4.40%) with more than 20 years of experience, 33 (10.4%) Professionals working in Government, 127 (39.9%) are working in Self Financing Minority and 158 (49.7%) are working in Self Financing Non-Minority institutions.

People Capability Maturity Model

People Capability Maturity Model **(**People CMM or P-CMM) is a workforce focused compatibility maturity model developed by the Software Engineering Institute (SEI). People CMM was introduced in 1995 to bring in a focus to workforce process efficiencies and productivity. It is a roadmap for implementing workforce practices that continuously improve the capability of an organizations workforce. Since an organization cannot implement all of the best workforce practices in an afternoon, the People CMM introduces them in stages. Each progressive level of People CMM produces a unique transformation in the organization's culture by equipping it with more powerful practices for attracting, developing, organizing, motivating and retaining its workforce.

The People CMM consists of five levels of maturity, four levels of themes/ objectives, twenty-two process areas. Each process associated with a specific maturity level aligned under one of four themes/objectives and has one implementation goal. Each goal is containing a clearly defined set of practices which support realization and sustainability of implemented/enhanced practices.

Figure 1 Significant facets for P-CMM

Maturity Level	People CMM Threads			
	Developing Individual Capability	Building Workgroups & Culture	Motivating & Managing Performance	Shapingthe Workforce
5 Optimizing	Continuous Capability Improvement		Organizational Performance Management	Continuous Workforce Improvement
4 Predictable	Competency Based Assets Mentoring	Competency Integration Empowered Workgroups	Quantitative Performance Management	Organizational Capability Management
3 Defined	Competency Development Competency Analysis	Workgroup Development Participatory Culture	Competency Based Practices Career Development	Workforce Planning
2 Managed	Training and Development	Communication and Coordination	Compensation Performance Management Work Environment	Staffing
1 Initial	(This initial maturity level contains no Process Areas)			

Source: Wademan M R, Spuches C M and Daughty P L (2007) Fig.1

The model is developed such that each level builds upon the previous level of maturity and requires that users establish a sound foundation before focusing on the next higher level of capability. Thus, each maturity level provides a "successive foundation" for continuously improving talent, developing an effective workforce, and successfully managing the human capital of the organization (Curtis, Hefley and Miller, 2002).

Data Analysis on Professional Skills Assessment

Fourteen variables were taken to assess the skills required for the LIS professionals in digital environment. The variable and the description are shown in the Table 1

Table-1 Professional Skills – Variables and Description

S. No.	Variable	Description
1	Careful decisions	Library Professionals take careful decisions backed by evidence
2	Exhibit consideration and Sensitivity	Library Professionals exhibit consideration and sensitivity in dealing with people and avoid giving offence
3	Effective communication	Library Professionals are effective communicators
4	Collaborative behaviour	Library Professionals are able to create collaborative behaviour within a team
5	Ability to persuade	Library Professionals have ability to persuade others

6	Technical, Cognitive and Interpersonal skills	Library Professionals have a combination of technical, cognitive and interpersonal skills that enables them to effectively coordinate and organise their teams
7	Connected with in org	Library Professionals are well connected within the organisation
8	Connected outside org	Library Professionals are well connected outside the organisation (e.g. Professionals networks)
9	Brings out best	Library Professionals bring out the best in our people
10	Inspire people for committment	Library Professionals inspire people to be committed to the organisation
11	Support their professionals	People perform well to support their Professionals
12	Encourage people for new ideas	Library Professionals exhibit consideration and sensitivity in dealing with people and avoid giving offence
13	Encourage staff to take responsibility	Library Professionals encourage their staff to take responsibility for the teams performance
14	Longer term development	Library Professionals are interested in the longer term development and progress of their team members

The opinion from the LIS professionals were asked to mark by using 5 point scale. The mean and standard deviation was calculated to assign ranks which is shown in the Table 2 and Fig.2

Table 2 Professional Skills

S. No.	Description	SD	D	UD	A	SA	M	Std	R
1	Careful decisions	7 2.2%	2 .6%	24 7.5%	196 61.6%	89 28.0%	4.13	0.75	4
2	Exhibit consideration and Sensitivity	9 2.8%	9 2.8%	16 5.0%	201 63.2%	83 26.1%	4.07	0.82	7
3	Effective communication	0 .0%	17 5.3%	15 4.7%	163 51.3%	123 38.7%	4.23	0.77	1
4	Collaborative behaviour	0 .0%	15 4.7%	0 .0%	212 66.7%	91 28.6%	4.19	0.66	2
5	Ability to persuade	0 .0%	0 .0%	25 7.9%	212 66.7%	81 25.5%	4.18	0.55	3
6	Technical, Cognitive and Interpersonal skills	0 .0%	2 .6%	34 10.7%	239 75.2%	43 13.5%	4.02	0.52	9
7	Connected with in org	1 .3%	38 11.9%	14 4.4%	181 56.9%	84 26.4%	3.97	0.90	11
8	Connected outside org	0 .0%	30 9.4%	88 27.7%	175 55.0%	25 7.9%	3.61	0.76	14
9	Brings out best	20 6.3%	4 1.3%	37 11.6%	160 50.3%	97 30.5%	3.97	1.02	12
10	Inspire people for committment	0 .0%	20 6.3%	34 10.7%	181 56.9%	83 26.1%	4.03	0.79	8

11	Support their professionals	7 2.2%	8 2.5%	48 15.1%	172 54.1%	83 26.1%	3.99	0.84	10
12	Encourage people for new ideas	0 .0%	2 .6%	48 15.1%	231 72.6%	37 11.6%	3.95	0.54	13
13	Encourage staff to take responsibility	0 .0%	10 3.1%	21 6.6%	225 70.8%	62 19.5%	4.07	0.62	5
14	Longer term development	0 .0%	16 5.0%	9 2.8%	229 72.0%	64 20.1%	4.07	0.65	6

M – Mean, SD – Standard Deviation, R – Rank

Among fourteen variables 90% of library professionals agreed that they are effective communicators and 95.3% are able to create collaborative behaviour within a team 92.4% have ability to persuade others and 89.6% take careful decisions backed by evidence. The least preference 62.9% of LIS professionals indicate that they are well connected outside the organization which is followed by 80.8% the Professionals exhibit consideration and sensitivity in dealing with people and avoid giving offence and 84.2% for the professionals exhibit consideration and sensitivity in dealing with people and avoid giving offence. The mean value ranges between 3.61 and 4.23 which indicate most of the variables between agreed and strongly agreed. The standard deviation ranges from 0.52 to 1.02. It is inferred that there is no significant deviation among the opinions.

Professional Skills Vs Gender

In order to assess the Professional skills, the study was further extended to gender wise comparison and their opinion marked in five point scales. Based on mean and standard deviation the ranks were assigned and the same is shown in Table 3.

Table 3 Professional Skills Vs Gender

S. No.	Description	Male			Female			Chi Sq.
		M	SD	R	M	SD	R	
1	Careful decisions	4.13	0.73	4	4.12	0.79	5	2.76
2	Exhibit consideration and Sensitivity	4.03	0.82	7	4.14	0.83	4	3.03
3	Effective communication	4.20	0.82	1	4.30	0.68	1	2.58
4	Collaborative behaviour	4.17	0.70	2	4.24	0.59	2	1.65
5	Ability to persuade	4.16	0.54	3	4.21	0.57	3	1.34
6	Technical, Cognitive and Interpersonal skills	4.00	0.53	9	4.04	0.50	8	1.15
7	Connected with in org	3.93	0.93	12	4.04	0.86	11	2.33
8	Connected outside org	3.61	0.78	14	3.61	0.74	14	2.84
9	Brings out best	3.96	1.00	11	4.01	1.06	13	1.56
10	Inspire people for committment	4.02	0.77	8	4.04	0.83	10	1.27
11	Support their professionals	3.96	0.84	10	4.06	0.86	7	2.50
12	Encourage people for new ideas	3.92	0.56	13	4.01	0.49	12	2.97
13	Encourage staff to take responsibility	4.06	0.62	6	4.08	0.63	6	1.06
14	Longer term development	4.09	0.62	5	4.04	0.72	9	1.59

M – Mean, SD – Standard Deviation, R – Rank

Professional skills Vs Experience in years

The analysis was further extended to work experience from less than 5 years to more than 20 years. The mean and standard deviation was calculated to assign ranks.

Table 4. 52 Professional Skills Vs Experience in Years

S. No.	Description	< 5			6-10			11-15			16-20			>20			Chi Sq.
		M	SD	R	M	SD	R	M	SD	R	M	SD	R	M	SD	R	
1	Careful decisions	4.16	0.62	1	4.07	0.84	6	4.15	0.76	2	4.13	0.64	6	4.21	0.89	4	18.06
2	Exhibit consideration and Sensitivity	4.03	0.80	7	4.12	0.82	4	4.03	0.87	10	4.13	0.74	7	4.00	0.88	8	1.67
3	Effective communication	4.07	0.81	5	4.32	0.70	1	4.23	0.84	1	4.40	0.51	1	4.36	0.84	2	15.38
4	Collaborative behaviour	4.15	0.73	2	4.26	0.58	2	4.12	0.78	5	4.07	0.26	8	4.36	0.50	1	10.03
5	Ability to persuade	4.04	0.57	6	4.23	0.56	3	4.19	0.52	3	4.33	0.49	2	4.29	0.47	3	11.17
6	Technical, Cognitive and Interpersonal skills	4.00	0.44	9	4.06	0.53	7	4.03	0.50	9	3.80	0.56	12	3.93	0.83	10	18.69
7	Connected with in org	3.80	0.94	13	4.04	0.86	9	4.08	0.89	7	4.27	0.46	4	3.57	1.22	14	35.33
8	Connected outside org	3.63	0.71	14	3.59	0.81	14	3.56	0.80	14	3.73	0.46	14	3.86	0.86	11	13.47
9	Brings out best	3.99	0.94	10	3.88	1.09	13	4.00	1.00	11	4.33	1.05	3	4.21	0.89	4	18.21
10	Inspire people for committment	4.01	0.78	8	3.98	0.81	12	4.12	0.76	4	4.07	0.88	9	4.07	0.73	7	6.56
11	Support their professionals	3.96	0.78	11	4.03	0.87	10	3.96	0.93	12	4.20	0.41	5	3.86	0.86	11	12.93
12	Encourage people for new ideas	3.92	0.52	12	4.01	0.53	11	3.95	0.52	13	3.93	0.59	10	3.71	0.73	13	14.13
13	Encourage staff to take responsibility	4.09	0.62	4	4.08	0.59	5	4.07	0.63	8	3.87	0.52	11	4.00	0.88	8	10.66
14	Longer term development	4.12	0.64	3	4.06	0.68	8	4.08	0.62	6	3.80	0.77	13	4.14	0.53	6	6.55

M – Mean, SD – Standard Deviation, R – Rank

Inferences

Both male and female professionals invariably given first priority to library professionals are effective communicators which is followed by they are able to create collaborative behaviour within a team and they have ability to persuade others. The least preference to library professionals are well connected outside the organization by both male and female. The mean value for male professionals ranges from 3.61 to 4.20 and for female 4.10 to 4.30. The standard deviation values ranges from 0.56 to 1.00 for male and 0.49 to 1.06 for female professionals. The library professionals take careful decisions backed by evidence given top preference by less than 5 years, they are effective communicators by 6-20 years and they are able to create collaborative behaviour within a team by the professionals with more than 20 years of experience. The least preference given to library professionals is well connected outside the organisation by less than 5 to 20 years of experience and they are well connected within the organization by more than 20 years of experience.

Conclusion

Facing technological innovations, for instance digitization, electronic publishing, Web 2.0, Library 2.0, RSS, Blogs, Wikis, SMS, Podcasting, Mashups, Tagging, Folksonomies, OSS, OA, etc., libraries worldwide have been adjusting to the shift from the printed era to the digital era. This change has created a new librarian landscape in terms of services and activities. These innovations impact the roles, competencies, skills and knowledge of LIS professionals. To work successfully in the digital environment, the basic knowledge and skills, attributes required for the LIS professionals should be analysed. Partridge and Hallam (2004) in their studies stated that the comparison of the structure of human DNA to the skills, knowledge and attitudes of the model information professional for the twenty-first century. They indicated that both discipline knowledge and generic capabilities were needed for a successful information professional in today's information environment.

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TRANSMOGRIFICATION OF KNOWLEDGE: LIBRARIES MORPHING FOR THE FUTURE

Shinsa Nazar[1] & Dr. B. Mini Devi[2]

Introduction

Imagine living without Google, where finding information requires more than just an internet search. For most of human history, libraries were the bright lights that led the way in this situation. The library is where people gather wisdom, as Egyptian pharaoh Rameses II stated. Libraries have served as safe havens for actual books, painstakingly conserving and transmitting information throughout generations, from the collections of clay tablets in Mesopotamia to the opulent halls of Alexandria. These safe havens provided access to information, advancing scientific research, inspiring creative writing, and giving people the power to change the world.

However, the digital era has brought a 'transmogrification' of information. 'Transmogrification' describes this significant move from tangible collections to an infinite digital space(Rajkumar et al., 2024)the anticipated requirements and expectations placed on various sectors undergo profound transformations. This proposed study explores the shifting landscape, identifying key demands and expectations across various domains and highlighting the requirement for adaptability and innovation. The digital era has directed transformative changes, redefining the landscape of libraries into dynamic digital repositories. Anticipating the future requirements and expectations in this evolving domain is imperative for effectively catering to user needs. The term 'digital library,' often referred to as a 'digital repository,' is crucial in contemporary information. The process of transforming a digital repository into an institutional repository (IR. Libraries have evolved from being the exclusive home of dingy books to vibrant places for accessing and curating the vast cyberspace. The changing context of libraries in the digital era is explored in this essay. We'll talk about the fantastic potential brought forth by this digital revolution and the challenges and evolving role of librarians.

Evolving Landscape of Libraries

The information landscape has undergone a fundamental transformation due to the digital revolution, and librarians are no longer responsible for looking after physical

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holdings. Librarians have significantly shifted their skill sets to succeed in this new century. They now have a wide range of tools that help them deal with the challenges of the digital age. Some of them are:

Digital Literacy Training

Librarians have always been champions of information literacy, but the digital age demands a deeper understanding of the online environment.

Assessing online information sources: By teaching users how to use critical thinking techniques, librarians may help them determine the legitimacy and dependability of internet material. They can select and curate internet materials and instruct users on how to spot false information or prejudices.

Sophisticated online search strategies: Libraries can access various electronic materials and online databases. Librarians must adapt to navigating these intricate systems to get exact information for users by applying sophisticated search operators and filters. For example, librarians may use Boolean operators like AND, OR, and NOT to filter search results in these databases(Kumar N et al., 2024)the integration of educational technology (EdTech.

Information Security Expertise

With the increasing volume of sensitive information stored digitally, librarians must prioritise data security. Reports from library associations, like the American Library Association (ALA), highlight the importance of information security training for library staff. This includes skills such as:

Best data privacy practices: Librarians should know about privacy laws and ensure that user information is handled safely. They can put policies in place for safe login processes and data encryption.

Fair usage and copyright: Complex copyright difficulties arise in the digital era. Librarians can advise users on properly utilising copyrighted content and ensure all library services adhere to copyright regulations.

Online Research Navigation Skills:

For numerous people, the Internet has emerged as their go-to source for research. Librarians are essential in assisting users in navigating this large and somewhat daunting area. Proficiency in the following is necessary:

Curating online resources: In addition to offering reputable websites, blogs, and periodicals that are pertinent to particular study topics, librarians can produce online research guides.

Techniques for conducting social media research: Social media sites can help research resources. Librarians can instruct users on using social media to get pertinent information efficiently while being aware of biases and false information(Okike & Adetoro, 2019).

Skillsets of Traditional and Digital Librarians

While traditional librarians excelled in managing physical collections through cataloguing and classification, digital librarians require expertise in selecting, acquiring, and managing digital resources like e-books and databases. Research assistance has transformed from navigating physical resources to guiding patrons through online search strategies and complex databases. Similarly, reference interview skills have adapted to understanding user needs through online interactions and virtual reference services instead of face-to-face communication. Instructional skills have broadened to encompass workshops and training sessions on digital literacy and online research, in addition to teaching patrons how to use the library catalogue. Technology proficiency has become paramount for digital librarians, requiring mastery of various digital tools and technologies beyond basic computer literacy. This includes expertise in search engines, online databases, and content management systems. Furthermore, digital librarians must be well-versed in information security practices to navigate online threats, protect data, and ensure user privacy. In contrast, traditional librarians have a more limited need for such knowledge. While foreign language skills remain advantageous, their importance may shift based on the prevalence of multilingual online resources. Once less emphasised, project management skills may become crucial for digital librarians managing digital library projects and initiatives. Excellent communication remains essential but now encompasses in-person and online interactions through various channels like email and online chat. In essence, while traditional librarians were masters of the physical realm, digital librarians must excel in a dynamic digital environment(Shah et al., 2024) These are only a few instances of the changing set of abilities needed in the digital age for librarians. Learning to use these new tools will help librarians ensure that libraries remain essential and relevant resources in a world where digital information is progressively taking over.

Bridging the Digital Divide

The difference in access to technology, the internet, and the digital skills necessary to use them efficiently between individuals and communities is known as the ‘digital divide’. Wide-ranging effects result from this disparity, including restricted access to jobs, essential government services, and educational opportunities. As hubs for the community and a lifeline for individuals without access to technology and the internet at home, libraries have become essential players in closing the digital divide.

Libraries provide free public computers and high-speed internet use for people and families who might not otherwise have access. They also offer training programs in digital literacy, which teach people how to use digital technologies for communication and education, conduct online research, and browse the internet safely and productively(Hussain et al., 2023). These include, for instance, ‘Tech Time’ workshops that teach fundamental computer skills like email, internet browsing, and online safety and ‘Digital Citizenship for Teens’ programs that teach teenagers how to use social media responsibly and stop cyberbullying. Libraries are also selecting digital

materials accessible to people with disabilities, like screen reader-compatible websites, closed captions for online films, and ebooks and audiobooks with text-to-speech features.

Challenges and Opportunities of Digital Preservation

Due to digital information's inherent fragility and loss-proneness, digital preservation is a crucial concern in the digital age. Data corruption, media deterioration, and technology obsolescence are some factors causing this problem. Libraries use extensive digital preservation techniques to guarantee the sustainability of digital resources over time. Investing in dependable and redundant storage options, such as cloud, on-site, and geographically distributed backup locations, is one of these tactics for reducing the risk of data loss from natural catastrophes or hardware malfunctions.

To ensure continuous accessibility as older formats become obsolete, libraries also employ digital format migration, which converts digital resources from older to newer formats. Nevertheless, obstacles are associated with migrating, like the need for meticulous preparation and testing to prevent data corruption throughout the conversion procedure. Digital preservation requires thorough metadata management, which includes details about a digital object's format, creation date, and originator.

Risk mitigation is crucial to the preservation of digital content. Libraries engage in staff training to ensure proper handling and maintenance of digital resources, and they create disaster recovery plans to meet potential hazards such as cyberattacks or natural catastrophes. Over the long run, maintaining digital information necessitates continuing attention to detail and personnel training.

User Experience in Digital Libraries

User experience is critical to effective information retrieval and satisfied patron use of library resources in the digital era. Research indicates a robust association between successful information retrieval and user experience. Clear and consistent navigation, efficient resource curation techniques, subject classification, and search result relevancy ranking are essential elements that affect user happiness.

Digital libraries should provide robust yet approachable search features like filtered search, sophisticated search options, and natural language search capabilities. Search is the foundation of user interaction with these resources. Precise and uniform vocabulary, search result relevance ranking, and navigation are all critical components of effective resource curation strategies.

Beyond functionality, a good user experience includes interactive elements such as online displays, training, and tailored recommendations. Libraries should also make sure that the digital collection is usable by people with disabilities by including features like font size adjustments, closed captioning for videos, and compatibility with screen readers.

Conclusion

The digital revolution has brought libraries into a new era of information access and services. With a focus on information security, digital literacy instruction, and online research tools, they are developing their skill sets to become digital navigators, educators, and information curators. Libraries today help users navigate the immense ocean of internet information, teach them how to critically evaluate information, and help them navigate intricate research databases. Libraries are helping to close the digital divide by offering training programs in digital literacy, public computers, and accessible digital resources for those with impairments. Additionally, they are tackling issues like information overload and digital preservation by implementing tactics like data storage solutions and information literacy instruction.

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GOVERNMENT INITIATIVES TOWARDS VIRTUAL LEARNING - WITH SPECIAL REFERENCE TO KERALA

Mohammed Sabique[1] & Alok V N[2]

Introduction

The beginning of transmogrification of the educational system into an electronic structure has started from the late 20th century itself. Even though a mass majority were unaware about it in the commencing stage, over a period of time, just like with every other advancements in general, people got adapted to it. By the beginning of the 21st century, the virtual learning system and utilisation of e-resources became inevitable in the academic domain. So at a point the government also had to come-up with resources or platforms which can be accessed by the public and remaining as an authentic source or platform for academic pursuits. The study mainly focused on accentuating the virtual learning platforms and sources provided by the central government and the impact of such platforms on learners with special reference to the state of Kerala. Recently within the last few years, the demand and the consumption of virtual learning is expanding tremendously. There are several factors which have contributed to this rise in demand for virtual learning. It includes the improved interconnectivity on a global level, arrival of the 5G network and the increased adaptability and comfort of people towards using the electronic gadgets, and leading edge.

Government of India provides PM eVidya which covers all the digital education infrastructure and thereby initiates a digital India campaign. It amalgamated several initiatives under the government including SWAYAM, DIKSHA, ePathshala, SWAYAM Prabha TV etc (PM e-Vidya, n.d.). The Government of Kerala also provides various digital platforms such as Kerala LMS, KITE,VICTERS,Samagra Portal, Schoolwikis, Little Kites, KOOL, Ecube, KALNET, Knimbus etc.

Central Government Initiatives Towards Virtual Learning

MOOCs According to the Government of India site, SWAYAM and NPTEL are the major MOOC initiatives in the Indian government sector.

SWAYAM Portal is a primary example of MOOC (Massive Open Online Course) when it comes to the Indian scenario. Swayam or Study Webs of Active

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Learning for Young Aspiring Minds was established by the Ministry of Human Resource Development (M.H.R.D.), now the Ministry of Education to fulfil the aim of access, equity and equality in education for everyone. SWAYAM was established in the year 2017 with the help of Microsoft. SWAYAM acts as a collective channel for providing online courses from various universities of India. So by being in a tie-up with the top quality major institutions, SWAYAM is able to provide 13,140 courses so far and providing a learning space to 4.2 crores people so far within these last few years. So when a person decides to go for online learning, there might be confusion and concerns regarding a platform which provides authentic and reliable source of information. SWAYAM basically rules out this gap by providing numerous courses in an open access method. Those who complete the courses from the SWAYAM will be benefited by the certificates provided by the respective universities. They can also utilise this for adding credit points in the Academic Bank of Credits. The versatility of academic content from class 9th till post-graduation is also a marvellous factor to be mentioned while briefing SWAYAM.

NPTEL (National Programme on Technology Enhanced Learning) is a venture begun by the cooperation of IITs and IISc, contributing study materials and videos to the science and technology field. It has been established for more than two decades. It has been providing MOOC courses for more than a decade now. Originally NPTEL provided its online certificate courses through its own platform, after the arrival of SWAYAM, now NPTEL courses are available on both SWAYAM Portal and its original website. NPTEL also disseminate educational content through YouTube, local chapters, email newsletters…etc

DTH Broadcasting Initiative

SWAYAM PRABHA is another major initiative by MHRD (Ministry of Human Resource and Development) which was started in the year 2017 itself. It is a collection of 40 DTH (Direct-to-Home) channels which broadcast educational content 24*7. Every day new content will be broadcasted in the SWAYAM PRABHA and it will be re-telecasted in the day itself making sure that the viewers can watch it according to their convenience. The content will be provided by IITs, IGNOU, UGC, CEC. The highlight of SWAYAM PRABHA is that in the remote areas those who still haven't got a proper internet connectivity, could make good use of content provided by SWAYAM PRABHA channels.

Digital Repositories

DIKSHA (Digital Infrastructure for Knowledge Sharing) launched in 2017 is a major digital platform spread across all over India available in 36 languages. It is under the supervision of NCERT (National Council for Educational Research and Training). It mainly aims to promote school level education in India by providing digital versions of textbooks, videos and interactive content (Department of School Education and Literacy, n.d.). It has QR code integration on textbook making the content easily available online

by scanning. Also, DIKSHA provides training sessions and courses for teachers thereby uplifting the quality of offline education.

e-Pathshala is a webportal or application which was developed by the ministry of education and NCERT in 2015 as part of digital India campaign. Similar to DIKSHA, e-Pathshala also provides e-content sticking with the curriculum of NCERT. It provided digital learning materials for both students and teachers. Other than that, it provides resources for parents to understand the subject and support their student education.

NDLI (National Digital Library of India) is a digital repository that constitutes information from various domains including science, engineering, technology, arts, social sciences… etc. It includes content needed for school education to research and career development. It also comprises newspaper archives and cultural archives. Presently it is the largest open digital repository initiative of India. It was initiated by the ministry of education and currently overlooked by IIT Kharagpur. It is collaborated with SWAYAM and SWAYAM Prabha, thereby increasing the accessibility to the content.

Apart from these, there are several digital consortia at national level that serve various academic and research purposes. e-ShodhSindhu, Consortium for e-Resources in Agriculture (CeRA), Consortium For Educational Communication (CEC) and UGC INFONET Digital Library Consortium. These consortia support virtual schooling and research by offering essential resources and facilities which makes an indirect contribution to the virtual learning ecosystem.

Digital India Internship

Digital India Internship is an initiative under MeiTy (Ministry of Electronics and Information Technology) that provides a 3 month internship to students who have a college background in computer science. This enables the students to have hands-on training in a working environment and having an expert to guide them, also providing stipend to students, thereby giving them a small earning opportunity . It aims at active participation in the learning process through experimentation and putting into practice the knowledge acquired in the classrooms.

Pragyata

Pragyata is a set of guidelines by MHRD as a part of digital india campaign initiated during covid pandemic. The aim of pragyata was to promote online education and while doing so, to create a set of guidelines and criteria that should be followed by the educational institutions while carrying out the process. The initiative aimed to promote online education and to streamline the process. The guidelines provided recommendations to the schools, teachers,parents and students. The major components of the guidelines included digital infrastructure, digital tools, online assessment, teacher training,cyber security, collaboration (Press Information Bureau, 2020). Even Though pragyata is not a primary learning platform, it acted as a catalyst in promoting and upbringing the quality of online education.

While a brief outlook of National level initiatives has been carried out, the study also aims to devote time for analysing the virtual initiatives taken by Kerala government. There are some major initiatives taken by the government of Kerala that helped them to manage the academic continuity of the students during the covid-19 Pandemic.

Kerala Government Initiatives Towards Virtual Learning

According to the government of Kerala site for KITE(Kerala Infrastructure and Technology for Education,n.d), and other sources, apart from the initiatives from the central government, the Kerala state government also had taken a couple of initiatives towards virtual learning from the beginning of 21st century itself. Kerala LMS, IT @ school, VICTERS, Vidyasree project etc which had a major role in the reinforcement of digitalisation of the education system in Kerala. Also by effectively utilising the central government's resources in the field, the state government has emerged in the path of digital literacy and virtual learning.

Kerala Learning Management System (Kerala LMS)

It is a digital platform for learning and education that was established in the year 2020 managed by the department of general education, government of Kerala. It provided virtual classrooms where a teacher can communicate with students in real time. It was supported by multimedia facilities like screen sharing, chatting...etc. It also had evaluation tools for conducting online exams and quizzes thereby students can practice for exams and know their knowledge level. Just like e-Pathshala, Kerala LMS also has training sessions for teachers. It also provided a portal for parents or guardians to monitor their child's progress or status in the academic pursuit. During the pandemic period the portal had an increased number of user access since all the offline platforms were offreach.

KITE and IT @ school

Kerala Infrastructure and Technology for Education (KITE) have undertaken a major part in the ICT sector of Kerala education. The list expands from implementing the broadcasting channels to making collaborative content for schools. The study also tries to shed light on the beginning of this project and how it has evolved its digitising process in the period of time. Originally the programme was initiated in the name 'IT @ school' launched in the year 2001-02. It was reformed into KITE in the year 2017. The State Project Director carried out an initial study early in May 2020 to determine the number of students without access to online courses prior to launching the online platform. According to the study's report, approximately 2.61 lakh pupils in Kerala out of 41.3 lakh students were found to not have access to online lessons.. KITE was operating under the education department, the project attained a milestone by making ICT a compulsory subject for the 10th standard students. Also by properly utilising the central government fund from the project 'ICT @ school', KITE issued direction to all the Headmasters of Government and Aided schools to make use of 1.2 lakhs laptops, 70,000 projectors and 4545 Television associated with Hi-tech school, Hi-tech lab scheme for the use of online classes.

The Govt appealed to the community to support our students for ensuring that each and every child comes under this venture. The response to this appeal was tremendous. People cut across all political perspectives, civil society organizations and a large number of individuals came forward to be part of this venture. Public sector undertakings, cooperative societies and private enterprises were ready to contribute funds as part of their CSR initiative. Given the actions taken in this regard and the overwhelming public and agency support for this initiative, the number of students identified as not having access to online classes has significantly decreased, reaching 17774 by 11.6.2020 and 872 by 14.06.2020.(Vikaspedia,n.d) IT @ school also created digital textbooks for lower and upper primary classes. Other major contributions include:

DTH Broadcasting Initiative

Kerala government launched the first complete educational DTH channel of India, VICTERS in the year 2005. More than just a TV channel, the significance of the initiative is phenomenal where back then interconnectivity was still a thing meant only for computer users and digital literacy was not in a progressed state compared to the current timeline. As for now, the Kerala government possesses two DTH channels namely KITE VICTERS and KITE VICTERS PLUS where VICTERS stands for 'Versatile ICT Enabled Resource for Students'. It is managed by KITE. Also, the government initiated a programme called "**first bell**" providing classes for students in each class at scheduled times. This was a success in terms of maintaining a student's academic pursuit and making sure that no child will be left without getting primary education. To make sure that the content should be accessible to students at any time, it was also uploaded to YouTube, facebook and KITE's official website.

Sampoorna School Management Software

The government introduced another significant initiative named as "Sampoorna School Management Software" under the "IT @ school" project. The government primarily utilised the software during the pandemic period for the online admission procedure and issuing of 'transfer certificates' to the school students. By this project, the parents of the students were able to access these merits remotely without directly going to the school, thereby preventing congestion and creating a secure environment during the covid-19 pandemic.

Also the government had a plan to ensure that every student from class 1st to class 12th have the equipment and facilities to access online classes. So the Sampoorna portal was used to collect the details of the students who have the equipment and facilities and the students who needed help. By this the government got a comprehensive knowledge of the number of students who needed aid, up to what level they needed support.

Schoolwiki

It is a collaborative wikipedia platform which was created with the cooperation of every school in Kerala. As the name refers to, schoolwiki acts as a source of information

or content created by the school students. Through the website, a person could go through the small writings, pictures or art works created by the students across Kerala. Also the platform contains the details of the major school initiatives of Kerala including artfest, IT fest, little kites, thirike vidyalayalm, haritha vidyalayam, aksharavriksham...etc. Through this, the public can access the details about each and every government school in Kerala, the special activities and initiatives that they are taking apart from the curriculum and can view the works done in the respective fields. It increases the transparency of school activities and through these, the schools and the students who excel in extra activities like IT,art,literature are getting a platform for showcasing their work and to get the deserved recognition and appreciation.

The AksharaVriksham was a venture initiated through schoolwiki during the lockdown period of covid pandemic.It aimed for enhancing and exhibiting the creative talents of school children. It uploaded the works made by the students on the topic environment,hygiene and disease resistivity in schoolwiki. Selected works published in schoolwiki were published by the SCERT (The State Council of Education Research and Training) in printed book format as ten volumes.

Little Kites and "Hi School Kuttikoottam".

After the completion of making every classroom hi-tech and initiating ICT involving education, the government wanted to involve students in the school ICT activities. To achieve this goal,in 2016 Kerala Government launched a project establishing student communities in every school. The programme was named as "Hi School Kuttikoottam". The programme promoted ICT enabled education, creating awareness in cyber security and cyber crimes. Later in 2018, by merging "Hi School Kuttikoottam" and IT clubs in schools "Little Kites" student community was formed. The programme aimed to benefit one lakh students under the project. It provided training for students in various programming languages and areas like hardware, animation and multimedia, cyber-security, internet and computer. This enriches the students on proper and safe internet usage and cyber security and also empower and provide confidence to the students to undertake minor technical issues of ICT equipments

KITE's Open Online Learning (KOOL)

KOOL is a tool launched by Kerala government which provides online training or courses to teachers, students, parents and the public. KOOL was inspired by the central government MOOC initiative. The tool include features for registration, assignment submission and communication with course mentor.

E-Cube English programme

E-Cube/E³ an initiative from KITE launched in 2019-20 for promoting language proficiency among students of classes from 1 to 8. E³ are Enjoy, Enhance and Enrich. Not only does it make the students improve their English but also make it enjoyable for learning. E³ has three components Samagra e-Library, e-Language Lab and e-Broadcast. Samagra e-Library is a digital library of international quality English books that can

be found in Samagra portal, digital copies of story books which can be enjoyable for reading are available in the digital library. By making use of the 'MGuru' e-Language Lab software, the students can hear, read, talk and write English depending on their learning capabilities. e-Broadcast includes programmes on VICTERS channels that will help students to learn how to use english in practical situations through interactive mode.

Avadhikala Santhoshangal

Avadhikala Santhoshangal, or Happy Vacation Times, was organised to help children make up for missed school days and to provide them the chance to grow up in an intellectual and creative atmosphere at home. In the initial phase of this initiative, KITE built the SAMAGRA online resource site and SCERT Kerala enhanced it with digital material for all students in Standard 5 through Standard 9. This was part of the Hi-Tech school project. Content that encouraged learning through poetry and storytelling, easy-to-do experiments, paintings, other artistic endeavors, reading cards, magic performances, computer activities, mathematics exercises, etc. were all featured in this.

Kerala Academic Library Network (KALNET)

Kerala State Higher Education Council (KSHEC) is an advisory body to the overnment of Kerala, in higher education, which acts as a state level coordinating agency for higher educational activities. It also brings together and expands the rich array of teaching, research and human resources development and fosters academic inquiry and research. (Kerala State Higher Education Council,n.d) The two major initiatives of the KSHEC related to libraries are Kerala Academic Library Network (KALNET) and e-journal Consortium . KALNET is a network of all the University Libraries of Kerala. A union catalogue of the members of KALNET supports Inter-Library Loan and Document delivery services. Through the e-journal consortium, provides Sciencedirect journals and scopus database to all members of the consortia. In addition to that, the digital Library Platform "Knimbus" is also provided by the KSHEC.

Teacher Training Portals

The Kerala government also initiated a couple of web portals for the training of academic staff and teachers. Those include the Samagra Resource Portal, IT @ school Portal and Kerala State Council for Science, Technology & Environment (KSCSTE).

Through the Samagra Resource Portal teachers and students can access textbooks,handbooks, audio and video visuals so that the teachers and students can get some extra help to prepare.

Vidyasree Project

Another significant initiative taken by the Kerala government as Vidyasree project. The project aimed to promote digital education by providing laptops to students for a lower rate through installments. It was managed by the Kerala State Financial Enterprises (KSFE) Ltd.It ensured that a student from a middle class family also getting benefitted from the digital resources properly.

Apart from this, there are also several other considerable projects initiated by the Kerala government to promote virtual learning including Hi-Tech school, Akshara Vriksham and also cooperating with the central government initiatives like DIKSHA.

Findings and Disscussion

India has a rich heritage of traditional learning, which offers face-to-face interaction, hands-on experience, and immediate feedback from instructors. With the rise of the digital era, virtual learning has become essential, offering flexibility in scheduling, accessibility from anywhere with an internet connection, and a wide range of resources and experts. However, scarcity of funds posed challenges for both central and state governments.

During the COVID-19 pandemic, the government took action to provide equal access to education through virtual learning. DIKSHA, introduced in 2017, is an NCERT digital portal with interactive material, videos, and digital textbooks in 36 languages. e-Pathshala, created in 2015, complements the NCERT curriculum and promotes Digital India. The NDLI, managed by IIT Kharagpur, is India's largest open digital repository, providing diverse information. The Digital India Internship offers hands-on training for computer science students.

The Kerala government, with community support, implemented initiatives like Kerala LMS, a digital learning platform launched in 2020, and KITE, which distributed devices to students during the pandemic. VICTERS, an educational DTH channel, provides scheduled classes and online content. Other initiatives like the Sampoorna portal, Schoolwiki, Hi School Kuttikoottam, and KOOL enhance digital learning. These efforts ensure equitable access to education, bridging the digital divide and preparing learners for future challenges.

All the initiatives of both central and state governments enhanced virtual learning. Virtual learning is scheduling flexibility, which lets students access materials and engage in classes whenever it's most convenient for them.(Dung, D. T. H.,2020) By facilitating teaching from any location with an internet connection, it improves accessibility and reaches a larger audience. The range of resources, including interactive materials, films, and talks by experts, enhances the educational process. It is also economical, saving costs associated with transportation and physical infrastructure. Improved collaboration tools encourage dialogue, cooperation, and a feeling of belonging among students.

India's education landscape blends rich traditional methods with transformative digital initiatives. Amidst financial constraints, platforms like DIKSHA, e-Pathshala, and NDLI democratize learning nationwide. Kerala's pioneering efforts with Kerala LMS and KITE ensure uninterrupted education through virtual classrooms and digital resources. Initiatives like Sampoorna portal and Schoolwiki foster transparency and community involvement, showcasing student achievements. Programs like Hi School Kuttikoottam and KOOL empower students with ICT skills, while E-Cube enhances language proficiency. The Kerala State Higher Education Council supports research

through KALNET and Knimbus. Overall, India's digital education journey bridges gaps, ensuring equitable access and preparing learners for future challenges in library science and beyond.

Suggestions

1. Enhance Digital Infrastructure
2. Implement Teacher Training and Support programs.
3. Develop localised Curriculum and Content.
4. Support and promote Student Engagement in digital learning.
5. Continuous assessment and proper Evaluation and Feedback Systems
6. Provide Inclusive Education for weaker sections with respect to gender and students who need special attention.
7. Involvement of Community and Parents in virtual education.
8. Advocate for support policies and explore for diverse funds.
9. Invest and adopt new innovations for Research and Development
10. Prepare for disaster recovery and implement backup solutions.
11. Support research and virtual learning with artificial intelligence.

Conclusion

In order to ensure that all citizens had equitable access to education during the COVID-19 pandemic, the government intervened and provided necessary digital equipment for online learning, therefore closing the digital gap and guaranteeing equal access to education for all residents. Through various schemes such as SWAYAM, MOOC, NPTEL, SWAYAM PRABHA, DIKSHA, e-Pathshala, NDLI and other schemes the central government provided initiatives to virtual learning to the citizens. Kerala government also facilitated through various schemes such Kerala LMS, KITE, IT@school, VICTERS, Sampoorna School Management Software, Schoolwiki, Akshara Vriksham, Little Kites, Hi School Kuttikoottam, KOOL - KITE's OPEN ONLINE LEARNING, E-Cube English programme, Avadhikala Santhoshangal, KALNET and KSCSTE, empowered students and general public by providing essential e-learning facilities. Even though, in India, where 142 crores of people reside and where a 1/5th of them belong to the below poverty line, state governments should establish comprehensive programs that supply essential devices to students that enhance students' learning experience and educational outcomes. The Kerala experience proves that the government initiatives and social support can be utilized to achieve the goal of universal digital literacy and virtual learning . The Accessibility rate of the citizens in utilising the virtual learning resources should be studied in detail and further constant efforts and initiatives should be put forth for the enhancement from the current scenario.

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MACHINE LEARNING
THE PROSPECTS FOR HUMAN LIVES

Dr. S. Dhanalakshmi[1]

Introduction

Over the years, machine learning has become the backbone of Information Technology which has become a hidden part of our lives. With the information explosion and the enormous volumes of data being generated these days, there is good reason to think that smart data analysis will become even more universal and indispensable for technological advancements. Machine

Learning conveys computer science and statistics organized for creating prognostic models. Machine learning algorithms are skilled in finding relationships and patterns in data. Data from the past as input to make forecasts are used by machine learning. Machine learning is a potent tool for problem solving, improving business processes, and automating routine tasks which more intricate and challenging technology that requires profound expertise and proper resources.

History of Machine Learning

- The early history of Machine Learning started in 1936, when Alan Turing developed the first modern computers and also detailed a procedure known as the Turing Test, forming the basis for artificial intelligence.
- The first mathematical model of neural networks was presented in the scientific paper "A Logical Calculus of the ideas immanent in nervous activity" by Walter Pitts and Warren McCulloch in the year 1943.
- Arthur Samuel wrote the first-ever computer learning program was written in 1952.
- Frank Rosenblatt in 1957 designed the first neural network for computers - the perceptron - which simulated the thought processes of the human brain.
- In 1997 IBM's Deep Blue shocked the world by beating the world champion at chess.
- In 2006 Geoffrey Hinton coined the term "deep learning" to explain new algorithms that let computers "see" and distinguish objects and text in images and videos.
- In 2010 Microsoft revealed their Kinect technology could track 20 human features at a rate of 30 times per second, allowing people to interact with the computer via movements and gestures.

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- In 2011 IBM's Watson beat its human competitors at Jeopardy.
- In 2015 Amazon launched its machine-learning platform
- In 2017 Waymo started testing autonomous cars in the US in 2017 with backup drivers only at the back of the car.
- In 2020, open AI announced a ground-breaking natural language processing algorithm GPT-3 with a remarkable ability to generate human-like text when given a prompt.

What is Machine Learning?

Machine learning is a subfield of artificial intelligence, which is broadly defined as the ability of a machine to copy human intelligence. Complex jobs which are done by humans are also possible to be completed by Artificial intelligence systems in the same manner. Machine Learning is precisely a technology that is used to guide machines to complete various activities such as predictions, recommendations, estimations, etc., based on past data or experience. There are three key aspects of Machine Learning which are task, experience, and performance:

- The task/problem can be related to the predictions, recommendations estimations, etc.
- Experience is defined as learning from historical or past data and used to estimate and resolve future tasks.
- Performance is defined as the capacity of any machine to resolve any machine learning task or problem and provide the best outcome for the same.

The working of Machine Learning

The steps involved in the working of the Machine learning is depicted below:

Data collection
Evaluating the model
Data preprocessing
Tuning and Optimization
Training the model
Choosing the right model
Predictions and deployment

Characteristics of Machine Learning

- The skill to achieve automated data visualization
- Automation at its best
- Customer engagement like never before
- The capability to change the mortgage market
- Accurate data evaluation
- Business intellect at its peak

Need for Machine Learning

Nowadays, machine learning is the need of the hour. Tasks that are too multifarious for humans to implement directly are made possible these days by employing machine learning methods. Computer systems handle huge amounts of data which the humans cannot manage manually as they have some limitations. Machine learning is a solution for making these things for the humans easy. Time and Money are saved by adopting machine learning methods.

Importance of Machine Learning

- Speedy growth in the creation of data.
- Settling complicated problems, which are tough for a human.
- Policy making
- in various segments including finance and business
- Discovery and development of new products.

Three major methods of Machine Learning

There are three major methods of Machine learning techniques which are:

- Supervised learning
- Unsupervised learning
- Reinforcement learning
- Supervised Learning

This machine-learning method is supervised by humans. In this method, model maps input data to the target variable which is supervisory in nature. Classification and regression techniques use this method. Image recognition, stock price analytics, and sentiment analysis also use this method. The machine uses large volumes of output data to get the required results by tuning the parameters one way or other which is supervised learning algorithm. The machine learning predictions are tested until the pattern is validated. The outcomes are then used for the analysis of new data. The strong side of supervised learning is that it is easy to use and accurate.

Unsupervised learning

No human involvement happens in this machine-learning method. Unlabelled data are used to train the machine learning model under unsupervised machine learning algorithms. This machine learning algorithm learns from the data and identifies patterns, tendencies, or relationships. It does not map the input to the output layer — only the input data is needed to teach this model. Clustering algorithms, anomaly detection, and association detection applies use unsupervised learning. Big volumes of training data are not required in unsupervised pattern recognition techniques. This speeds up and simplifies the machine learning implementation process.

Reinforcement learning

Gaming, autonomous system development, and robotics use Reinforcement learning methods. Reinforcement learning denotes learning from experience and tests by cooperating with the context. The outcomes gained as a result of reinforcement learning are incorporated into further learning processes to ensure that the same errors are prevented or the same results are obtained... One of the advantages of this method is learning from errors or trials, which helps to expand the models and make them more accurate. Reinforcement learning is an adaptive model that can be applied to complex tasks and changing conditions.

Six Machine Learning Techniques

Six major machine-learning techniques include:

- Regression
- Classification
- Clustering
- Decision Tree
- Neural Networks
- Anomaly Detection

Applications of Machine Learning

Image Recognition

This is one of the most common applications of machine learning which is used to identify objects, persons, places, digital images, etc. The popular use case of image recognition and face detection is, **Automatic friend tagging suggestion.**

Speech Recognition

The option of "**Search by voice**," when using Google comes under speech recognition, and it is a popular application of machine learning. Today machine learning algorithms are widely used in various applications of speech recognition aids like **Google Assistant**, **Siri**, **Cortana**, and **Alexa** which use speech recognition technology to follow voice instructions.

Traffic prediction

The usage of Google Maps when one wants to visit a new place shows the correct path with the shortest route and calculates the traffic conditions. It predicts the traffic conditions such as whether traffic is cleared, slow-moving, or heavily congested with the help of two ways:

Real Time location of the vehicle from Google Maps app and sensors

Average time has taken on past days at the same time.

Product recommendations

Various E-commerce and entertainment companies like **Amazon** and **Netflix** use Machine learning for product recommendations to users Whenever a search is made for a product on Amazon, the emergence of an advertisement for the same product while surfing the internet on the same browser is possible because of machine learning. Google understands user interest using various machine learning algorithms and suggests the product as per customer interest.

Email Spam and Malware Filtering

A new email received is automatically filtered as important, normal, or spam. Important mail is tagged with the important symbol and spam mail in the spam box uses this machine-learning technique only.

Virtual Personal Assistants

Google Assistant, Alexa, Cortana, and **Siri are some of the virtual personal assistants that we use in our daily lives**. These assistants use our voice instruction to find the information that we seek. These assistants help us in various ways just by using our voice instructions such as Play music, calling someone, opening an email, Scheduling an appointment, etc. These virtual assistants use machine learning algorithms as an important part.

Online Fraud Detection

Online transactions are made safe and secure by machine learning by detecting fraudulent transactions. When an online transaction happens there is a possibility that fake transactions may take place such as using **fake accounts, fake IDs,** and **stealing money** in the middle of a transaction**. For this Feed Forward Neural network** helps us by checking whether it is an authentic transaction or a fraud transaction.

Stock Market trading

Stock markets widely use Machine learning. In the stock market, there is always a risk of ups and downs in shares, and for this machine learning's **long short-term memory neural network** is used for the prediction of stock market trends.

Medical Diagnosis

For the diagnosis of diseases, machine learning is used in the field of Medical sciences. With this, usage, Medical technology which is growing very fast can build 3D models that can predict the exact position of lesions in the brain. Brain tumors and other brain-related diseases are also detectable using this machine learning method.

Conclusion

Machine learning is a catchword for today's technology, and it is budding very swiftly day by day. Machine learning models give plenty of prospects to benefit from collecting labelled and unlabelled data and employing it in different contexts. Healthcare, Fintech, Cybersecurity, and E-commerce are the main areas where machine learning methods are applied.

In the present days, machine learning is having serious thrust all over the world and it has become one of the main duties of management to lead their business in the correct direction by leveraging its true features. We are in an era where machines and humans will have to work in coordination to cooperate, drive, and promote their products and services in an inventive mode that is more special, effective, and efficient than ever before which can be achieved only if business owners think of employing **machine learning** features. It is also important to roll out an effective and apparent policy to embrace **machine learning**. Machine learning developments are expected across a range of fields over the next five to 10 years which would prove to be a boon for the human kind if employed in the correct manner.

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THE TRANSMOGRIFICATION OF LIBRARIES; ADAPTING TO DIGITAL DYNAMICS

Abitha Shekar[1]

Introduction

Libraries have embarked on an extraordinary journey of transformation in the wake of the digital revolution. This evolution, aptly termed as the transmogrification of libraries, encapsulates a profound shift in the very essence and functionality of these venerable institutions. In a world where information flows ceaselessly through digital channels, libraries have undergone a metamorphosis that transcends mere adaptation. It is a redefinition of their purpose, relevance, and impact in society. The emergence of the digital era has heralded unprecedented changes in the way knowledge is accessed. From the invention of the printing press to the ubiquitous presence of the internet, each technological milestone has left a mark on the landscape of libraries, reshaping their physical spaces, collections, and services. Yet, it is the amalgamation of these advancements, coupled with evolving user needs and expectations, that has propelled libraries into a new era of transmogrification.

This paper endeavors to delve into the multifaceted dimensions of library transmogrification, unravelling its historical antecedents, contemporary manifestations, and future trajectories. By traversing through the annals of library history, we aim to illuminate pivotal moments that have shaped the evolution of libraries from ancient repositories of scrolls to dynamic hubs of digital information. Beyond mere technological advancements, the transmogrification of libraries raises profound questions about the essence of librarianship, the democratization of knowledge, and the preservation of intellectual freedom. As libraries navigate the digital frontier, they are confronted with the imperative to balance traditional values with the imperatives of the digital age, fostering inclusivity, accessibility, and innovation.

Background

Tracing its origins to ancient civilizations, libraries have served as repositories of cultural heritage, intellectual inquiry, and scholarly discourse. From the fabled Library of Alexandria to the monastic scriptoria of the Middle Ages, these early incarnations of libraries symbolized the collective wisdom of civilizations and the aspirations of humanity to preserve and transmit knowledge across generations. However, it was not

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until the advent of the printing press in the fifteenth century that libraries witnessed a transformative leap in their evolution. With Johannes Gutenberg's revolutionary invention, the mass production of books became feasible, democratizing access to knowledge and catalyzing the spread of ideas across continents. The proliferation of printed materials fueled the rise of libraries as centers of learning and scholarship, laying the groundwork for the modern library as we know it today. The twentieth century ushered in another epochal shift in the history of libraries with the dawn of the digital age. The invention of computers, coupled with the development of the internet, led to an era of unparalleled connectivity and information abundance. Libraries, once synonymous with towering stacks of printed volumes, began to grapple with the challenges and opportunities presented by digital technologies. The digital revolution brought about a paradigm shift in the very essence and functionality of libraries, prompting scholars and practitioners to examine the phenomenon of library transmogrification. This term encapsulates the profound transformation undergone by libraries in response to the imperatives of the digital age, encompassing changes in technology, user behaviors, and institutional roles. In recent decades, libraries have embraced digital technologies with fervor, digitizing their collections, and expanding their online presence to reach a global audience. The proliferation of electronic resources, online databases, and digital archives has democratized access to information, enabling users to explore vast repositories of knowledge from the comfort of their homes. The rapid pace of technological change necessitates continuous adaptation and upskilling on the part of librarians and information professionals to remain relevant in an increasingly digital and interconnected world.

Historical Evolution of Libraries

Ancient Libraries: In antiquity, libraries primarily consisted of scrolls housed in repositories. These scrolls, meticulously curated by scholars and scribes, were symbols of cultural heritage and intellectual achievement. The transition from scrolls to codices, bound manuscripts resembling modern books, marked a significant advancement in the organization and preservation of knowledge. Codices offered greater durability, portability, and ease of access compared to scrolls, laying the groundwork for the codex format that would dominate library collections for centuries to come.

Medieval Libraries: During the Middle Ages, monastic scriptoria emerged as centers of manuscript production and preservation. Monks painstakingly copied and illuminated religious texts, creating knowledge within monastic communities. Concurrently, the rise of universities in medieval Europe spurred the establishment of collegiate libraries, which housed texts on theology, philosophy, law, and the liberal arts. These libraries served as intellectual hubs, nurturing scholarship and fostering the exchange of ideas among scholars and students.

Enlightenment Era: This era witnessed the democratization of knowledge with the proliferation of public libraries. Inspired by the ideals of reason, rationality, and intellectual freedom, Enlightenment thinkers advocated for the establishment of public libraries accessible to all citizens. Institutions such as the Library Company of

Philadelphia, founded by Benjamin Franklin in 1731, exemplified this vision of universal access to information. Public libraries became engines of social progress, empowering individuals with the tools for self-improvement, civic engagement, and enlightenment.

Industrial Revolution: The Industrial Revolution brought about profound socio-economic transformations, spurring the expansion of libraries as agents of social change. Public libraries evolved into community centers, offering resources and programs to support literacy, education, and vocational training. The proliferation of lending libraries and traveling libraries, such as the Bookmobiles, extended library services to underserved communities, bridging the gap between urban centers and rural areas. Libraries played a vital role in fostering social cohesion, economic empowerment, and cultural enrichment during this period of rapid industrialization.

Information age: The Information Age ushered in a new era of library transmogrification characterized by digitization and the proliferation of the internet. Libraries embraced digital technologies to digitize their collections, making them accessible to a global audience. The rise of online databases, electronic journals, and digital archives revolutionized the way information was accessed. Moreover, the internet transformed libraries into virtual spaces, expanding their reach beyond physical boundaries and enabling users to access a wealth of resources remotely. However, the digital age also brought about challenges such as information overload, digital preservation, and equitable access, prompting libraries to adapt their services and infrastructure to meet the evolving needs of users.

Contemporary Manifestations: In the contemporary landscape, libraries continue to embrace technological innovations to enhance access to information and streamline library operations. Digital collections, comprising digitized manuscripts, photographs, maps, and other materials, offer users unprecedented access to primary sources and cultural heritage artifacts. Online databases provide searchable repositories of scholarly articles, research papers, and multimedia resources, enabling users to conduct comprehensive research from any location. Library automation systems automate routine tasks such as cataloging, circulation, and interlibrary loan, freeing librarians to focus on more specialized services and user engagement initiatives.

Changing User Behaviors: The emergence of digital natives, individuals who have grown up in the digital age, has transformed user behaviors and expectations in libraries. Digital natives are accustomed to accessing information instantly, at the touch of their fingertips and expect seamless access to resources across multiple devices. Consequently, libraries have shifted towards user-centered design principles, redesigning spaces, services, and interfaces to cater to the preferences and needs of diverse user groups.

Evolving Institutional Roles: Libraries offer a diverse range of programs, workshops, and events to promote literacy, digital skills, and lifelong learning among patrons of all ages. From children's storytime sessions to adult education classes, libraries serve as inclusive spaces that foster creativity, critical thinking, and cultural enrichment. Moreover, libraries collaborate with local schools, universities, and community

organizations to address societal challenges, promote civic engagement, and support economic development initiatives.

Information Literacy: Information literacy encompasses the ability to locate, evaluate, and use information effectively and ethically to solve problems, make informed decisions, and engage in lifelong learning. Libraries play a central role in promoting information literacy through instruction sessions, research consultations, and online tutorials that teach patrons how to critically evaluate sources, avoid misinformation, and cite information responsibly. By fostering information literacy skills, libraries empower individuals to become discerning consumers and creators of information, equipping them with the tools needed to thrive in the digital age.

Technological Drivers: Libraries leverage emerging technologies such as artificial intelligence, machine learning, and cloud computing to enhance their services and collections. Investments in digital infrastructure, such as high-speed internet connectivity and robust cybersecurity measures, enable libraries to deliver seamless digital experiences and protect sensitive patron data. By embracing technological innovation, libraries position themselves as dynamic and responsive institutions that meet the evolving needs of users in the digital age.

Literature Review

Drawing on a diverse array of disciplines including library and information science, history, sociology, and cultural studies, researchers have explored implications of this transformative phenomenon. Works such as "The Library: An Illustrated History" by Stuart A. P. Murray offer comprehensive surveys of ancient library collections, organizational structures, and their role in disseminating knowledge. Furthermore, studies such as "From Scroll to Codex: The Shape of the Book in Late Antiquity" by Thomas C. Oden Jr. illuminate the transition from scrolls to codices, shedding light on the technological innovations that revolutionized the preservation and accessibility of knowledge. Works such as "Medieval Libraries of Great Britain: A List of Surviving Books" by N. R. Ker provide invaluable insights into the manuscript collections housed in medieval libraries. Additionally, studies such as "Libraries and Learning in Northern Italy, 1300-1600" by Brian Richardson explore the role of libraries in shaping intellectual networks and fostering academic inquiry during the Renaissance. Works such as "Republic of Readers: The Literary Turn in Political Thought and Analysis" by David M. Ricci provide insights into the role of libraries in fostering democratic citizenship and civic engagement during the Enlightenment. The Industrial Revolution witnessed the transformation of libraries into agents of social change, as they expanded their services to support literacy, education, and vocational training. Researchers have explored the role of libraries in addressing societal challenges such as urbanization, immigration, and social inequality. Works such as "The Library in America: A Celebration in Words and Pictures" by Edwin P. Hoyt offer historical accounts of libraries' contributions to community development and cultural enrichment during the Industrial Revolution. Scholars have investigated the impact of digital technologies on library collections,

services, and user behaviors. Works such as "Libraries in the Digital Age" edited by Peter Brophy et al. examine the challenges and opportunities of digitization for libraries in the twenty-first century, while studies such as "The Networked Library: A Guide for the Educational Use of Social Networking Sites" by Carol Smallwood explore the role of social media in enhancing library outreach and engagement. Works such as "Managing Digital Libraries: Emerging Strategies, Practices, and Perspectives" edited by Anne J. Gilliland et al. provide insights into the management and preservation of digital collections, while studies such as "The Digital Public Library of America: Strategic Plan" by Emily Gore et al. examine the strategic initiatives shaping the future of digital libraries. Works such as "The New Digital Age: Reshaping the Future of People, Nations, and Business" by Eric Schmidt and Jared Cohen offer insights into the digital habits and expectations of the millennial generation, while studies such as "User Experience (UX) Design for Libraries" by Aaron Schmidt and Amanda Etches explore strategies for designing user-centered library services and spaces. Works such as "Bridging the Digital Divide: Technology, Community, and Public Policy" edited by D. C. McAdams offer interdisciplinary perspectives on the digital divide phenomenon, while studies such as "Digital Inclusion and Social Justice: Library and Information Science Perspective" by John Carlo Bertot et al. explore the role of libraries in promoting digital inclusion and social equity. Researchers have investigated the conceptual frameworks, instructional approaches, and assessment strategies for promoting information literacy skills in library users. Works such as "Information Literacy: A Practitioner's Guide" by Helen Blanchett provide practical guidance for designing information literacy programs, while studies such as "Information Literacy in the Digital Age: An Evidence-Based Approach" by Jessica Keyes offer evidence-based strategies for teaching and assessing information literacy competencies in diverse contexts. While studies such as "Privacy and Confidentiality Issues: A Guide for Libraries and Their Lawyers" by Theresa Chmara et al. provide legal perspectives on privacy issues in the library context. Overall, the literature on library transmogrification reflects a rich network of interdisciplinary research and scholarship, spanning historical, theoretical, and practical dimensions. By examining, researchers contribute to a deeper understanding of this transformative phenomenon and provide insights for libraries seeking to thrive in the digital age.

Findings

Digital collections, online databases, and electronic resources have expanded the boundaries of traditional library services, providing users with unprecedented access to a wealth of knowledge from around the globe. However, this digital transformation also poses challenges such as information overload, digital preservation, and equitable access, necessitating continuous adaptation and innovation on the part of libraries. Moreover, the findings highlight the evolving role of libraries as agents of social change and community empowerment. Throughout history, libraries have played a vital role in addressing societal challenges such as literacy, education, and social inequality. In the contemporary landscape, libraries continue to serve as inclusive spaces that foster creativity, critical thinking, and cultural enrichment among diverse communities. By

offering a diverse range of programs,libraries empower individuals to pursue lifelong learning and civic engagement, thus contributing to social cohesion and economic development. Furthermore, the research underscores the importance of information literacy in the digital age. Information literacy, encompassing the ability to locate, evaluate, and use information effectively and ethically, is essential for navigating the complexities of the digital landscape. Libraries play a central role in promoting information literacy through instruction sessions, research consultations, and online tutorials, equipping users with the skills needed to critically evaluate sources, avoid misinformation, and engage in informed decision-making. However, the findings also reveal a research gap in the effectiveness of current information literacy programs and the need for innovative approaches to address the evolving information needs of users in the digital age. Additionally, they shed light on the challenges and opportunities presented by digital inclusion and social equity. While digital technologies have the potential to democratize access to information and bridge digital divides, they also have the potential to exacerbate existing inequalities. Libraries play a crucial role in promoting digital inclusion by providing equitable access to digital technologies, training programs, and support services for underserved communities. However, the findings suggest a need for greater collaboration between libraries, policymakers, and community organizations to address systemic barriers to digital access and participation.While libraries play a central role in promoting information literacy, there is a need to assess the effectiveness of current information literacy programs in addressing the evolving information needs of users in the digital age. Research could explore innovative approaches to information literacy instruction and assessment that reflect the changing nature of information and technology. Despite efforts to promote digital inclusion, there are persistent disparities in access to digital technologies and information resources among underserved communities. Further research is needed to identify systemic barriers to digital access and participation and to develop strategies for promoting digital equity through collaboration between libraries, policymakers, and community organizations. The preservation of digital collections presents unique challenges related to format obsolescence, digital decay, and long-term access. Research gaps exist in developing sustainable strategies for the preservation and curation of digital materials, as well as in ensuring their accessibility and usability for future generations. With the proliferation of digital resources and online services, concerns about privacy, security, and data protection have become increasingly salient. Research could investigate the privacy implications of digital library services, user data management practices, and the effectiveness of privacy safeguards in mitigating risks and protecting patron confidentiality. Addressing these research gaps will contribute to a deeper understanding of library transmogrification and provide valuable insights for libraries seeking to thrive in the digital age.

Discussion

At the heart of this discussion lies the recognition of libraries as dynamic entities that have continuously adapted to societal changes while upholding their core mission of facilitating access to knowledge. From ancient repositories of scrolls to modern hubs

of digitized information, libraries have navigated through technological revolutions, societal upheavals, and cultural shifts, consistently reinventing themselves to meet the evolving needs of communities. One of the central themes emerging from this discussion is the pivotal role of libraries in democratizing access to information and promoting literacy. Throughout history, libraries have served as egalitarian spaces where individuals, irrespective of their socio-economic background, could access a wealth of resources for learning and intellectual growth. However, as the digital age unfolds, the discussion expands to encompass not only access but also digital literacy and inclusion. Libraries are increasingly called upon to bridge the digital divide by providing equitable access to digital technologies and fostering digital literacy skills among patrons. Furthermore,it delves into the transformative power of libraries as agents of social change. From the Industrial Revolution to the present day, libraries have been instrumental in addressing societal challenges such as urbanization, immigration, and social inequality. By offering educational programs, vocational training, and community engagement initiatives, libraries have played a vital role in empowering individuals and fostering community development. Another significant dimension of the discussion revolves around the challenges and opportunities posed by digitization. While digital technologies have revolutionized the preservation, dissemination, and accessibility of information, they have also raised concerns about privacy, censorship, and the preservation of cultural heritage. Thus, the discussion extends to encompass strategies for managing digital collections, ensuring information security, and promoting ethical use of digital resources.

Methodology

As a research scholar investigating library transmogrification, the methodology employed in this study encompasses a mixed-methods approach, combining qualitative and quantitative research techniques to provide a comprehensive understanding of the phenomenon. The methodology involves several key components, including literature review, data collection, analysis, and interpretation. The research methodology begins with an extensive review of existing literature on library transmogrification, drawing on a diverse array of disciplines including library and information science, history, sociology, cultural studies, and technology studies. It serves to establish a theoretical framework for the study, identify key concepts and themes, and contextualize the research within the broader scholarly discourse. It also helps to identify gaps in the existing literature and areas warranting further investigation. The data collection phase of the research involves both qualitative and quantitative methods to gather empirical evidence and insights into library transmogrification. Qualitative data is collected through interviews, and observations to capture the subjective experiences, perspectives, and perceptions of librarians, information professionals, and library users. Semi-structured interviews are conducted with key stakeholders to explore their views on the impact of digital technologies, evolving user needs, and emerging trends in librarianship. Observations are conducted in library settings to observe user behaviors, interactions, and usage patterns, providing firsthand observations of how libraries are adapting to the digital age. Quantitative data is collected through statistical analysis to quantify trends, patterns,

and correlations related to library transmogrification. Questionnaires are administered to library staff to assess their perceptions of digital technologies, training needs, and institutional priorities. Statistical analysis is used to analyze survey data, identify trends, and test hypotheses related to library transmogrification. The collected data is analyzed using qualitative and quantitative analysis techniques to identify patterns, themes, and relationships relevant to the research objectives. Qualitative data analysis involves coding, categorizing, and thematically analyzing interview transcripts, focus group discussions, and observational notes to identify recurring themes, concepts, and perspectives. Quantitative data analysis involves descriptive and inferential statistical techniques to summarize survey responses, compare groups, and identify correlations between variables. The final phase of the research methodology involves interpreting the findings, synthesizing the qualitative and quantitative data, and drawing conclusions that contribute to a deeper understanding of library transmogrification. The qualitative and quantitative findings are triangulated to corroborate, complement, or challenge each other, enhancing the validity and reliability of the research findings. The interpretation of the findings is guided by the research questions, theoretical framework, and relevant literature, providing insights into the implications of library transmogrification for librarianship, information management, and knowledge dissemination. Overall, the methodology employed in this research combines qualitative and quantitative approaches to investigate library transmogrification from multiple perspectives, generate rich empirical evidence, and contribute to theoretical and practical advancements in the field.

Conclusion

Through interdisciplinary inquiry spanning fields such as history, sociology, information science, and cultural studies, researchers have unraveled the enduring significance of libraries as dynamic institutions that continually adapt to societal shifts and technological advancements. At its core, it affirms the timeless mission of libraries as custodians of knowledge and champions of intellectual freedom. From the ancient libraries of Alexandria to the digital repositories of the twenty-first century, libraries have served as bastions of learning, offering sanctuary to seekers of knowledge across diverse cultures and epochs. Despite the seismic changes wrought by technological innovations, libraries remain steadfast in their commitment to democratizing access to information, fostering literacy, and promoting lifelong learning. Moreover, the discourse underscores the transformative role of libraries as agents of social change and community empowerment. Throughout history, libraries have been at the forefront of addressing pressing societal challenges, from promoting literacy during the Industrial Revolution to bridging digital divides in the digital age. By providing educational resources, vocational training, and community engagement initiatives, libraries have empowered individuals, strengthened communities, and catalyzed social progress. Yet, as libraries embrace the digital frontier, they confront a myriad of challenges and opportunities. The proliferation of digital technologies has revolutionized the way information is accessed, shared, and consumed, presenting libraries with new avenues for innovation and outreach. However, this digital revolution also poses formidable challenges, including issues of information

security, privacy, and equitable access to digital resources. As libraries navigate this complex terrain, they must strike a delicate balance between embracing technological advancements and preserving their traditional values of intellectual freedom, privacy, and inclusivity.By examining the past, engaging with the present, and envisioning the future, researchers contribute to a deeper understanding of libraries' multifaceted roles and provide insights for shaping their evolution in the digital age. As libraries continue to evolve, they remain steadfast in their mission to empower individuals, enrich communities, and advance knowledge for generations to come. The transmogrification of libraries is a dynamic and ongoing process shaped by technological, socio-cultural, and institutional forces. While digital transformation presents challenges such as information overload and digital divide, it also offers opportunities for innovation and collaboration. By embracing digital technologies and reimagining their roles, libraries can continue to serve as vital resources for lifelong learning, intellectual inquiry, and community engagement. However, this transformation requires proactive leadership, strategic planning, and ongoing adaptation to meet the evolving needs of users in the digital age.

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IMPACT OF RANGANATHAN'S FIVE LAWS TO DBT RESEARCH INSTITUTIONS AND ITS LIBRARIES

Dr. D. D. Lal[1]

Introduction

The public started to use libraries more frequently in the 1900s after they were freed from the control of the monarchy, which had governed the world before to that time, and progressive intellectuals known as librarians took over library management.

Many studies and advancements in the areas of information organization and distribution, librarianship standards, and library administration systems have been made during this Renaissance. These had a significant impact on the revolutionary advancement in the field of information and library science.

In the modern era, the American Library Association (ALA) got involved in establishing frameworks and standards that were appropriate for libraries. those who are directly affected in order to fulfill the field's organizational objectives. Technology and tools developed during the industrial revolution improved printing and publishing and provided outstanding support for the growth of the library and information science fields.

The introduction of dada communication over cables (ARPANET, which replaced the World Wide Web and Internet) in the 1960s had a significant impact on the telecommunications sector. Information could be sent swiftly between locations as packet data, and this technology increasingly affected the LIS field's ability to store information and promptly deliver it to another party upon request.

"Information era" refers to the current period. Information is therefore regarded as a crucial instrument in all facets of human existence and, as of late, it has emerged as the fifth necessity. People are using mobile devices that are connected to the blazing-fast 4G internet these days to seek for information. Additionally, libraries now have an invisible mode (virtual library) in their shape. Many information clusters in the cloud are waiting for user requests for data. At last, the desire for information has grown to be critical to human existence.

Ranganathan's Five Laws of Library Science have had a profound impact on the field of library and information science. These laws, formulated by renowned

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Indian librarian S.R. Ranganathan, provide a guiding framework for the organization and management of libraries. They are principles that emphasize the importance of user-centric services, efficient organization of resources, and continuous growth and development of libraries. The impact of Ranganathan's Five Laws can be seen not only in traditional library settings, but also in specialized research institutions, such as the Department of Biotechnology research institutions, and their libraries in India. In recent years, research institutions in India, particularly those focused on the field of biotechnology, have recognized the value of Ranganathan's Five Laws in enhancing the effectiveness and efficiency of their libraries. In the context of DBT research institutions in India, Ranganathan's Five Laws have played a crucial role in shaping the approach towards library management and services. These institutions have embraced the user-centric principles advocated by Ranganathan, prioritizing the needs and experiences of researchers and scholars accessing their library resources. By organizing their libraries in a manner that aligns with Ranganathan's laws, DBT research institutions have aimed to streamline access to information, maximize the utilization of resources, and create an environment conducive to scholarly inquiry and collaboration.

Furthermore, the emphasis on continuous growth and development inherent in Ranganathan's Five Laws has spurred DBT research institutions to adopt evolving technologies and modern practices in library management. Through embracing digitalization, implementing advanced cataloging systems, and integrating online access to research databases, these institutions have sought to keep pace with the rapidly changing landscape of information dissemination and retrieval.

As a result, the impact of Ranganathan's Five Laws on DBT research institutions in India has been transformative, contributing to the enhancement of research endeavors and the facilitation of knowledge creation and dissemination. This alignment with Ranganathan's principles has not only bolstered the efficiency and effectiveness of library services but has also fostered a culture of academic excellence and innovation within these institutions.

The Department of Biotechnology (DBT) – Ministry of Science & Technology (GOI)

In 1986, India started a spectacular journey towards technological advancements and the biosciences. That year, the late Rajiv Gandhi, the nation's prime minister at the time, agreed with the idea that India would not advance to the intended degree if the Ministry of Science and Technology, Government of India, did not establish a distinct Department for Biotechnology. This was a result of the fact that the advancement of that science encompassed many of our macroeconomic growth concerns.

India is now among the first nations with a dedicated department for this field of science and technology as a result of that choice. Nonetheless, the discussions to create the department began far earlier. In 1982, the government established the National Biotechnology Board (NBTB) to determine priority areas and develop a long-term perspective for biotechnology in India, following extensive discussions with the

scientific community and based on recommendations made by the Scientific Advisory Committee to the Cabinet at the time. It was also in charge of developing the curriculum and bolstering native skills in this recently developed field.

The excellent scientist Professor MGK Menon, who was then a Member (Science) of India's Planning Commission, presided over the NBTB. Members of this Board were appointed by the secretaries of the various government agencies that deal with science.

Finally, in February 1986, a distinct Department of Biotechnology (DBT) was established, and Dr. S. Ramachandran was chosen by the NBTB to serve as the department's first secretary. To make sure the Department was up to date with advancements in the field of biotechnology around the world, the DBT established a seven-member Standing Advisory Committee for North America (SAC (0)) and a ten-member Scientific Advisory Committee (SAC) including heads of several scientific agencies.

According to Dr. S. Ramachandran, Prime Minister Shri Rajiv Gandhi realized that "unless we leap forward, there is no way of catching up with the rest of the world" due to the rate at which biological sciences were expanding globally. In order to set up the DBT, a tiny team was given room to sit in the expansive, contemporary CGO Complex on Lodhi Road in New Delhi. Dr. Ramachandran states that the Department's first budget was relatively small, ranging from Rs 4 to 6 crores.

- To begin with, there were numerous significant obstacles. Interdepartmental conflicts were the first issue, with no department willing to cede its previous responsibilities to a new, specialized body.
- The "tendency of Indian scientists to publish only in national journals" was the second most significant issue, as it took too long to publish in international, well-peer-reviewed journals.
- Finally, the industry could not be convinced to collaborate early on because of the length of governmental procedures. Purchasing laboratory supplies, reagents, and other essentials was the fourth significant challenge.
- Obtaining scientific equipment, reagents, and other essentials for laboratory study constituted the fourth major challenge.

Not many people in the nation were employed in the biosciences back then. Thus, the department's priorities had to be:

1. Developing human resources
2. Establishing a regulatory framework;
3. conducting research and development; and
4. building the necessary infrastructure

Notwithstanding these obstacles, the department got going practically immediately after it was established. DBT took over the National Institute of Immunology, the first independent institute, which was founded in 1981. The National Facility for Animal Tissue and Cell Culture of Pune, established in 1986 and subsequently renamed the National Centre for Cell Science, soon joined it. Numerous other institutes began to

take shape in the late 1990s and early 2000s, including the Institute of Bioresources and Sustainable Development, the Institute of Life Sciences, the National Brain Research Centre (NBRC), the Center for DNA Fingerprinting & Diagnostics, and the National Institute for Plant Genome Research (NIPGR). Later on, a number of other eminent institutions were founded, including the Institute for Stem Cell Biology and Regenerative Medicine (InStem), the Translational Health Science and Technology Institute (THSTI), the National Agri-Food Biotechnology Institute (NABI) in Mohali, and the National Institute of Biomedical Genomics (NIBMG) in Kalyani, West Bengal.

Additionally, there is a renewed focus on social issues like environmental security, energy security, food and agriculture security, and health care. The scope and breadth of international collaborations have improved, and industrial relationships are expanding, making them more strategic. The numerous grants, funds, and awards, together with the DBT's pledge to review the financing process in order to facilitate a speedier evaluation of project values and the distribution of research funding, all demonstrate the renewed emphasis on Young India.

Autonomous Institutes under the Department of Biotechnology, GoI

The Indian government's Department of Biotechnology is home to numerous institutions. A few of them are listed below. Research, innovation, and development in biotechnology are much advanced in India thanks in large part to the autonomous institutes operating under the Department of Biotechnology, Government of India. These organizations are significant for the following reasons:

1. Cutting-edge Research: These institutes are centers of excellence that carry out state-of-the-art biotechnology research in a variety of fields. They aid in the advancement of science, the comprehension of biological processes, and the creation of cutting-edge technologies.
2. Addressing National Priorities: The institutions concentrate on addressing issues related to the environment, agriculture, healthcare, and other fields. They seek to address pressing issues like sustainable development, clean energy, food security, and disease prevention.
3. Human Resource Development: Students, researchers, and scientists can receive instruction and training from these institutes. They are essential to the upbringing and development of the upcoming generation of biotechnology experts, which bolsters India's scientific workforce.
4. Commercialization and Technology Transfer: A large number of these institutes are involved in commercialization and technology transfer. In order to integrate research discoveries into useful applications and promote innovation-driven entrepreneurship and economic growth, they work with industries, startups, and entrepreneurs.
5. Policy and Advisory Role: These institutes advise the government on scientific matters and help formulate policy. Based on their knowledge and research findings, they support the development of national policies pertaining to biotechnology, healthcare, agriculture, and other pertinent fields.

6. Cooperation and Networking: These institutes actively work with academic institutions, businesses, and national and international research groups. These kinds of partnerships improve the flow of information, make multidisciplinary research easier, and boost the stature of Indian biotechnology research internationally.
7. Impact on Public Health and Agriculture: By creating diagnostic tools, immunizations, and treatment plans for a range of illnesses, these institutes improve public health through research and development. Additionally, they strive to increase crop quality through biotechnological treatments, produce drought-resistant crops, and increase agricultural production.

All things considered, these independent institutes are significant because they are at the forefront of scientific inquiry, invention, and biotechnology application to meet social demands, promote economic development, and enhance people's quality of life in India and beyond.

The following list includes independent institutions under the Department of Biotechnology (DBT), Government of India, along with their contact information:

1. National Institute of Immunology, Aruna Asaf Ali Marg, New Delhi – 110067,India http://www.nii.res.in/content/national-institute-immunology
2. National Centre for Cell Science, NCCS Complex, University of Pune Campus, Ganeshkhind,Pune 411007, Maharashtra, India https://www.nccs.res.in/
3. National Brain Research Centre, NH-8, Nainwal Road, Manesar – 122051, Distt:Gurgaon, Haryana, India http://www.nbrc.ac.in/
4. Center for DNA Fingerprinting and Diagnostics [CDFD], Bldg. 7, Gruhakalpa, 5-4-399 / B, Nampally, Hyderabad-500 001, India http://www.cdfd.org.in/
5. National Institute of Plant Genome Research, Aruna Asaf Ali Marg, P.O. Box No. 10531, New Delhi – 110 067 http://www.nipgr.ac.in/home/home.php
6. Institute of Life Sciences, Nalco Nagar Rd, NALCO Nagar, Chandrasekharpur, Bhubaneshwar, OD 751023 http://www.ils.res.in/
7. Institute of Bioresources and Sustainable Development(IBSD), Takyelpat, Imphal, Manipur- 795001 (INDIA) http://ibsd.gov.in/
8. Rajiv Gandhi Centre for Biotechnology, Poojappura, Thiruvananthapuram – 695 014 Kerala, India. http://www.rgcb.res.in/
9. Institute for Stem Cell Science and Regenerative Medicine (inStem), GKVK – Post, Bellary Road, Bangalore 560065, India. https://www.instem.res.in; http://instem.res.in/
10. Translational Health Science and Technology Institute, NCR Biotech Science Cluster, 3rd milestone on Faridabad-Gurgaon Expressway, PO Box 4, Faridabad 121001 http://www.thsti.res.in/

11. National Institute of Biomedical Genomics, Netaji Subhas Sanatorium (T.B. Hospital), 2nd Floor, P.O.: N.S.S., Kalyani 741251, West Bengal, INDIA Website: http://www.nibmg.ac.in
12. Regional Centre for Biotechnology, NCR Biotech Science Cluster, Bhankri, Faridabad – 121 004. Haryana http://www.rcb.res.in/
13. National Agri-Food Biotechnology Institute, Sector 81, Sahibzada Ajit Singh Nagar, Mohali, Punjab -140306 https://nabi.res.in/
14. National Institute of Animal Biotechnology (NIAB), Opposite Journalist Colony Near Gowlidoddy, Extended Q city Road, Gachibowli, Hyderabad, Telangana India, PIN: 500 032 http://www.niab.org.in/
15. CIAB (formerly Bio-Processing Unit), Interim Facility, C-127, II Floor, Phase-VIII, Industrial Area, SAS Nagar, Mohali-160071, Punjab, India http://ciab.res.in/
16. ICGEB Campus, Aruna Asaf Ali Marg, New Delhi, Pincode- 110 067, INDIA https://www.icgeb.org/home-nd.html

About Library and Information Sciences

People that work in the field of library and information science are often really happy with what they do and are passionate about changing the world. In a recent survey, more than 85% of information professionals who were asked stated they would do it again given the option. The gaps that exist between people, information, and technology are filled by librarians. In their careers, librarians and information professionals design and develop knowledge organization systems, develop reader's advisory resources to inspire young students to love reading and learning for a lifetime, assist scholars in finding archival and other resources essential to their work, identify resources for support in personal and family crises, and assist physicians in more quickly locating health information in urgent situations.

What is Technological Innovations?

New products and processes as well as substantial technological modifications to existing products and processes are considered technological innovations. Without a question, technology has changed libraries in a significant way.

Libraries, once believed to be dying out like brick-and-mortar stores, have recovered and are prospering in today's tech-driven society. Libraries are adopting new technologies and developing vibrant, dynamic community hubs with the aid of creativity, reimagining, and vision.

Five Laws of Dr. S.R. Ranganathan for LIS

Some aspects of library and information science are covered by Dr. Shiyali Ramamrita Ranganathan, who is regarded as the founder of library science in India. He taught library science and served as a university librarian at Benares Hindu University from 1945 to 1947. From 1947 to 1955, he was a professor at the University of Delhi.

His most recent position made him the director of the first higher degree-granting Indian school of librarianship. From 1944 until 1953, he served as the Indian Library Association's president. He founded the Colon Classification system and wrote numerous LIS textbooks. In 1957, he was elected an honorary member of the International Federation for Information and Documentation (FID) and appointed vice-president of the Library Association of Great Britain for life. In addition, he created the Colon Classification method and wrote numerous LIS textbooks. He presented the five rules to LIS in 1931, and the majority of his contemporaries regarded those principles as the foundational elements of the library administration system.

These statutes are listed in the following order

1. Books are meant to be used.
2. Each reader has their own book.
3. Every book has a reader.
4. Respect the reader's time.
5. The library is an expanding institution.

Some of the most important ideas in the area are the Five Laws of Library Science. These five laws, which were first published in 1931, continue to be the cornerstone of LIS professionals' professional principles and the mission of all libraries.

These five laws, which were first published in 1931, continue to be the cornerstone of LIS professionals' ethical standards. These foundational ideas of LIS continue to have a direct bearing on how this field develops as well as how well all libraries function.

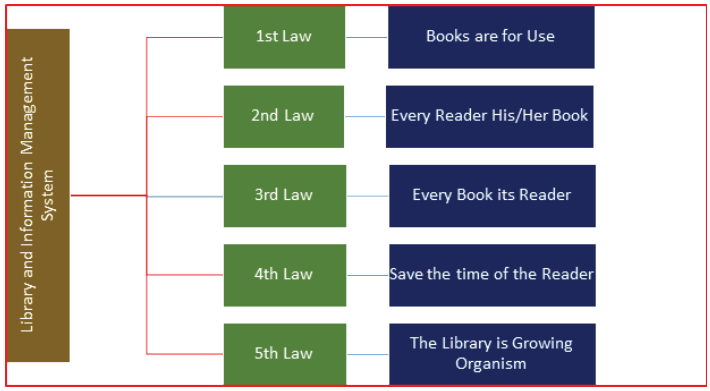


Fig. 1 : Five Columns of Modern Library Management System

Technological Innovations for Library materials

Unrestricted access to material in a variety of formats and from a wide range of sources is becoming increasingly synonymous with modern libraries. They are delivering services that are no longer limited to a building's physical walls by making content available online and offering librarian support in sifting through and evaluating vast volumes of data using a range of digital tools.

Printed books have been replaced by contemporary e-books. Digital technology and mobile connectivity have created an excellent bridge that allows consumers to read e-books on iPads or Kindles. People now use e-libraries to obtain information, and current technology has completely transformed the way they read. The form of information materials has already altered in the current era of information, growing smaller. There are a lot of e-books available that have no print counterpart. E-books that are produced and sold for a profit are often meant to be read on specialized e-readers. But you can read e-books on practically any sophisticated electronic device with a controlled viewing screen, including PCs, tablets, and smartphones.

In the US, the percentage of adults who have read an e-book has increased from 23% in 2013 to 28% in 2014. This is rising because, by 2014, 50% of Americans owned a dedicated device—a tablet or an e-reader—as opposed to 30% at the end of 2013.

In his first four laws, Dr. S. R. Ranganathan talked on the usefulness of library resources in terms of time-saving for users. His emphasis on making books available to the general people had a direct impact on the physical improvements made to the libraries. As a result, it has completely altered the library environment today.

After his regulations were ratified, the public was encouraged to use libraries and the information they held, which had a growing impact on advancing technological research and development. The libraries saw several organizational, structural, and managerial changes as a result of these improvements.

Following the law's publication, books became incredibly accessible information sources, and publishers began to consider how easy their books would be for their readers. They also used to adopt technology in the publishing sector.

Technological Innovations under Library services

The most innovative technology component in LIS nowadays is the internet. It has already significantly impacted the library's ability to grow and provide more services. In addition to lending books, libraries can now offer Selective Dissemination of Information (SDI), Current Awareness Services, and email alert information services (CAS). The tremendous transformation of the LIS industry has had the opposite effect, with libraries getting smaller and services and information storage growing greater. With the advent of new technologies, Ranganathan's fifth law—that "libraries are a growing organism"—is beginning to take shape.

The most cutting-edge innovations in LIS are e-reading, e-borrowing, and online "ask a librarian" research services. Today, a lot of librarians may interact with their patrons online to meet their informational needs. Time savings for readers has emerged as one of the LIS's key components. Rangathan has identified this requirement in his Fifth Law.

This law acknowledges that a library's capacity to effectively serve its patrons' needs is a necessary component of its exceptional service. He was more aware of user

needs and consistently reminded the librarians to cut down on the amount of time it takes a user to get the information they need from the start of their search to the end. Alternative information providers also embraced the law's foundation in order to fulfill their organizational objectives.

Prior to designing their product or service, a number of technology innovators in the LIS sector used to base this law. Time savings is the foundation of library classification schemes, indexing and abstracting services, and other forms of selective information dissemination. Because the primary factor influencing every type of customer's happiness with products and services is time savings. The primary goal of librarians' reference abilities is to save users' time. LIS technical advancements that align with Ranganathan's Fourth Law include online public assessment catalogues (OPAC), cataloguing technologies, and cross-reference services provided by libraries.

As the growing organism the libraries facilitate to their users to access information in correct format and in time

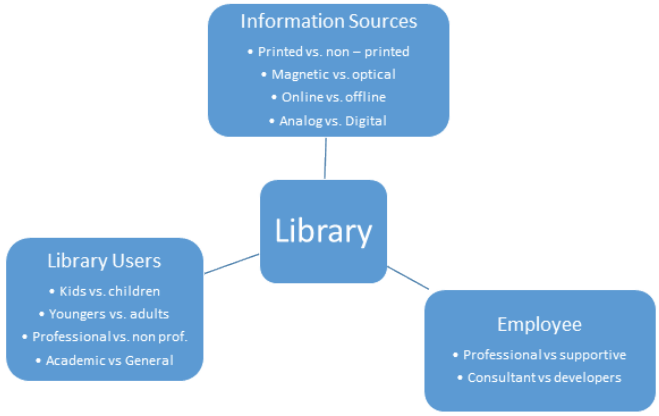


Fig. 2 : Library is a growing organism

The library is a growing organism, according to the fifth law of library science, which states that a library should be a dynamic organization with a constantly evolving perspective. Over time, it is important to modernize the physical library, staff, books, and processes. He assumed that libraries ought to be expanding, if only in terms of personnel, resources, and patronage.

Key Assumptions and profound Impact

Ranganathan's Five Laws of Library Science have had a profound impact on library and information science practices worldwide, including in India. When considering their impact on DBT (Department of Biotechnology) research institutions and their libraries in India, several key assumptions can be drawn:

Organization and Service: Ranganathan's first law, "Books are for use," emphasizes the user-centric nature of library services. In DBT research institutions, this translates to ensuring that library resources are readily accessible and effectively organized to support the research needs of scientists and scholars. Libraries must focus on providing timely access to scientific literature, databases, and research tools to facilitate the advancement of biotechnology research in India.

Information Access: The second law, "Every reader his/her book," underscores the importance of equitable access to information for all users. In the context of DBT research institutions, this means ensuring that researchers, students, and faculty have access to a diverse range of resources relevant to biotechnology research, regardless of their specialization or level of expertise. Libraries must adopt strategies to acquire and manage a comprehensive collection of materials that cater to the diverse information needs of the scientific community.

Library Management: Ranganathan's third law, "Every book its reader," highlights the importance of efficient library management practices. In DBT research institutions, this involves effective collection development, cataloging, and circulation procedures to optimize the use of library resources. Librarians must employ modern library management systems and technologies to streamline workflows and enhance the user experience for researchers and scholars.

Information Organization: The fourth law, "Save the time of the reader," emphasizes the need for efficient information retrieval systems. In DBT research institutions, where researchers often work under time constraints, it is crucial to implement robust search mechanisms and indexing methods to facilitate quick and accurate access to relevant scientific literature and research findings. Librarians should employ advanced information retrieval techniques and metadata standards to enhance the discoverability of library resources and minimize the time spent searching for information.

Continuous Improvement: Ranganathan's fifth law, "The library is a growing organism," emphasizes the dynamic nature of libraries and the need for continuous improvement and adaptation to meet evolving user needs. In the context of DBT research institutions, libraries must stay abreast of advances in biotechnology research and information technology to remain relevant and effective. Librarians should actively engage with researchers and scholars to understand their changing information needs and proactively develop library services and collections to support their research endeavors.

Conclusion

Libraries are among the most important locations for the transmission of knowledge and communication in this day and age, as well as for the growth of collections and the use of cutting-edge technology. Digital content is obtained and secured by libraries (usually through licensing), saved as local services, and made available to a designated community. As leaders in technology, libraries work to guarantee complete access to the digital collection via a variety of information services and to move content

in line with emerging technologies. Libraries serve as a developing global organism and social companion in the interim.

Because of the aforementioned methods, the field of LIS is always evolving to reflect new advances in technology. The main methods they used with contemporary technological innovations in this information era were e-books, e-journals, web 3.0 technology, social media interaction, online user feedback systems, worldwide catalogue searching facility (world cat), and web based library circulations. Cloud library initiatives, library access via iPhones, kindles, QR codes, and 3M library gates are also included.

Because of their relevance, Dr. S.R. Ranganathan's five rules of library science still apply to contemporary library advancements. These regulations cover all aspects of library management, particularly as libraries are dynamic institutions that can adapt their fundamental organizational structure to meet the requirements of their patrons. It is despised that the conceptual framework of R's five laws served as the foundation for the majority of LIS-oriented advances. The majority of recent technological advancements in the LIS sector are founded on these five laws. It is evident that there are connections between many laws when one examines individual laws. Since they are an organization, the library cannot avoid breaking any laws because they are unique. The organization's culture has been altered by this interconnectedness to meet present needs and increase the output of more recent developments.

In conclusion, Ranganathan's Five Laws of Library Science provide a solid foundation for guiding the development and management of libraries in DBT research institutions in India. By adhering to these principles and adapting them to the specific needs of the biotechnology research community, libraries can play a vital role in advancing scientific knowledge and innovation in the country.

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31. http://ciab.res.in/
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THE ROLE OF LIBRARIES IN TRADITIONAL LEARNING AND VIRTUAL LEARNING ENVIRONMENTS

R. Swetha[1]

Introduction

The education sector has undergone significant changes in recent years, influenced largely by advancements in technology and the internet. The rise of virtual learning environments (VLEs) has changed the way knowledge is accessed and imparted, bringing about a shift in teaching and learning methodologies. This transformation was accelerated by the COVID-19 pandemic, which forced educational institutions worldwide to rapidly adopt online learning platforms. As a result, educational support systems, including libraries, have had to evolve to meet the new demands of students and educators.

Virtual learning offers numerous benefits, such as convenience and flexibility, making education accessible to a broader audience. Students can access educational materials from anywhere and at any time, which is particularly beneficial for those who may not have the means to attend physical classes regularly. However, despite the clear advantages of virtual learning, traditional libraries continue to hold an essential place in the educational ecosystem. These physical spaces are not just collections of books and journals but are also vital for providing an environment conducive to study and research. The curated collections found in traditional libraries support comprehensive learning and provide a tactile, immersive experience that digital resources often cannot replicate.

Librarians play a critical role in this evolving times. Beyond managing collections, they act as educators and guides, helping students navigate the complex world of information. They teach essential information literacy skills, enabling students to discern credible sources and develop critical thinking abilities. This is increasingly important in an age of information overload, where students are bombarded with vast amounts of data from various sources.

In India, the role of libraries is even more pronounced due to the significant disparity in digital infrastructure across urban and rural areas. While urban students may have easy access to digital resources, those in rural areas often rely heavily on traditional libraries. These libraries serve as crucial educational resources in communities where digital access is limited. They provide not only materials for study but also a space for students to engage in academic activities and develop a habit of learning.

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This paper explores the multifaceted role of libraries in supporting both traditional and virtual learning environments. It highlights the enduring relevance of libraries in the evolving educational scenario of India. By examining how libraries contribute to both educational paradigms, this study aims to shed light on how libraries can continue to innovate and adapt to meet the diverse needs of learners. The discussion will cover the benefits and challenges faced by libraries in this dual role, offering insights into how they can bridge the digital divide and enhance their services to support education in both physical and virtual spaces.

The Role of Libraries in Traditional Learning Environments

Libraries have been an important part of traditional learning environments for centuries. In academic institutions, they provide students, educators, and researchers with access to a vast array of physical resources, including books, journals, theses, and other printed materials. These resources are meticulously curated to support various academic disciplines and to develop a culture of in-depth study and research.

Resource Access: Traditional libraries offer a wealth of printed materials essential for comprehensive learning and research. These collections include not only textbooks and reference books but also specialized archives and rare collections that provide unique insights and primary sources for scholarly research. For example, many university libraries house special collections that are invaluable for historical and cultural studies.

Learning Environment: The physical space of a traditional library is designed to promote concentration and academic excellence. Libraries provide quiet zones for individual study, dedicated rooms for group discussions, and collaborative spaces for research activities. Many students prefer studying in the library due to its focused and quiet atmosphere, which is conducive to deep learning and intellectual exploration.

Librarian Support: Librarians play a pivotal role in traditional learning environments. Beyond managing collections, they assist students in navigating complex information systems, offer guidance on research methodologies, and teach information literacy skills. Librarians often conduct workshops on research strategies and the critical evaluation of sources, helping students to develop essential academic skills.

The Role of Libraries in Virtual Learning Environments

As education increasingly moves online, libraries have expanded their services to support virtual learning environments. Digital libraries provide access to a vast array of electronic resources, including e-books, digital journals, and online databases, which are accessible from anywhere at any time. This accessibility is crucial for ensuring that all students, regardless of their location, have the resources they need for their studies.

Digital Resources: Digital libraries remove geographical barriers, democratizing access to information. Students from remote areas can access the same resources as their urban counterparts, levelling the educational gap. The availability of digital resources is

particularly beneficial in ensuring that students can continue their education uninterrupted, even during unforeseen circumstances like the COVID-19 pandemic.

Online Services: Virtual libraries offer a range of online services that are similar to those of traditional libraries. These include virtual reference desks, online tutorials, webinars, and digital literacy programs. For example, the British Council Library provides online chat support and digital literacy workshops, ensuring that students receive timely assistance and develop the skills needed to navigate digital resources effectively.

Technology Integration: Libraries are utilizing advanced technologies to improve the learning experience. AI-driven recommendation systems suggest relevant resources based on users' search histories and preferences, making information retrieval more efficient. Additionally, virtual reality (VR) and augmented reality (AR) are being used to create immersive educational experiences, such as virtual field trips and interactive learning modules.

Benefits and Challenges of Traditional Libraries

Benefits of Traditional Libraries

- Quiet, Focused Environment: Traditional libraries provide a calm and quiet atmosphere conducive to study and research, helping students concentrate and work efficiently.
- Access to Rare and Specialized Collections: They offer access to rare books, manuscripts, and specialized collections not available in digital format, providing invaluable resources for in-depth research.
- Personalized Assistance: Librarians offer one-on-one guidance on research methodologies, helping students navigate complex information and improve their academic skills.
- Sense of Community: Traditional libraries foster a sense of community among students and researchers, providing a space for intellectual exchange and collaboration.
- Tactile Experience: Physical interaction with books and materials can improve learning and retention, offering a tactile and immersive experience that digital formats might lack.
- Structured Environment: Libraries provide a structured environment that can help students develop good study habits and time management skills.
- Supplemental Academic Programs: Many libraries host academic programs, workshops, and seminars that enhance learning opportunities outside the regular curriculum.

Challenges of Traditional Libraries

- Limited by Physical Space: Physical space constraints limit the number of resources and users a library can accommodate at any given time.
- Operating Hours: Access is restricted to the library's operating hours, limiting availability for students with varying schedules.

- Geographical Accessibility: Only those who can physically visit the library can access its resources, which can be a barrier for remote or disabled students.
- Cost of Maintenance: Maintaining and updating physical collections, as well as the library infrastructure, can be costly and resource-intensive.
- Physical Deterioration: Physical books and materials are subject to wear and tear over time, requiring preservation efforts and regular replacements.
- Limited Digital Integration: Traditional libraries may struggle to integrate with modern digital tools and resources, limiting their appeal to tech-savvy users.

Benefits and Challenges of Virtual Libraries

Benefits of Virtual Libraries

- Accessibility from Anywhere: Virtual libraries can be accessed from anywhere at any time, offering great flexibility to students and researchers globally.
- Large Digital Collections: They can store vast volumes of digital resources, including e-books, journals, and databases, which can be easily searched and retrieved.
- Advanced Technology Integration: Use of advanced technologies like AI-driven recommendations and VR/AR tools enhances the learning experience with personalized and immersive features.
- Cost Effective: Digital resources can reduce costs associated with physical storage and maintenance of materials.
- Immediate Updates: Digital libraries can be updated instantly with new resources and information, ensuring that users have access to the latest knowledge.
- Environmental Impact: Digital libraries contribute to environmental sustainability by reducing the need for paper and physical shipping of books and materials.
- Support for Diverse Learning Styles: Multimedia resources, including videos, podcasts, and interactive tools, cater to various learning styles and preferences.

Challenges of Virtual Libraries:

- Dependence on Internet Access: Reliable internet access and digital devices are essential, which can be a barrier in areas with poor connectivity.
- Digital Divide: Students in rural or economically disadvantaged areas may have limited access to the necessary technology, exacerbating educational inequalities.
- Continuous Investment: Maintaining and updating digital infrastructure requires ongoing financial investment in technology and skilled personnel.
- Data Security and Privacy: Protecting users' data and ensuring privacy in a digital environment poses significant challenges.
- Information Overload: The vast amount of available digital information can overwhelm users, making it difficult to find relevant and credible resources.
- Technical Issues: Technical problems such as software glitches, server downtimes, and compatibility issues can hinder access to digital resources.
- Lack of Physical Interaction: Virtual libraries lack the tactile and personal interaction with books and materials that some learners find beneficial.

How Libraries Can Bridge the Digital Divide in India?

The digital divide in India presents a significant challenge, as there is a substantial disparity in access to digital infrastructure between urban and rural areas. Libraries can play a crucial role in bridging this divide by adopting a hybrid model that integrates both physical and digital resources.

i. Enhancing Digital Infrastructure: Libraries, particularly in rural areas, should invest in enhancing digital infrastructure. This includes providing high-speed internet access and digital devices such as computers and tablets. Partnerships with government agencies and non-profits can help secure funding and resources for these improvements.

ii. Digital Literacy Programs: To ensure that all students can effectively use digital resources, libraries should offer digital literacy programs. These programs can teach basic computer skills, internet navigation, and how to use digital learning tools. Regular workshops and training sessions can empower students to take full advantage of virtual learning environments.

iii. Mobile Libraries and Outreach Programs: Libraries can significantly extend their reach by establishing mobile libraries and outreach programs. These initiatives involve setting up mobile units equipped with books, digital devices, and internet access, which travel to remote and underserved communities. By bringing educational resources and library services directly to these areas, mobile libraries ensure that students who cannot visit traditional libraries still have access to the materials and support they need. Additionally, outreach programs can include workshops and training sessions on digital literacy, helping students and community members develop essential skills for using online resources effectively.

iv. Collaboration with Educational Institutions: Libraries should actively collaborate with schools, colleges, and universities to integrate their resources into the broader educational framework. By aligning library services with the curriculum, libraries can provide targeted support that directly enhances the learning experience for students. This collaboration can include joint development of reading lists, research guides, and curriculum-specific digital resources. Furthermore, libraries can offer specialized training for educators on how to utilize library resources effectively in their teaching, thereby creating a more cohesive and supportive educational environment for students. Such partnerships not only enrich educational programs but also imparts a culture of lifelong learning and academic excellence within the community.

v. Hybrid Library Model: Adopting a hybrid model that combines the strengths of traditional and virtual libraries can ensure that all students have access to comprehensive educational resources. This model allows libraries to offer physical spaces for study and research while also providing digital resources that can be accessed remotely.

By implementing these strategies, libraries can help bridge the digital divide in India, ensuring that all students, regardless of their geographical location or socio-economic status, have access to the resources and support they need to succeed in their educational pursuits.

Examples of How Libraries Support Traditional Learning?

Libraries across India play a crucial role in supporting traditional learning environments by providing access to extensive physical collections and offering valuable academic support services. Here are some specific examples:

i. Indian Institute of Science (IISc) Library, Bangalore: The library at IISc is renowned for its vast collection of scientific literature and research journals. It supports traditional learning by offering access to specialized resources that aid students and researchers in conducting in-depth studies and advancing scientific knowledge. Librarians at IISc provide personalized assistance in navigating complex databases and accessing rare materials, enhancing the research capabilities of students and faculty.

ii. Delhi University Central Library: As one of the largest university libraries in India, the Delhi University Central Library serves as a hub for traditional learning. It houses a diverse collection of books, manuscripts, and periodicals across various disciplines. The library provides quiet study spaces, group discussion rooms, and access to digital catalogues that enable students to explore and retrieve academic resources efficiently.

iii. National Library, Kolkata: The National Library in Kolkata is an exemplary institution that supports traditional learning through its extensive collection of rare books, historical documents, and manuscripts. It preserves India's cultural heritage and provides scholars with access to primary sources for historical research and literary studies. The library's archives and special collections contribute significantly to academic research and intellectual inquiry.

Examples of How Libraries Support Virtual Learning?

Libraries in India have adapted to the digital age by expanding their services to support virtual learning environments, offering access to a wide range of electronic resources and innovative digital practices:

i. E-ShodhSindhu Consortium: Managed by the Ministry of Education, the E-ShodhSindhu consortium provides access to a vast collection of electronic resources, including e-journals, e-books, and databases, to academic institutions across India. This initiative ensures that students and researchers can access up-to-date scholarly information remotely, thereby supporting virtual learning across the country.

ii. The British Council Library, New Delhi: The British Council Library offers a comprehensive range of digital resources and online services to support virtual learning. It provides access to e-books, audiobooks, online courses, and digital newspapers, catering to the educational and cultural needs of students and professionals. The library also hosts webinars, virtual events, and digital literacy workshops that enhance learning opportunities and promote digital skills development.

iii. Digital Libraries in IITs and IIMs: Premier institutions like the Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs) have established robust digital libraries that support virtual learning. These libraries offer access to digital archives, research databases, and multimedia resources that complement classroom learning and facilitate remote study. Students benefit from personalized digital services, including AI-driven recommendations and virtual tutorials, which enhance their academic experience.

Conclusion

Libraries in India play a pivotal role in both traditional and virtual learning environments, serving as dynamic hubs of knowledge dissemination and academic support. In traditional settings, libraries provide invaluable resources such as books, journals, and archives that foster deep learning and research. They offer a quiet, focused environment conducive to study, complemented by the expertise of librarians who guide students in navigating complex information landscapes.

With the advent of virtual learning, libraries have adapted by expanding their services to digital platforms. They now offer extensive collections of e-books, online journals, and multimedia resources accessible from anywhere at any time. This evolution has democratized access to education, bridging geographical barriers and levelling the playing field for students across urban and rural areas. Innovative practices such as augmented reality tours, digital lending platforms, and collaborative online spaces demonstrate libraries' commitment to enhancing the learning experience.

To address the digital divide in India, libraries are increasingly adopting hybrid models that integrate physical and digital resources. Initiatives like mobile libraries and partnerships with educational institutions are expanding access to underserved communities, ensuring equitable access to educational opportunities.

In conclusion, libraries remain indispensable in India's educational landscape, improving to meet the diverse needs of learners in a rapidly changing world. By adopting technology and inculcating innovation, libraries continue to empower students, researchers, and communities with the resources and support necessary to thrive in the digital age.

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SKILLS AND COMPETENCIES FOR NEW ERA LIBRARIANS

Dr. R. Prabu[1] & Dr. R. Sujatha[2]

Introduction

Higher education is constantly changing. The academic library is subject to these changes and must keep up with the rate of development. According to David Lankes (2022), future libraries will be valued more for their services than their book collections. Librarians today play an important role as intermediaries, facilitators, end-user trainers, educators, web designers, researchers, knowledge managers, and more. As a result, possessing a variety of talents and abilities has become critical for adjusting to change. Librarians must possess a diverse set of talents, depending on the type of library and the nature of the profession. Hard skills are utilized to generate educational material, future career profiling, and the technical functions that the institution values the most (Frederick, 2017). Technical skills are required for the completion of a certain job or the abilities required to do a specific job, for example, employability skills such as classification, cataloguing, automation, networking, programming, database analysis and design, etc. Professional skills are essential for success in an organizational environment, and they are performance accelerators; without them, people fail to flourish in their work. Life skills are a set of human abilities gained through instruction or direct experience and utilized to solve challenges encountered in daily life. Soft skills are behavioral and personality attributes that help librarians develop positive relationships with customers, colleagues, and others at work. The paper examines the numerous Skills and Competencies needed for the era of librarians.

Skills and Competencies for New Era Librarians

Foundational Knowledge

New era librarians must have a solid understanding of the social, cultural, economic, political, and information environments in which they work. The role of a librarian is to act as a bridge between mankind and its recorded knowledge and information. The library's foundational knowledge is the promotion of intellectual freedom through the creation,

administration, and preservation of scholarly research records. In the library system, the librarian collaborates with numerous departments, divisions, and units of the recognized

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institution. The librarian was involved in the decision-making process, the advisory committee, the budget, the development of rules and regulations, essential policies and procedures, and the provision of services to stakeholders. Librarians must work in the non-institutional world, notably with regional, national, and international organizations that influence library organization and operations. Information Professionals should have the knowledge of various legal issues like IPR, Indian copyright legislation and how does it applies to libraries and knowledge of a range of licensing models related to service and resource provision.

Interpersonal skills

All library and information professionals should have communication and advocacy skills in order to effectively convey the importance of libraries to their parent institutions and target audiences, as well as advance library profession values such as empowering users to be self-sufficient, freedom of expression, upholding the right to access information and knowledge in all forms, preserving the corpus of human knowledge for future generations, and so on. Negotiation skills are essential when engaging with people to achieve mutually acceptable/beneficial solutions. Decision making abilities are required to make well-informed judgments, comprehend the repercussions, and commit to actions in order to achieve organizational goals. Problem-solving abilities include detecting problems, establishing the relevance and accuracy of associated information, and using excellent judgment to find solutions; and the capacity to manage conflicts/ disagreements constructively. Marketing abilities for marketing the library's expertise, collections, services, and facilities to a wide range of clients (e.g., undergraduate and graduate students, as well as professors from all disciplines), and establishing the library as a vital institution in research, teaching, and learning. Mentoring, writing, and presentation abilities are desired, as is the ability to provide meaningful advise and comments to new members of the profession in order to assist them succeed in the field and their new roles.

Leadership and Management

All library and information professionals should commit to and develop the leadership qualities required to influence and motivate people to strive for greatness, as well as the ability to adapt to a variety of working/learning styles and organisational cultures and lead change within the organisation. Financial and human resource management abilities are required to comprehend the principles of planning and budgeting in academic libraries, as well as to implement effective personnel practices and HR development. Services and resource development abilities include understanding how to assess the need for additional services and/or resources, as well as plan and implement them in light of present and expected needs. Risk management abilities include acknowledging the benefits and drawbacks of any actions or decisions, as well as the ability to effectively assess any decision made. Project management abilities involve planning, organising, and managing resources in order to successfully achieve certain project objectives within a set time limit. Assessment and evaluation abilities are required to grasp the concepts

and procedures for service, resource, and project evaluation, as well as result assessment. Partnerships and Collaborations skills are used to comprehend the reasons and tactics for forming collaborations and partnerships with stakeholders and relevant communities.

Collections Development

Professionals in libraries and information science should be familiar with the fundamentals of the academic publishing cycle in order to comprehend the entire life cycle of scholarly publishing, from conception to various usage phases and disposal. Knowing collection strengths and the goals and objectives of libraries and institutions for collection development are just a few of the collection development and management abilities required to comprehend the ideas, problems, and procedures linked to the acquisition and disposition of resources. Proficiency in digital curation enables one to comprehend optimal approaches for the identification, gathering, safeguarding, characterization, arrangement, and storage of digital records and research data across diverse media. Proficiency in collection administration and preservation is crucial for gaining a fundamental understanding of the techniques involved in managing and preserving both common and rare books and archives. Understanding how information is arranged for simple identification and retrieval, including cataloguing, classification, and metadata standards for all forms, is regarded as essential for records management skills.

Information Literacy

Proficiency in information literacy is necessary to comprehend the fundamentals and various forms of information literacy within the academic setting. Understanding learning models and methods, as well as pertinent teaching methodology and models for the academic setting, are essential for both learning and teaching skills. The purpose of institutional teaching and learning skills is to transfer knowledge of the programmes and objectives of the institution in order to successfully engage stakeholders and incorporate information literacy initiatives where suitable. Knowledge of information literacy concepts and principles, particularly the importance of incorporating critical thinking and lifelong learning into teaching and instruction approaches, is a prerequisite for possessing critical thinking and lifelong learning skills. The knowledge of the principles and practices of a successful reference service that provides users with relevant and reliable information is referred to as reference services skills expertise. The ability to interact with people to ascertain their information needs and when those needs have been satisfied is known as patron engagement abilities.

Research & Contributions to the Profession

Research and publication contributions through writing, editing, refereeing or reviewing books, articles, or reports; presentations to professional or scholarly associations/meetings; and research should be known to and supported by all librarians. Formal education to increase subject or professional knowledge; this could involve earning advanced professional and related academic credentials. Librarians in the modern period should be able to plan, organize, and oversee conferences, seminars, workshops,

and other professional activities. They should also be actively involved in professional groups, which should include holding executive offices and serving on committees. In order to support a research agenda or carry out other tasks as a librarian in the library, personnel should be able to stay up to date on research in their field. They should also be knowledgeable about grant writing and searching for opportunities to assist research projects. Models and research approaches that grasp the principles of both qualitative and quantitative research methodologies as well as the protocols that needs to be adhered to, such as developing research questions and conducting peer reviews.

Information Technology Skills

It is imperative that librarians possess a robust understanding and proficiency in integrated library systems (ILS). This includes an understanding of the fundamental structure, content, and operation of an ILS, as well as an awareness of emerging web technologies, such as online social networking tools. Librarians in the modern period should be knowledgeable with the management of electronic resources as well as the acquisition, administration, and accessibility of digital materials. Proficiency in web page development is necessary to comprehend the fundamentals of web page design, development, and upkeep as well as the fundamentals of institutional repository usage, content, and structure. Additionally, you should be familiar with the fundamentals of LMS/CMS usage and structure, as well as the design and layout of databases to facilitate easy data and information retrieval.

Conclusion

Ultimately, the competences and skills needed by modern librarians go beyond those needed for typical library duties. Proactive, flexible, and committed to the values of lifelong learning, community involvement, and information access, librarians should be. Embracing technology, being aware of how user requirements are evolving, and speaking up in favor of libraries' long-term worth are all part of the modern librarian's job description. In the rapidly evolving digital environment, LIS professionals need to possess high-quality credentials that enable them to provide information and exercise their personal, general, and discipline-specific skills in a dynamic manner.

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SECTION VII

INFORMATICS AND MATRIC STUDIES

TOWARDS THE REALIZATION OF SUSTAINABLE DEVELOPMENT GOALS (SDG) THROUGH HEALTH / MEDICAL INFORMATICS

Prof. B. Ramesh Babu[1] & Dr. Sujin Butdisuwan[2]

Introduction

Healthcare is becoming part of information technology. -- ***Bill Maris***

"The goal of medical informatics is to help health care workers improve outcomes, not to further the discipline itself". --- ***H A Heathfield, 1993***

The term "data analytics" is inclusive and covers a variety of data analysis methods. The science that enables the development of knowledge-based judgments is unprocessed data analysis. Trends and indicators that could otherwise get lost in the deluge of data might be discovered thanks to its approaches. It has quickly developed in terms of technological capabilities, along with a wide range of mathematical and statistical techniques for crunching numbers. Many sectors, including travel and hospitality, where turnaround times may be short, have adopted it. Data collection, transformation, and organization are required in order to draw conclusions, create projections, and direct well-informed judgments. Healthcare is another sector that uses both structured and unstructured data in significant amounts, and data analytics can help with decision-making in this sector. It combines the use of a sizable amount of both structured and unstructured data with the ability to act quickly utilizing data analytics.

The science of managing information is known as informatics. It employs a number of ways to automate, or, to put it another way, utilize computers to manage data and information to assist in decision-making. The word "informatics" first used in a 1968 Russian book titled Oznovy Informatiki (Foundations of Informatics). Following that, the idea of information science was explained in relation to a computer. When European colleges and research organizations began to provide programs to keep up with the advent and use of computers, the term informatics was coined in the early 1970s. Informatics in medicine has grown dramatically during the past few years.

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Sustainable Development Goals (SDG)

A long-term, continual development, sustainable development is now prevalent. It is a growth, in accordance with one definition, that satisfies present desires without jeopardizing the capacity of future generations to satisfy their own needs. In other words, it highlights the importance of independence so that success can be achieved without having to rely too heavily on outside resources. In all areas of human existence, it is regarded as one of the fundamental questions that must be investigated and studied, and libraries in particular are not an exception to this rule.

The crucial objectives of sustainable development are listed by the World Commission on Environment and Development in 1987. They include reviving growth, enhancing the quality of growth, ensuring a sustainable level of population, providing for basic needs like jobs, food, energy, water, and sanitation, preserving and enhancing the resource base, reorienting technology and risk management, integrating the environment and economics in decision-making, reorienting international economic relations, and enhancing participation in development. Sustainable development can be achieved by developing new revenue streams, expanding existing services within reasonable bounds that can generate a small amount of funding, conserving existing resources as much as is practical for future use, implementing efficient technologies in library settings that result in significant cost savings, and/or having an impact on the environment.

Alongside the United Nations, 195 countries declared in 2015 that they had the power to transform the world. By 2030, each nation's population will lead better lives thanks to the collaboration of its governments, corporations, media outlets, institutions of higher learning, and local NGOs. (Source: globalmovement.worldtop20.org?gad=1, accessed on September 14th, 2023). The Sustainable Development Goals (SDGs), often referred to as the Global Goals, were created as part of a global agreement with the aim of eradicating poverty, protecting the environment, and guaranteeing that everyone lives in peace and prosperity, both now and in the future.

Seventeen Sustainable Development Goals (SDG) 2030 Agenda are as follows:

1. To eradicate poverty;
2. To eradicate hunger;
3. To advance health and wellness;
4. To provide high-quality education;
5. To uphold gender equality;
6. To improve clean water and sanitation;
7. To encourage the development of affordable and clean energy
8. Encourage economic expansion and fair employment
9. Boost industry, innovation, and infrastructure
10. Reduce inequality
11. Promote sustainable urban and neighborhood development
12. Promote ethical production and consumption
13. Plan for climate action

14. Enhance on-land life
15. Promote life beneath the water
16. Ensure peace, justice, and robust institutions
17. Form Partnerships to Reach the Objectives (Source: https://data.unicef.org/sdgs/goal, Accessed on 14th September 2023)
18. Everyone's future is thought to be better off, thanks to the Sustainable Development Goals. The 17 objectives are interconnected, and the UN wants to accomplish each and every one of them.

The third goal namely, PROMOTE GOOD HEALTH and WELLBEING, can be linked to the concept of health / medical informatics.

SDG 3: Optimal wellbeing and health. Better connectivity can enhance telemedicine, health /medical informatics, and direct patient interaction. It focuses on important objectives that improve the overall health of a population in order to eliminate avoidable suffering from preventable diseases and early mortality. Locations with high rates of chronic diseases and underserved populations are given priority. Along with that, it wants to make sure that everyone, regardless of age, leads healthy lives and improves their wellness. Every stage of life, beginning at birth, is crucial for one's health and welfare. This goal takes into account all significant health objectives, including the preservation of reproductive, maternal, new-born, child, and adolescent health as well as universal access to inexpensive, high-quality, safe medications and vaccines, the prevention of infectious and non-communicable illnesses, and any other relevant health concerns. It urges greater expenditures on risk management, R&D, and health financing.

The third objective is to guarantee healthy lifestyles and to improve wellness for everyone, regardless of age. Raising health spending, reducing premature mortality, preventing needless baby and toddler deaths, and lowering the mortality rate could all be helpful. The eradication of the epidemics of tuberculosis, AIDS, tropical diseases, and malaria, as well as the battle against hepatitis, water-borne illnesses, and other infectious diseases, are steps toward attaining this goal.

Origin of Health / Medical Informatics

The first articles on this topic started to appear in the 1950s, and publications on it quickly proliferated in the 1960s and 1970s, when it was recognized as a new specialization (Collen, 1986). It is required to do research on and put these techniques into practice in order to enhance the administration of patient information, clinical data, demographic data, and other information essential to patient care and public health. Bioinformatics, clinical informatics, consumer health informatics, and public health informatics are all subfields of medical informatics. It embodies a general desire to create an information agenda for health services that acknowledges both the role of patients as participants in their own care and the critical information handling responsibilities of non-medical healthcare professions. It is based on both computer and information sciences as well as life sciences. To reach its full potential, it keeps a tight relationship

with the biological sciences (Mishra and Mishra, 2006). 'Medical informatics' is a word that is used in clinical medicine or medical research. It is becoming more significant in clinical practice.

Medical informatics is a brand-new field of research, training, and practice in computer and information science, engineering, and technology. It has changed over the past 30 years as medicine has learned how to better fulfil its complex information needs by utilizing the extraordinary capabilities of the electronic digital computer. The area presently known as medical informatics is regarded to have been created at the time it was first described in the paper, namely Education in Informatics of Health Personnel in 1974. Since then, it has grown in popularity as an essential component of modern medical treatment.

What of Health / Medical Informatics?

It is ideal to think of medical informatics as the knowledge, abilities, and resources that make it possible to share and use information in order to provide healthcare and advance health. Its origins can be found in the terms medical informatics, where medical denotes the academic discipline and informatics the supporting technique. The latest edition of Shortliffe's textbook defines it as, *"a field of study concerned with the broad issues in the management and use of biomedical information, including medical computing and the study of the nature of medical information"*. According to Warner, (1988) it is "*the study, invention and implementation of structures and algorithms to improve communication, understanding and management. of medical information"*.

Medical informatics is a recently developed academic discipline that combines the subjects of information science and medicine. It might be defined as the science and art of processing medical information, where information refers to processed data. The preservation, retrieval, and best application of biological information, data, and knowledge for problem-solving and decision-making are the focus of the scientific field of medical informatics, which is currently under rapid development. The design, development, implementation, and application of information technology-based innovations in healthcare service management, planning, delivery, and patient care are the main foci of this interdisciplinary subject. It is also known as operational informatics and applied clinical informatics. Clinical decision support, visual imagery (such as radiological, pathological, dermatological, and ophthalmological images), clinical documentation, provider order entry systems, system design, system implementation, and system acceptance are just a few of the many topics covered by clinical informatics.

Why of Health / Medical Informatics in the Context of SDG 3?

Medical informatics may have initially been seen as a 'nice-to-have' rather than a 'need-to-have' topic in both computer science and biomedicine as well as the health sciences (Haux, 2010). It is the term now used to investigate the information and communication processes in therapeutic settings. It is situated at the point where information technology and the various fields of medical and healthcare come together.

It is the foundation for modern medicine's comprehension and application. The study's major tool, the mechanism by which a man's health and diseases are studied, and the operation of all health-related duties are carried out, is the computer, which also includes all of its other components. It is a critical study of the definition, selection, and design of patient therapies by clinicians, who act as managers. It looks at the hierarchical structures that physicians employ to create and run healthcare systems. Information theory, system theory, decision theory, communication theory, structuring and organizing information, building databases, building informational documentation systems, classification theory, semiotics, organizational sciences, biostatistics, epidemiology, health politics, medical ethics, etc. are the theoretical underpinnings of information and medical informatics science. It combines the science of information technology and communication with the art of administering medical and health care. It is a form of synergy where both industries benefit from one another. Medical informatics research and applications are multidisciplinary and reflect contemporary information, communication, and medical developments. It is the convergence of both underlying qualities and applied aspects. Medical informatics, like medical and health science, is multidisciplinary in nature since it works with all areas of medicine and health care, from primary care practices to hospital and health administration, from computer-based patient records to image processing (Bansal, 2003).

The following four categories can be considered to view health / medical informatics in the context of SDG3:

1. ***Knowledge management***, which involves systematically obtaining, analyzing, and disseminating knowledge to improve performance;
2. ***Clinical Information Management***, an electronic system for organizing, storing, and protecting medical data;
3. ***Communication:*** The use of networking and computer technologies in the healthcare industry;
4. ***Decision Support***: Programs that help healthcare management foresee future outcomes and develop appropriate policies based on analyses, forecasts, and suggestions (Bhatia, 2015, p. 4)

A rapidly expanding academic field called medical informatics integrates the study of medicine with the study of information sciences. There are connections between information science, computer science, medical informatics, and health care informatics in this field of study. It is used in many scientific fields, including public health, dentistry, and pharmacy. This is one of the areas of the health care sector that is expanding quickly. It entails using the simplest method to locate the appropriate information. Because the idea of health informatics involves using technology, it is very important. It combines the fields of science, information technology, and medicine. The provision of patients with high-quality healthcare is the main goal of health informatics. Also included are technological advancements in pharmacy, dentistry, and pharmaceutical research.

All facets of understanding and fostering the efficient organization, analysis, management, and use of information in healthcare are included in the field of medical informatics. By facilitating improved access to medical information and knowledge, it has the potential to benefit patients. There are many benefits of using health informatics. Computers, the Internet, and numerous medical databases can assist doctors in learning more effective patient treatment techniques. Data retrieval from health informatics produces statistical information that can significantly affect how medications are administered, operations are performed, and recovery is tracked. It also aids hospitals in keeping better track of their historical data so that patients can be treated more swiftly in the future. Its primary goals are the creation, upkeep, and management of vast, intricate information systems that can safely collect, store, transfer, and make Electronic Health Records (EHRs) and Electronic Medical Records (EMRs) accessible. Clinics may now treat patients more quickly and effectively thanks to the usage of health informatics, which also helps these clinics streamline their current processes. Finding ways for hospitals, clinics, doctor's offices, and other facilities to provide patient-centered care is one of informatics' most important jobs in the health care industry. The patient can now take control of their own care by gaining access to their electronic medical records or connecting with them via a secure platform. (https://www.topmastersinhealthcare.com/faq/informatics-used-healthcare/).

Medical informatics has the potential to improve patient care just as much as a recently developed drug or therapy, even though the benefits won't be felt right away through conventional treatment approaches. Instead, they will result from greater medical information and knowledge transmission, which will enhance patient care. As medical practice advances in the digital age, this promise of medical informatics will become clear. The value proposition of health care and medical informatics can be summed up as the investigation, creation, and implementation of structures and algorithms designed to enhance the management of data and information as well as the dissemination and comprehension of health care data and information. Thus, the clinical, technical, public, and commercial aspects of healthcare are all included in the value proposition (Latour and Eichenwald, 2002, p. 38).

Applications of Health / Medical Informatics for the Realisation of SDG 3

The applications of medical informatics towards the realisation of SDG 3 lie in the following:

- Epidemiological disease surveillance and risk assessment for epidemics and outbreaks.
- Management of disasters: prevention, mitigation, and response.
- Public health information and health education dissemination.
- Tele-cardiology, tele-cancer care, tele-ophthalmology, and other types of remote medical care and illness screening.
- Linkages between electronic health records and electronic medical records.

- Current health statistics: to understand the prevalence of diseases, various statistics relating to health care, etc.
- Medical providers receive on-going education and training in this area.
- Creation of Decision Support Systems (DSS) for patients and healthcare professionals, such as providing doctors with details on the evolution of health information systems and antibiotic resistance in commonly occurring microorganisms.
- Improving public health governance through increased accessibility of medical services to rural areas, the adoption of standard treatment protocols, increased efficiency, and the use of DSS for disease surveillance and disaster management.
- Studying public health (Athavale and Zodpey, 2010).

Value of Health /Medical Informatics In The Realization of SDG3

In order to design and develop software that maintains patient information where it can be retrieved by those providing care for the patient, health/medical informatics combines technology with the science of healthcare. The center of the health informatics wheel is the electronic health record (EHR). Communication among healthcare professionals, staff, managers, and patients is significantly impacted by the advantages of healthcare informatics across a broad range of applications. The EHR establishes a basis for patient care by leveraging software created specifically for use with essential data, such as:

- Test and X-ray findings
- A patient's medical history and notes
- Prescriptions from a doctor
- Medications, allergies, and vaccines
- Discharge planning
- When insurance companies analyze the patient's record, the next person providing care for the patient, the administration in charge of managing patient care, and others, accurate documentation is helpful.

Support for Clinical Decisions

The key to clinical decision support is having the relevant information when you need it. Clinical decision support enables staff to take these considerations into account before making care decisions when knowledge and information are strategically placed at risky decision points, such as safety, care options, and education.

Enhanced Administrative Capability

Data may support leadership and be used to help create corporate policy. Leadership may identify educational requirements, improve the caliber of programs, and promote a culture of safety and accountability for the management and staff by having a full awareness of the facility's operations.

Enhanced Safety and Quality

Two key elements that can lower errors and improve successful outcomes are the availability of knowledge and information and the caliber of the treatment provided. The following key sectors have seen quality and safety improvements because to technology. Care may be provided more quickly and safely by integrating clinical process within the application. Data sharing can assist in decision-making with the patient by providing nurses with alerts regarding a patient's care to prevent missing instructions.

Improvements in Accreditation Standards Compliance

The documentation for employees and providers of EHR software packages typically include the Joint Commission standards. The Joint Commission has standards for dealing with sedation in the records that cover all aspects of the care, including choosing the proper patient, prescribing the appropriate dosage, and noting its consequences.

Better Education

The patient record contains a variety of information about patient and staff education. Tools for education on procedures, drugs, and disease processes are accessible in the EHR.

Better Information Access

Better information access for patients and clinicians can improve decision-making and decrease errors brought on by a lack of documentation.

Is Health / Medical Informatics An Academic Discipline and Profession?

Certainly it is an academic discipline and profession due to the following reasons:

The study of medical informatics focuses on the cognitive, information-processing, and communication processes that are involved in medical practice, education, and research, in addition to the information science and technology that supports these tasks. Medical informatics is a naturally interdisciplinary discipline that has a strong emphasis on applications. However, it also deals with a variety of fundamental research problems as well as planning and policy issues. Currently, it is recognized as a unique academic organization. Some healthcare institutions have already made large investments in information systems and services, while others are considering doing so. The operations of their organizations will be impacted in every way by these investments. Since traditional medical fields all have similar information processing requirements, it applies to all of them. It sits at the nexus of computing science and technology and the medical subject domain (Greenes and Shortliffe, 1990).

Compared to other medical sciences, the field of medical informatics is still relatively new. Professionals in the rapidly expanding field of "health informatics," which involves gathering and analyzing health care data, are forging a new route in a field where computers and healthcare providers collaborate. The size of the organization and the sorts of health data they manage affect the medical informatics careers that are

available. The majority of occupations entail collecting and analyzing data, developing work flows, determining impact, and instructing and training end users. Consequently, individuals with medical informatics training are required for the systematic processing of information in healthcare.

Medical informatics could be utilized at medical colleges for the following purposes:

1. Model building, theory creation, and innovative experimentation in medical research and education. Goals should include organizing and integrating the knowledge in terms of causes, processes, and effects as well as creating new knowledge from existing ones. Standardizing decision-making procedures is also essential.
2. Accurate evaluation and formal experimentation make up applied research.
3. Specialized tool development and engineering employed in basic medical research.
4. The use of applications, including user education, management, operation, and maintenance, for basic medical research and instruction.
5. Information technology's role in medical education and healthcare delivery: Policymaking and Planning (Sarbadhikari, 2005)

Graduates with a degree in health/medical informatics may find work as a clinical informaticist, pharmaceutical or nutrition informaticist, informatics analyst, nurse informaticist, informatics expert, manager, or director, to mention a few possibilities. As a result, it is appropriate to acknowledge and promote health / medical informatics as an academic discipline that will determine whether or not health-care delivery in Digital India is successful or failed through the creation of professionally competent health informaticians at this point. (Sarbadhikari, 2018).

Health / Medical Informatics Education In India

The National Informatics Centre (NIC), which was founded in 1976, is credited with popularizing the word "Informatics" in India. It has now established itself as a "prime builder" of e-Government / e-Governance applications all the way down to the community level and as a supporter of online potential for India's sustainable development. In India, medical informatics is still in its infancy and is in transition. In tropical nations like India, it is a vital discipline. In many nations around the world, medical or health informatics education has become a crucial component of instruction and preparation for doctors, nurses, and administrators. Additionally, medical informatics courses are made available to informatics students, and programs specifically designed for medical informatics professionals are organized. India has very little experience with medical informatics. Only recently have several institutions begun offering programs under the heading of bio-informatics. Only in the past several years has this scenario begun to change. However, there remains a sizable gap that needs to be closed at twice the speed.

There are now more graduate degree programs that are solely dedicated to the fundamentals of health informatics due to the rising demand for qualified medical informatics professionals and the emphasis on advanced education for those practicing

informatics within the health care industry. Nurses and other clinical care providers, health information management experts, and IT professionals can all benefit greatly from such training.

India is exporting its excess IT labor force, but this cannot be true of the medical informatics labor force because India has not significantly aided MI. The Medical Council of India (MCI) has to start taking medical informatics into account when developing the MBBS curriculum. In order to develop degree or certificate programs in medical informatics for healthcare workers, just like in Western nations, pressure from organizations like the Computer Society of India (CSI) may be necessary.

There are several disagreements over the direction that medical informatics education will go. Medical informatics education in India is soon going to show an increased trend. Everyone may agree that the importance of medical informatics to overall health care and staffing requirements is enormous. However, there is not yet a consensus regarding the teaching programs due to the complex and fast-paced nature of medical informatics, which makes it more challenging to deliver reliable educational programs. Another issue of controversy is the academic year in which it should be transferred from medical informatics. Most experts continue to concur that emphasis should be placed on later study years due to the fact that an increasing number of students enroll in faculties with prior informatics illiteracy and that knowledge of specific medical informatics domains requires prior clinical skills (Masic, 2013).

Conclusion

The Sustainable Development Goals exhort all nations-rich, poor, and moderately developed-to act. With this call, we want to improve the welfare of both people and animals while protecting the environment. Every country agrees that initiatives to reduce poverty must be pursued in tandem with those to boost economic growth. A variety of issues in the areas of employment, education, health, social protection, and health should be addressed right away, along with combating climate change and protecting the environment.

The enormous upheaval of the health care industry is being significantly aided by technology. In order to ensure that some of the change results in better care, more efficiency, and better coordination, medical and health informatics are helping. Medical informatics is playing a bigger role in improving the entire health care system. Information technology has been intelligently combined with health and other related biomedical areas. Medical informatics practices and technologies are still being developed in India. Many hospitals and healthcare facilities still use manual processes, which indicates a low IT (Information Technology) penetration rate (Samal, 2013).

Medical informatics is a fast evolving field of science that is reshaping the practice of medicine by creating new knowledge about the causes and treatments of disease, as well as new employment prospects for those who are interested in working in the healthcare industry. It has helped develop both the sciences and the way that individuals

are treated in our cultures. In a nation like India, it has enormous potential. In the years to come, the demand for skilled labor in the field of health informatics would be enormous. It has completely changed the landscape of medical sciences. It is used in fields including nursing, clinical care, dentistry, pharmacy, public health, and biomedical research, among others. It has fundamentally changed how the healthcare sector is growing throughout the world by bridging the gap between the health and information sciences, opening up new avenues for study and advancing the development of complex illness treatments. It has progressed to the point where it is pervasive. In the larger field of health informatics, it is rapidly developing as a new and unique speciality area. Numerous reports from throughout the world have pointed out the potential contribution of informatics to the reduction of health disparities in underserved groups. The development and integration of a complete and responsive public health informatics domain will be crucial for India's population health and public health governance in the fast changing global public health landscape. Effective healthcare, sound medical and health knowledge, and well-managed healthcare for the individual are all supported. Health care practices evolve together with the underlying science and practice of health. The discipline of medical informatics is well-positioned to play a substantial part in these changes and is affected significantly by them (Haux, 2010). Health informatics has made it possible to conduct new studies and evaluate novel disease-treating methods. As part of achieving the SDG 3, it is a rapidly growing field that is influencing many parts of modern healthcare.

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EVALUATING PAID AND OPEN ACCESS ARTICLES PUBLISHED IN SCIENTOMETRICS: A CASE STUDY

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Introduction

Open Access (OA) journals provide their content for free, according to Suber (2007), users of open access articles are free to read, copy, print, download, distribute, and link to the entire text of these articles without having to pay for them. Subscribed resources can be accessed using IP (Internet Protocol)-based restricted access, VPN (Virtual Private Network), or login credentials, but most of the academic and organizations were not able to afford the subscription cost. (Bjork, 2013). Certain subscription journals have opted for hybrid publication in alignment with the open access trend. Actually, from the time of publication, every article in the complete gold road journals is open access. However, only a small number of publications are published as open access (OA) in hybrid journals using the article processing charge model (APC). The majority of the papers in these journals are subscription-based, meaning readers must pay a charge to access them, however individual writers do pay publications a fee to have their works published (Björk, 2012). However, a number of studies have demonstrated that, in comparison to non-open access journals, publication in open access journals is on the rise in practically all disciplines. This growth can be attributed to higher citation counts (Cueto, 2024).

Open access publishing types fall into four primary categories: gold, hybrid, green, and bronze. Readers consider gold or open journals to be the most generally accessible because they have the fewest licensing limitations, allow the sharing and reuse of their articles under a creative common license, and make their content immediately accessible to all readers via the journal's website. In fully open-access journals, authors have to pay an average article processing charge of $1,760 (2022 US dollars) (Pinfield, 2017), and readers are not required to pay a subscription fee for publications published. Open journal publishing publishes three-quarters of scholarly articles, making it one of the most popular modalities [12]. Hybrid journal articles are a combination of fully open access and subscription journals. Access, reusability, and copyrights for works published in hybrid journals are contingent upon the author's publishing terms, including payment

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of a publication fee (Laakso, 2016). Green open access journals are the most common in the United States, the United Kingdom (UK), and France. Green open access allows authors to publish for free in open access repositories, with the version that gets deposited dependent on the publisher who retains the copyright (Björk, 2014 and Zhang, 2022). Bronze or closed license journals are open access publishing; however, they are typically published without an explicit open license, which is required for unrestricted sharing and reuse of published work [17].

Source Journal

Scientometrics is an international, peer-reviewed, monthly journal that publishes original research on all quantitative aspects of the production, communication, and use of scientific and technological information (Martín-Martín, 2018). Major research issues include measuring the impact of research papers and academic journals, understanding scientific citations, and utilizing such measurements in policy and management contexts (Leydesdorff, 2012). In actuality, Scientometrics and other scientific domains, including information systems, information science, science of science policy, sociology of science, and meta science, have a lot in common. The over-reliance on Scientometrics, according to critics, has produced a publish-or-perish climate that encourages low-quality research by creating a system of perverse incentives.

Literature Review

There are several studies on the mode of access: open access or paid access. Authorship: single authorship or joint authorship; types of collaboration: international or domestic. There is a widespread belief that open-access documents are more accessible and visible to the scientific community in the public domain; they receive more citations than articles published through paid access. The findings have varied according to region, country, discipline, or subject. Wang et al. (2015) found that the Nature Communication Journal cites more open-access publications than non-open-access articles. Sotudeh et al. (2015) compared open access versus non-open access manuscripts. They concluded that in the field of social sciences, OA articles in APC journals have received more citations in comparison with non-OA articles.

Torres- Salinas, et al. (2020) assessed the uptake of OA to COVID-19 literature and their social media attention benefits over NOA access articles. The study discovered that OA articles received the highest share of social media attention compared to NOA articles. Wang (2011) reported that there were seventy-two Taiwanese journals. They found that OA articles received more frequent citations than non-OA papers. Aman (2013) similarly found that OA preprints got higher citations than non-OA papers in the discipline of LIS. However, Wray (2016) contended that author-paid open access articles in the humanities and social sciences do not yield citation advantages.

According to a study by Esyenbach (2006) citations obtained inside various OA article formats that are published immediately on the journal website have a greater influence than OA publications that are self-archived or otherwise publicly accessible.

The study also discovered compelling evidence that open access (OA) articles receive quicker recognition and citations from peers than non-OA articles published in the same journal, even in journals that are widely available in research libraries.

Methodology

The study is based upon publications of Scientometrics from the Springer publisher. The datasets were downloaded from SCOPUS database using the search option in the source with the word "Scientometrics". The study period has been considered for five years from 2019 to 2023 and the total number of retrieved documents was 2252, out of them, conference proceedings were excluded and the journal documents was 1870, duplicate titles, letter, erratum and editorial are excluded and included only 1661 articles The entire data collection was completed in the first week of June 2024. R-Studio (biblioshiny) was used author collaboration, descriptive statistics for authorship, institutional affiliation, and tables related to document type, year-wise distribution, and access type were calculated using Microsoft Excel. We classify publications into two categories, Open Access and Paywalled access.

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Results and Discussion

The study period from 2019 to 2023 identified a total of 1661 documents for analysis. The trends of document type, open and paid access documents, number of authors, single-authored documents, and international co-authorship are presented in Table 1.

Table 1- Main Information

Main information about data		
Source : Scientometrics	Publisher: Springer	
Timespan	2019:2023	
Document Type	Article	
Description	Open Access	Paid Access
No. of Documents	743	918

Authors		
Authors	1789	1965
Authors of Single-Authored Docs	92	93
Authors Collaboration		
Single-authored docs	111	116
Co-Authors per Doc	3.14	3.14
International co-authorships %	32.03	22.77

Paid access has a higher number of documents (55.27%) compared to open access (44.73%). On average, open access documents have a higher number of authors (2.4 documents) than paid access documents (2.1 documents). Authors of single-authored documents also have a higher number of documents (12.38%) than paid access documents (10.13 documents). In terms of author collaboration, the number of single-authored documents is higher in open access documents (14.9%) than in paid access documents (12.6%). There is no difference in co-authors per document; both open and paid access have 3.14% of documents. Open access has more international co-authorship (32.03%) compared to paid access (22.77%).

Table 2: Year-wise distribution of documents and citations

Year	No. of Articles		Mean Total Citation Per Article		Citable Years		Mean Total Citation Per Year	
	Open	Paid	Open	Paid	Open	Paid	Open	Paid
2019	92	179	24.10	16.77	6	6	4.02	2.79
2020	172	221	19.01	10.82	5	5	3.80	2.16
2021	182	213	16.87	7.05	4	4	4.22	1.76
2022	165	161	6.46	4.33	3	3	2.15	1.44
2023	132	144	1.88	1.05	2	2	0.94	0.52

Table 2, displays the distribution of all articles published in the Scientometrics Journal for the period 2019–2023. It shows a total of 743 in open access and 918 in paid access. In open access, 2019 has fewer documents (92) and 2021 has the highest number of documents (182) published, similarly, in paid access, 2023 has fewer documents (144), and 2020 has more (221) published. In terms of citations, open access publications have received more citations than paid access publications across all years.

Table 3 - Authorship pattern publications

Author Pattern	Total No of Contributions		Percentage (%)		Cumulative contributions		Percentage (%)	
	Open Access	Paid Access	Open Access	Paid Access	Open Access	Paid Access	Open Access	Paid Access
Single	111	116	14.94	12.64	111	116	14.94	12.64
Double	194	230	26.11	25.05	305	346	41.05	37.69

Three	208	253	27.99	27.56	513	599	69.04	65.25
Four	104	173	14.00	18.85	617	772	83.04	84.10
Five	62	77	8.34	8.39	679	849	91.39	92.48
Six-Ten	60	66	8.08	7.19	739	915	99.46	99.67
More than ten authors	4	3	0.54	0.33	743	918	100	100
Total	743	918	100	100				

According to Table 3, the journal has more articles written by three authors (208 in open access and 253 in paid access), followed by those written by two authors (194 in open access and 230 in paid access). While single authors have authored more articles in open access than in paid access, more than ten authors have authored less than 1% of documents in both open and paid access categories.

Table 4- Top 10 Affiliated Institution

Affiliated Institution - Open Access			
Sl. No.	Affiliation Name	No. of Documents	Rank
1	Leiden University, Leiden, Netherlands	23	1
2	KU Leuven, MSI, Naamsestraat, Belgium	21	2
3	Administrative Headquarters of Max Planck Society, Germany	19	3
4	University of Wolverhampton, United Kingdom	18	4
5	Consiglio Nazionale delle Ricerche, Italy	18	4
6	Sapienza University of Rome, Rome, Italy	18	4
7	Consejo Superior de Investigaciones Científicas, Madrid, Spain	17	5
8	Wuhan University, Hubei, Wuhan, China	16	6
9	German Centre for HERS Studies, Germany	15	7
10	University of Antwerp, Belgium	13	8
Affiliated Institution - Paid Access			
Sl. No.	Affiliation Name	No. of Documents	Rank
1	Wuhan University, Hubei, Wuhan, China	38	1
2	Nanjing University, Jiangsu, Nanjing, China	33	2
3	Dalian University of Technology, Dalian, China	28	3
4	Chinese Academy of Sciences, China	26	4
5	SUN Yat-Sen University, Guangdong, Guangzhou, China	21	5
6	University of Chinese Academy of Sciences, China	19	6
7	Beijing Institute of Technology, China	18	7
8	Nanjing University of Science and Technology, Nanjing, China	15	8
9	HSE University, Moscow, Russian Federation	15	8
10	KU Leuven, MSI, Naamsestraat, Belgium	15	8

Table 4 shows the top ten affiliated institutions published in Scientometrics journals, both open and paid access. Leiden University, located in Leiden, Netherlands, publishes the most open access documents (23), followed by KU Leuven, MSI, Naamsestraat, Belgium (21) and the Administrative Headquarters of the Max Planck Society, Germany (19). When comparing the institutions to their affiliated paid-access counterparts, there is no significant difference. Wuhan University, Hubei, Wuhan, China, has the most publishing-paid access documents (38), followed by Nanjing University, Jiangsu, Nanjing, China (33) and Dalian University of Technology, Dalian, China (28) respectively. China is home to the top eight affiliated institutions with paid access.

Table 5 - Geographical Distribution of Contributors of Articles

Open Access		Paid Access	
Country	Contributions	Country	Contributions
Germany	126	China	343
United States	95	United States	109
China	93	Brazil	55
Spain	85	Spain	53
United Kingdom	77	South Korea	51
Italy	67	India	41
Netherlands	47	Canada	40
Belgium	33	Pakistan	35
Australia	29	Taiwan	35
Poland	28	Japan	28

During the research period, authors from various countries contributed to the Scientometrics journal, as illustrated in Table 5's geographical distribution of article contributors. Germany emerged as the top contributor, with 126 contributors in open access, followed by the United States with 95 and China with 93 contributors. China emerged as the top contributor with 343 contributors in paid access, followed by the United States with 109 and Brazil with 55 contributors, but there is a major difference between the countries in paid access when compared with open access.

Table 6- Top 10 Authors

S.No.	Open Access		Paid Access	
	Author	Contributions	Author	Contributions
1	Bornmann, L.	19	Afzal, M.T.	11
2	Thelwall, M.	15	Larivière, V.	9
3	D'Angelo, C.A.	12	Fdez-Valdivia, J.	8
4	Abramo, G.	10	Hou, J.	8
5	Costas, R.	8	Rodriguez-Sánchez, R.	8
6	Daraio, C.	8	Cheng, Y.	7

7	Haunschild, R.	8	Shu, F.	7
8	Peroni, S.	8	Xu, S.	7
9	Sivertsen, G.	8	Zeng, A.	7
10	Zhang, L.	8	Daud, A.	6

Table 6 lists the top ten productive authors. Bornmann is the leading contributor with 19 papers in open access and Afzal with 11 papers in paid access. In the top four papers in open access and the top two in paid access, there is no equivalent, but after that, there are equivalent numbers of authors.

Table 7 – Days taken for publish the article

Days taken for publication	Open Access	%	Paid Access	%
Less than one month	2	0.27	2	0.22
1 – 2 months (31 – 60 days)	9	1.21	5	0.54
2 – 3 months (61 - 90 days)	21	2.83	25	2.72
4 -6 months (91 – 180 days)	237	31.90	253	27.56
6 - 9 months (181 – 270 days)	252	33.92	325	35.40
9 – 12 months (271 – 365 days)	123	16.55	166	18.08
1year – 2 years (366-730 days)	95	12.79	127	13.83
More than 2years (731 + days)	4	0.54	15	1.63
Total	743	100	918	100

Table 7 displays the number of days it takes to publish an article after submission. The number of publications increases from six to nine months for both open 252 (33.92%) and paid 325 (35.40%) access articles after submission. This is followed by four to six months for both open 237 (31.90%) and paid 253 (27.56%) access articles after submission. Similarly, more than 12% of the articles have taken more than one year to publish for both open and paid access. Paid access has 15 (1.63%) articles, which took more than two years to publish after submission.

Table 8 – Minimum and Maximum days taken for publish the article

Year / No. of Days	Open access			Paid access		
	Min. days	Max. Days	Avg. days	Min. days	Max. Days	Avg. days
2019	38	495	195	33	665	224
2020	18	716	202	20	816	229
2021	66	952	238	53	1419	256
2022	55	777	270	71	1050	292
2023	79	778	279	79	820	301
Average days	51	743	237	51	954	260

Table 8 shows the minimum and maximum number of days taken for publishing the article after submitting the papers. It shows a minimum of 18 and 20 days in 2020 for open and paid access, respectively, to publish the paper after submitting the manuscript. The year 2021 will see a maximum of 952 days and 1419 days for both open and paid access to publish the paper following manuscript submission. On average, a minimum 51 days and a maximum 743 days are taken to publish in open access, and a minimum 51 days and a maximum 954 days are taken to publish in paid access.

Conclusion

This study's findings confirm that paid access has published more articles than open access articles. The year-wise publication of papers over the last two years has mirrored the decreasing order of paid-access publications over the last three years. However, this study observed that open-access articles receive more citations than paid-access articles. This could be due to the fact that open-access articles are easily accessible without restriction. In the authorship type, multiple authors have a higher number of publications compared to single authorship papers. We also conclude that there are no significant differences between affiliated institutions in terms of open and paid access. In terms of the geographical distribution of contributors to articles, Germany emerged as the top contributor in open access, followed by the United States, and China emerged as the top contributor in paid access, followed by the United States. Bornmann is the leading contributor to open access, while Afzal is the leading contributor to paid access. The top four papers in open access and the top two in paid access have no equivalent authors, but after that, there are equivalent numbers of authors. Both open and paid-access articles typically take six to nine months to publish after submission, with some papers taking over a year. Open access takes a minimum of 18 days and a maximum of 952 days, while paid access takes a minimum of 20 days and a maximum of 1419 days to publish the paper after submitting the manuscript. Overall, open access has more citations and fewer days to publish the papers. This is due to the fact that open-access articles are free to read, copy, print, download, distribute, and link to their entire text without paying for them.

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VISUALIZING RESEARCH TRENDS IN ENVIRONMENTAL SCIENCE AT THE CENTRAL UNIVERSITY OF HIMACHAL PRADESH: A BIBLIOMETRIC ANALYSIS OF CITED KEYWORDS

Muruli. N[1] & N.S. Harinarayana,

Introduction

Environmental science, as a multidisciplinary domain, holds a significant position in comprehending and mitigating ecological challenges. It encompasses various disciplines such as ecology, chemistry, plant science, zoology, mineralogy, oceanography, limnology, soil science, geology and physical geography, atmospheric science and sustainable development (Eddy, 2008). Its scope encompasses diverse disciplines, spanning ecology, conservation, pollution control, and sustainable development, collectively contributing to a holistic approach towards environmental issues (Miller & Spoolman, 2020).

The evolving nature of environmental science necessitates tracking of research trends to remain attentive to its dynamic evolution (Berkes et al., 2000). In this pursuit, the analysis of keywords within cited sources emerges as a powerful tool for understating the ever-shifting scope of environmental research (Bornmann & Leydesdorff, 2014; Chen & Song, 2019). This approach reveals emerging areas of interest, and shed light on the evolution of research priorities and practices.

The Central University of Himachal Pradesh (CUHP) stands as the pioneer institution in the state of Himachal Pradesh to achieve an 'A+' grade from the National Assessment and Accreditation Council (NAAC). Through its dedication to academic importance, research activities, and active involvement within the community, CUHP has risen as a prominent educational institution in the state. The contributions of its researchers to the field are commendable. However, a comprehensive analysis of their cited references holds the potential to offer valuable insights into their citation behaviour and research trends.

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Conducting a bibliometric analysis of the references cited by environmental science researchers at CUHP holds multifaceted benefits, and the analysis of keywords employed in these citations emerges as an effective means to identify trending topics and emergent research themes.

Review of Literature

In recent years, bibliometric analysis has emerged as a valuable tool for evaluating research trends and impact within various scientific disciplines (Aria & Cuccurullo, 2017; Ellegaard & Wallin, 2015). These studies have employed diverse methodologies, including the extraction of keywords from research publications, to decode the emerging themes within a field (Donthu et al., 2021; Leydesdorff & Vaughan, 2006; Mejia et al., 2021). The significance of keyword analysis resides in its ability to offer a bird's-eye view of the thematic shifts occurring within a field.

Keywords are linguistic signposts that encapsulate the essence of research, reflecting the central ideas of scholarly investigations. This makes them invaluable tools for tracking the evolution of topics over time and identifying emerging areas of interest (Liang et al., 2022). By analyzing the prevalence, co-occurrence, and changes in keywords within the cited sources, researchers gain a comprehensive understanding of the field's current state and its potential directions (Bihari Sethi et al., 2014).

As the academic landscape continually evolves, the analysis of keywords becomes essential for keeping pace with shifting trends and for making informed decisions in the domain of research, education, and policy (Nita, 2019). Haunschild (2016) presented a comprehensive review of the literature pertaining to climate change research. The authors employed bibliometric analysis to gain insights into the growth, trends, and impact of scientific research in this field. The review covered a wide range of topics, including the publication patterns, citation analysis, collaboration networks, and research themes within climate change research.

Through their analysis, the authors provided a comprehensive overview of the current state of climate change research, highlighting key findings and identifying research gaps. Similarly, Sweileh (2020) conducted a bibliometric analysis to assess research activity on climate change and human health, with a focus on infectious diseases. The study found a significant increase in publications on this topic, particularly after 2007. The analysis revealed four main research themes in the health-related literature, including climate change and infectious diseases, public health and food security, heat waves and non-communicable diseases, and climate change, air pollution, allergy, and respiratory health.

Urhan et al. (2023) also conducted a bibliometric analysis to examine the connections between climate change and marketing. The study found a growing number of publications on the topic, with the USA, the UK, and Australia being the most productive countries. The top keywords included climate change, sustainability, and marketing. Interestingly, research themes shifted during the COVID-19 pandemic, with

a focus on energy, innovation, insect farming, and carbon management. In the same year, Jiang et al. (2023) conducted a bibliometric analysis to explore research trends and hotspots in climate adaptation of the agricultural system.

The study utilized data from the Web of Science Core Collection and employed CiteSpace for analysis. The findings revealed that research in this area is experiencing rapid development, with the United States being the most impactful country and the University of Leeds being the leading institution. Wan et al. (2023) conducted a bibliometric analysis to identify the hotspots and trends in environmental, social, and governance (ESG) research. While these studies have made significant contributions to understanding research trends and impact in environmental science, there is a need for more specific analyses at the institutional level. The study aims to fill this gap by conducting an analysis of keywords in the cited references by environmental science researchers at the CUHP.

Methodology

Data Collection

The data for this study was collected from the Scopus database. Scopus is a widely used bibliographic database in academic research (Elsevier, 2023). The data collection period spanned from 2012 to 2021, providing a substantial timeframe to capture a significant amount of research output. The search was limited to research '*articles'* and '*reviews'* published in Scopus-indexed journals by researchers affiliated with the CUHP in the field of environmental science.

Data Extraction and Preparation

The process of data extraction involved retrieving the cited sources from the total 71 publications. A total of 4,365 cited references data was exported from the Scopus database in BibTeX format, which facilitated further analysis using bibliometric analysis software packages. The extracted data included bibliographic details along with essential information such as keywords, document types, author names, publication titles, journal names, affiliations, countries, and citation counts.

Bibliometric Analysis Software

Two software packages of R Studio, Bibliometrix and Biblioshiny, were used for the bibliometric analysis (Aria & Cuccurullo, 2017). Bibliometrix was utilized for descriptive statistics; examining aspects such as document types, frequently cited sources, authors, affiliations, and countries. On the other hand, Biblioshiny was utilized for collaboration network analysis, generation of Word Cloud and Tree map visualization of keywords, to analyse trending research topics and themes, to analyse co-occurrence of keywords network.

Analysis of Frequently Used Keywords

The analysis of Figure 1, the Word Cloud of frequently used author keywords, and Figure 2, the Tree-Map Visualization of top title keywords, provides valuable insights into the research focus and themes within environmental science at the CUHP. Both figures highlight the importance of studying pollutants and their impact on the environment.

Figure 1 reveals that heavy metals, such as cadmium, lead, and mercury, are significant research topics, along with microplastics and marine debris. These keywords indicate a focus on understanding the behaviour, adsorption, and potential risks associated with these pollutants. Biosorption and phytoremediation, as well as the synthesis and application of nanoparticles, are also prominent areas of investigation. Figure 2 complements these findings by emphasizing the importance of research conducted in India, particularly in the context of water resources.

The keywords "water," "metal," and "nanoparticles" suggest a comprehensive study of water pollution and the effects of metals and nanoparticles on aquatic ecosystems. Additionally, keywords related to assessment, analysis, and characterization reflect the attention given to understanding the chemical properties and composition of environmental samples. Other notable keywords in both figures include soil, toxicity, pollution, and waste, indicating the significance of studying soil contamination, the adverse effects of pollutants, pollution sources, and waste management strategies.



Figure 1. Word Cloud of Top 50 Author Keywords

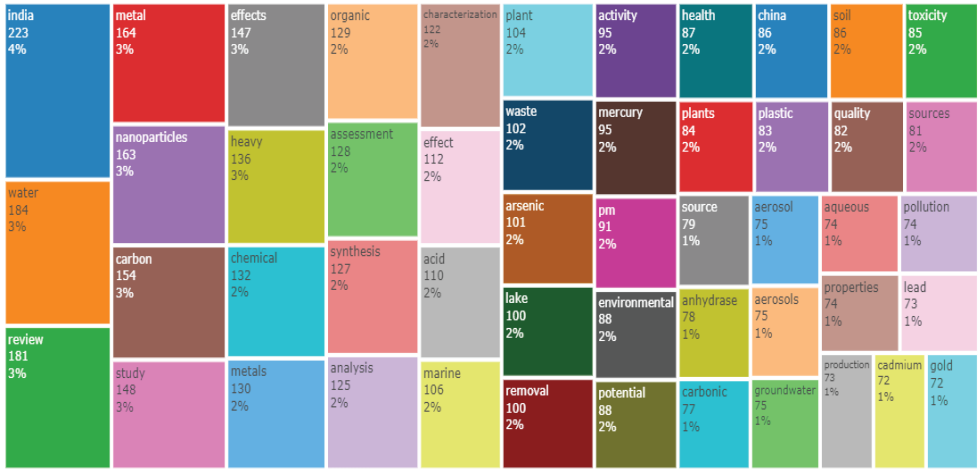


Figure 2. Tree-Map Visualization of Top 50 Title Keywords

The Figures 1 and 2 emphasizes the interdisciplinary nature of environmental science research at the CUHP. The combination of author keywords and title keywords reveals a comprehensive approach that encompasses aspects of environmental chemistry, ecotoxicology, remediation techniques, and the assessment of environmental risks. These findings provide researchers with valuable insights into the current research landscape, emerging trends, and potential areas for collaboration within the field of environmental science.

Trending Topics and Research Themes

Through the analysis of the extracted keywords and their frequency of occurrence, this section aims to identify trending topics and research themes in environmental science research at the CUHP. By identifying common keywords and their patterns, researchers can gain insights into the evolving areas of interest and emerging research trends in the field. This analysis can help guide future research directions and highlight potential areas of collaboration and innovation. The data from Figure 3 provides a comprehensive picture of the trending research topics in environmental science at the CUHP. By examining top keywords, we can identify common themes and gain deeper insights into the research interests and focus areas within the field.

- Early Research Topics: The data from figure 3 reveals research topics that were prominent in the earlier years, such as protein structure, hair, and lipid peroxidation from Figure 3. These early research topics signify the foundation and exploration of fundamental concepts within environmental science.
- Biochemical and Biological Topics: Figure 3 highlight the significance of biochemical and biological aspects within the field. Keywords like amino acids, serum, proteins,

enzymes, microorganisms, gene, and gene interactions indicate a strong focus on understanding biological processes and the role of biomolecules in environmental systems.

- Pollutants and Remediation: The presence of keywords related to pollutants and remediation techniques, such as heavy metals, phytoremediation, biosorption, nanoparticle synthesis, adsorption, mercury, arsenic, lead, and organic chemicals, emphasizes the continuous efforts to understand and mitigate the impact of pollutants on the environment. This demonstrates a sustained interest in studying pollution sources, developing remediation strategies, and evaluating the toxicity of various pollutants.
- Water and Air Quality: Visual representation of top keywords emphasize research topics related to water and air quality, including keywords like groundwater, marine debris, particulate matter, source apportionment, water, lake, and marine. This indicates the importance of studying and monitoring the quality of natural resources and identifying pollution sources in these domains.
- Nanotechnology and Materials**:** The growing interest in nanotechnology and materials research within environmental science is evident in figure. Keywords such as gold nanoparticles, graphene, silver, oxide, nanoparticles, and carbon-based materials indicate a focus on exploring innovative materials and their applications in environmental contexts.
- Emerging Topics: Figure 3 also highlight emerging topics that gained prominence in recent years, such as microplastics, green synthesis, climate change, disaster management, COVID-19 pandemic, and drought. These emerging topics represent new avenues of research, emerging environmental concerns, and the need to address current global challenges.

Overall, we can observe the multidimensional nature of environmental science research at the CUHP. It encompasses diverse areas, including biochemical and biological investigations, pollutant analysis and remediation, water and air quality monitoring, nanotechnology and materials research, as well as addressing emerging environmental issues. Researchers can leverage this integrated information to gain a comprehensive understanding of the current research landscape, identify interdisciplinary collaborations, and explore potential areas for further investigation.

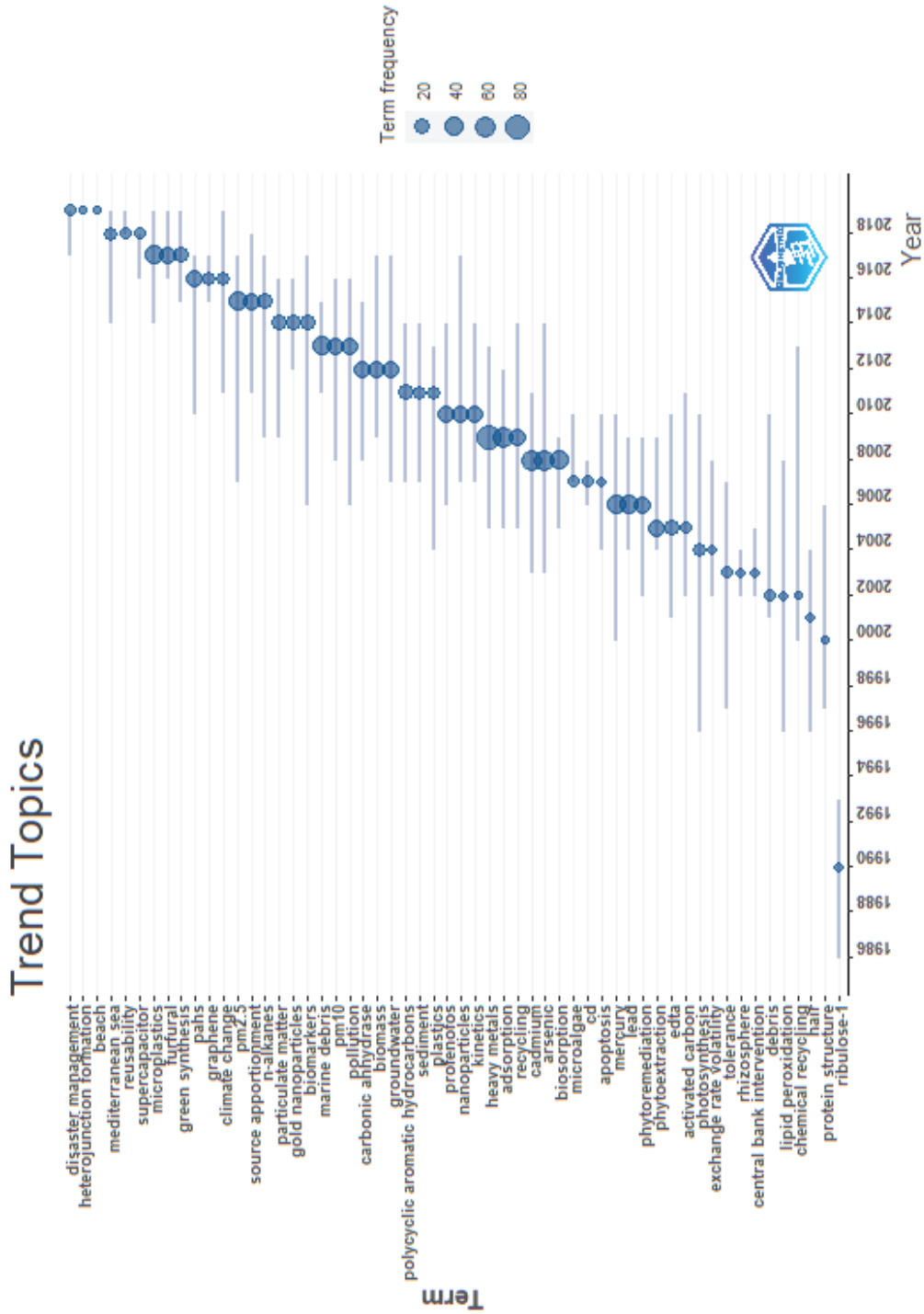


Figure 3. Trending Topics - Based on Author Keywords

Co-Word Network Analysis

Co-word network analysis provides a systematic approach to explore the relationships between keywords and identify thematic patterns and interconnections within a research field. It offers valuable insights for understanding the structure of knowledge and research trends within a specific domain. Figure 4 presents a co-occurrence network based on author keywords in sources cited by environmental science researchers at the CUHP. The figure provides information about the nodes (keywords) in the network, their cluster assignment. The keywords in the network are organized into different clusters.

Cluster 1: This cluster includes keywords related to heavy metals, pollution, and remediation techniques. Some keywords in this cluster are heavy metals, cadmium, adsorption, mercury, biosorption, lead, phytoremediation, and soil.

Cluster 2: This cluster consists of keywords related to microplastics and marine debris. Keywords like microplastics and marine debris are present in this cluster.

Cluster 3: The keywords in this cluster are primarily related to particulate matter (PM) and air pollution. Some keywords include pm2.5, pahs (polycyclic aromatic hydrocarbons), pm10, source apportionment, metals, particulate matter, and n-alkanes.

Cluster 4: This cluster contains keywords like profenofos and biomarkers, indicating research interests in pesticide toxicity and biological markers.

Cluster 5: This cluster is focused on nanoparticles and green synthesis. Keywords such as nanoparticles, green synthesis, silver nanoparticles, gold nanoparticles, and biosynthesis are part of this cluster.

Cluster 6: Keywords in this cluster are associated with groundwater quality, water quality, and hydrochemistry. Examples include arsenic, groundwater, water quality, india, hydrochemistry, and groundwater quality.

Cluster 7: This cluster includes keywords related to biomass and furfural.

These clusters represent thematic areas or topics of research within environmental science at CUHP. Co-occurrence network analysis, as shown in Figure 4, helps identify keyword clusters and relationships, providing a visual representation of the connections between different research areas within environmental science. This information can be useful for understanding thematic patterns and interconnections and can guide further research and collaboration in the field.

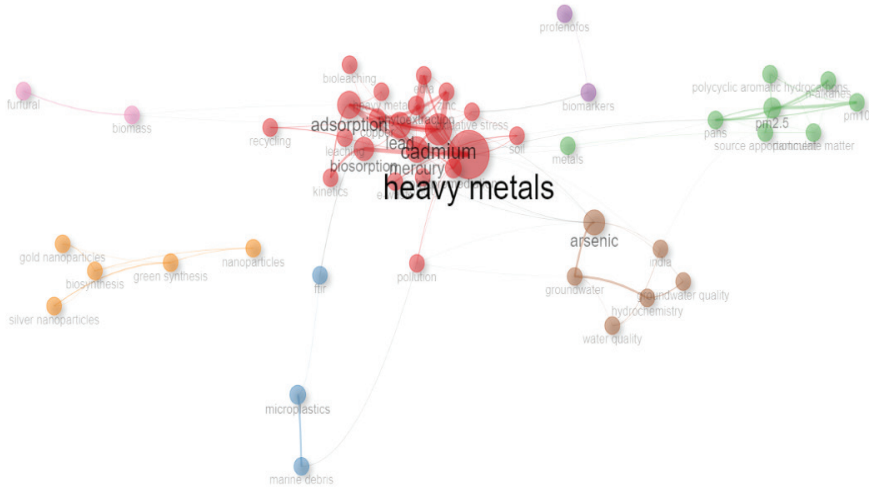


Figure 4. Co-occurrence Network - Based on Author Keywords

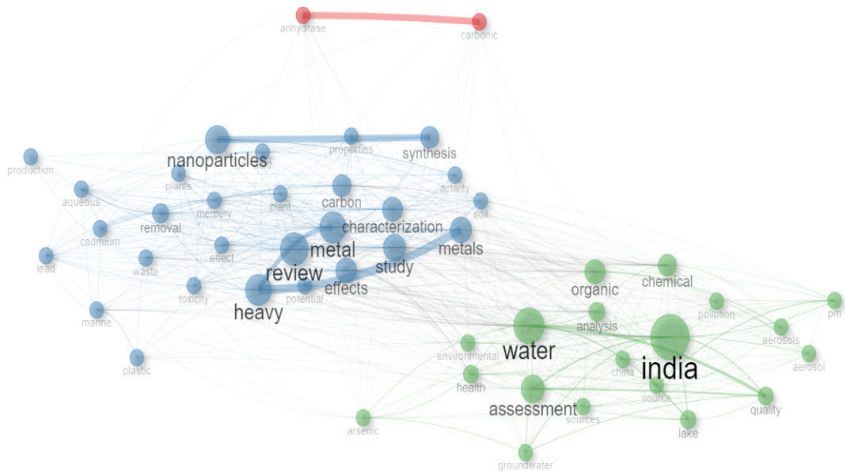


Figure 5. Co-occurrence Network - Based on Title Keywords

Figure 5 presents a co-occurrence network based on “title keywords” in sources cited by environmental science researchers at the CUHP. The keywords in the network are organized into different clusters.

Cluster 1: This cluster comprises keywords related to anhydrase and carbonic, suggesting a focus on specific enzymes or processes.

Cluster 2: The majority of keywords are present in this cluster, representing diverse research areas. Some notable keywords include review, metal, nanoparticles, carbon,

study, effects, heavy metals, synthesis, characterization, effect, acid, marine, plant, waste, removal, activity, mercury, potential, soil, toxicity, plants, plastic, aqueous, properties, lead, production, and cadmium. These keywords cover a wide range of topics such as environmental effects, material synthesis, pollutant removal, and more.

Cluster 3: Keywords in this cluster are primarily related to research conducted in India, with keywords like India, water, arsenic, lake, and groundwater.

Cluster 4: This cluster focuses on keywords associated with water quality, chemical assessment, and environmental analysis. Keywords include water, chemical, organic, assessment, analysis, arsenic, lake, pm, environmental, health, china, quality, sources, source, aerosol, aerosols, groundwater, and pollution.

These clusters help identify thematic patterns and interconnections based on the co-occurrence of title keywords. By analyzing co-occurrence networks of title keywords, researchers can gain valuable insights into the research landscape, identify emerging trends, and explore potential collaborations or interdisciplinary research opportunities in the field of environmental science at CUHP.

Discussions and Conclusions

The analysis of frequently used keywords, as evidenced in Figures 1 and 2, reveal key thematic areas within CUHP's environmental science research. These figures emphasize a notable emphasis on pollutants and their environmental ramifications. The prominence of keywords related to heavy metals like cadmium, lead, and mercury, alongside microplastics and marine debris, indicates a research focus on understanding these pollutants' behaviors, adsorption mechanisms, and potential ecological risks. The prevalence of biosorption, phytoremediation, and nanoparticle synthesis emphasizes efforts towards developing innovative pollution mitigation strategies. Importantly, the intersection of these keywords exemplifies the interdisciplinary nature of environmental science research at CUHP, integrating fields like chemistry, biology, and engineering. The comprehensive analysis of extracted keywords presents the dynamic and diverse research scope within CUHP's environmental science domain.

The identification of early research topics, such as protein structure and hair, showcases foundational exploration. The substantial attention to biochemical and biological aspects reflects a concerted effort to comprehend the biological processes shaping environmental systems. The continued investigation of pollutants, coupled with remediation techniques, emphasizes CUHP's dedication to addressing real-world environmental challenges. The keywords related to water and air quality highlight a keen interest in monitoring and safeguarding these critical resources. Furthermore, the emerging topics demonstrate CUHP's responsiveness to contemporary environmental concerns, such as microplastics, green synthesis, and climate change.

The co-word network analyses represented by Figures 4 and 5 provide a visual representation of thematic clusters and interconnections within CUHP's environmental science research. These figures illustrate the multifaceted dimensions of the research landscape, ranging from heavy metals and pollutants to emerging areas like nanotechnology and sustainable materials. The identified clusters offer valuable insights into collaborative areas, enabling researchers to pinpoint thematic intersections for interdisciplinary exploration. Furthermore, the network analyses highlight the centrality of certain keywords, indicating their pivotal role in connecting diverse research domains.

In this study, analysis has been conducted to illuminate the evolving research trends and thematic patterns within environmental science research at the Central University of Himachal Pradesh. The exploration of frequently used keywords has highlighted the institution's emphasis on pollutants, their effects, and innovative remediation strategies.

The analyses further emphasizes CUHP's interdisciplinary approach, bridging chemistry, biology, and engineering to address environmental challenges. By scrutinizing the trending research themes, the study has revealed a dynamic research landscape. Early topics have paved the way for robust investigations into biochemical processes, pollutants, and water and air quality. Emerging topics, indicative of CUHP's forward-looking approach, encompass microplastics, green synthesis, and climate change. The co-word network analyses have provided a holistic understanding of CUHP's environmental science research themes, presenting clusters that signify both established and emerging areas of interest.

This network perspective aids researchers in identifying collaborative opportunities and fostering interdisciplinary research. Overall, the insights obtained from this analysis provide a roadmap for future research, enable cross-disciplinary collaborations, and empower policymakers with informed insights for tackling contemporary environmental challenges. In the ever-changing domain of environmental science.

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GLOBAL PUBLICATIONS ON HEAT WAVES: A SCIENTOMETRICS ANALYSIS

Dr. Iranna M. Shettar[1], Manjunath Kaddipujar[2] & Dr. Gururaj S. Hadagali[3]

Introduction

Climate change is a global concern, adversely affecting planetary and population health. Extreme heat is one of the most significant climate-related causes of death and is projected to cause heat waves globally. A heat wave can be defined as a period during which local excess heat accumulates over a succession of days and nights. The Intergovernmental Panel on Climate Change (IPCC) defines a heat wave as "a period of abnormally hot weather, often defined concerning a relative temperature threshold, lasting from two days to months (IPCC, 2024)." With the increasing effects of climate change, heat waves are placing an enormous burden on health and social systems and

threatening ecological diversity worldwide. Countries in South and Southeast Asia drowned in extraordinary heat in 2024; New data from the Copernicus Climate Change Service (C3S, 2024) reports that April 2024 was the hottest April on record. According to the European Union's Climate Change Monitoring Service, April 2024 was 1.58°C warmer than the pre-industrial period, or the average temperature from 1850 to 1900. The Hindustan Times looked at the data over 30 years since 1990 and found that more than 1.53 lakh deaths a year were associated with heat waves worldwide, with over a fifth of the share - coming from India (Hindustan Times, 2024).

Heat waves are expected to increase with climate change, posing a significant threat to the human beings health. As heat waves become more frequent due to climate change, adopting preventive measures to maintain health and well-being during extreme heat events will be critical. Therefore, research around heat waves becomes more essential and is more than a primary research fashion. In this regard, the scientific community has contributed extensively to the comprehensive understanding of the Earth's climate system, mainly by providing various data and projections on heat waves, future climate, and expected global warming impacts and risks (Akompab et al., 2013)intensity and

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duration as a consequence of climate change. The effects of heat waves on human health could be reduced if individuals recognise the risks and adopt healthy behaviours during a heat wave. The purpose of this study was to determine the predictors of risk perception using a heat wave scenario and identify the constructs of the health belief model that could predict adaptive behaviours during a heat wave. A cross-sectional study was conducted during the summer of 2012 among a sample of persons aged between 30 to 69 years in Adelaide. Participants' perceptions were assessed using the health belief model as a conceptual frame. Their knowledge about heat waves and adaptive behaviours during heat waves was also assessed. Logistic regression analyses were performed to determine the predictors of risk perception to a heat wave scenario and adaptive behaviours during a heat wave. of the 267 participants, about half (50.9%. Research on heat waves is an emerging topic in climate change research that is increasingly relevant to the society. This study aims to assess the current status and future of research on heat waves by adopting Scientometric indicators.

Literature Review

As mentioned in the introduction, heat wave research is a trending topic. Therefore, the authors felt it essential to conduct a brief survey of the literature on heat waves and its related topics, i.e. climate change. The Russian heatwave 2010 took many lives and was declared the worst in European history since 1950. In this regard, Russo et al. (2015) ranked the top ten European heatwaves from 1950 to 2014. Their study suggested a proactive vulnerability assessment in Europe to design strategies to reduce the heat wave effects. Sweileh (2020)public health and food security; (3 conducted a bibliometric study on climate change research using SciVerse Scopus from 1980 to 2019. The authors found 4247 publications and distributed them among four themes, i.e., climate change and infectious diseases; climate change, public health and food security; heat waves, mortality, and non-communicable diseases; and climate change, air pollution, allergy, and respiratory health. Further, the study reveals that the USA achieved the top position with 1235 contributions, and the *Australian National University* ranked first.

Using the Berkeley Earth temperature dataset and key heatwave metrics, Perkins-Kirkpatrick and Lewis (2020) systematically examine regional and global heatwave trends. The study shows that the trends in heatwaves have accelerated since 1950s, and the authors recommend that regional trends be assessed over multiple decades to gain an in-depth understanding. Marx et al. (2021) analyzed the rapidly growing scientific literature on heat waves. A total of 8,011 related publications were extracted from the Web of Science (WoS) database. The results show that research on heat waves doubled over five years. The authors also present the most severe heat wave events, the cities affected by heat waves, and the ecological and medical impacts they bring. Iancu et al. (2022) studied 74,703 articles published between 1990 and 2022 on climate change, which were extracted from the Web of Science Core Collection. The study found that there was an increase in published research. Further, the study reveals that policies

established by the European Union have created synergies between Member States, discovering and developing solutions to help adapt to climate change.

Caka & Caka (2022) conducted a scientometric analysis of climate change-related research in Kosovo. The results indicate a growth in climate change research in Kosovo, with 2014 being the most productive year. Further, the authors suggest that heat wave-related research and policymaking should focus more on climate change adaptation. Domeisen et al. (2022) document the capabilities for heat wave prediction at daily to decadal timescales. The authors felt that knowledge of climate change and its impact allows heat waves to be skillfully predicted daily to weekly and helps to focus on the increased occurrence of humid heat waves, especially in southern Asia. Klingelhofer et al. (2023) provide a detailed insight into the publications and project funders related to heat wave research. The findings of the study indicate that the number of publications on heat waves increased with a lag in funding. The USA, Australia, China, and some European countries have been identified as significant players in heat wave research. Further, the study suggests that internationally networked efforts are necessary for an efficient monitoring or early detection system against heat waves. Laino and Iglesias (2023) have made a comprehensive review that comprises the key findings of a systematic scientific literature analysis on climate change's extreme impacts on coastal cities. The study includes 2321 papers in 470 journals from 1976 to 2021. The study found that geographical diversity in 97 countries and identified the research gaps, which could help find research directions.

Thirukanthan et al. (2023) assessed climate change research trends and future directions. This study is based on publications from the Web of Science Core Collection published between 1977 and 2022. The authors reviewed 2834 papers and 107,502 citations. The findings indicated that the USA was the most significant contributor, followed by China and Brazil. The researchers from the USA and Germany were among the top authors published in this field. Lindawati and Meiryani (2024) quantitatively analyze the global scientific performance of global climate change. The data used for the study was based on 259 papers indexed in the Scopus database. The authors opined that their research could be used by scholars and policymakers to explore future research and to contemplate the existing directions of climate change studies.

Objectives of The Study

1. The main objective of the study is to analyse the research literature on 'Heat Waves' published and indexed in the Web of Science database between 2004 and 2023. The other specific objectives are to:
2. study the publications and citations trends at the global level on heat waves;
3. identify the most prolific authors, productive organizations and countries in the field of Heat waves;
4. determine the most preferred journals and research areas to publishoin 'Heat Waves' Research; and list out the most supportive funding agencies in the field of 'Heat Waves' research.

Materials and Methods

The publication records of the published research papers on 'Heat Waves' during the period 2004 - 2023 were extracted from the Web of Science database. A total of 2,715 records were found where 'Heat Wave' is part of the title or author keywords were extracted in the CSV file format. The publication records were further analyzed using Excel Spreadsheet, VoSViewer, Biblioshiny, mathematical and statistical formulae for various indicators used.

Analysis and Results

Year-wise distribution of research literature

Table 1 presents the year-wise distribution of the publications, citations received, citations per paper and h-index for the research literature on 'Heat Waves' published and indexed in the Web of Science database between 2004 and 2023. Overall, 2,715 publications were extracted and considered for the analysis, which together received 95,837 citations at the rate of 35.30 citations per paper across the period.

The highest number of research papers were published in 2023, i.e. 562 publications; however, the highest number of citations received for research papers published in 2019, i.e. 10,026 citations and the highest h-index of 50, is also recorded for the publications in 2019. The lowest number of publications (10), citations received (643) and the lowest h-index recorded for the research papers published in 2005. Though the number of publications in the year 2004 is only 17 research papers and it is noted that the same year, it has recorded the highest number of 337.00 citations per paper, followed by 2008 (110.00) and 2010 (109.15); the lowest number of citations per paper was recorded for the research papers published in the year 2023, which clearly indicates that for any research paper time is required to get its readers and research impact. Figure 1 shows the chart for year-wise publications and citations received across the study period for infographic representation.

Table 1: Year-wise distribution publications, citations on Heat Waves

PY	TP	TC	CPP	h-index
2004	17	5,729	337.00	10
2005	10	643	64.30	7
2006	20	1,166	58.30	11
2007	25	1,671	66.84	15
2008	38	4,180	110.00	20
2009	27	1,756	65.04	12
2010	53	5,785	109.15	31
2011	45	2,975	66.11	23

2012	48	4,189	87.27	25
2013	49	3,864	78.86	26
2014	97	5,137	52.96	43
2015	83	5,300	63.86	36
2016	105	6,544	62.32	42
2017	137	7,165	52.30	48
2018	173	9,216	53.27	47
2019	234	10,026	42.85	50
2020	262	7,924	30.24	48
2021	341	6,733	19.74	39
2022	389	3,876	9.96	27
2023	562	1,958	3.48	16
Total	2,715	95,837	35.30	-

PY: Publication Years; TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

Distribution of research output by document types

Overall, 2,715 research papers on 'Heat Waves' have been published in 13 different document types. The maximum number of researchers preferred to publish their research as a Journal Article, i.e. 84.70%, followed by the Review Articles (4.09%) and Meeting Abstracts (3.33%). According to the citations received, Articles have attracted the highest, i.e. 84,987 citations, followed by Review Articles (9,553), Proceeding Papers (1,607) and Book Chapters (1,525). Although only three book chapters were published during the study period, Book Chapters achieved the highest 508.33 citations per paper, followed by Review Articles (84.54) and Proceeding papers (66.96). Figure 2 presents the infographic presentations of the document types preferred by the researchers on 'Heat Waves'.

Table 2: Distribution of research output by document types

Document Types	TP	%TP	TC	%TC	CPP	H-Index
Article	2341	84.70	84,987	85.84	36.30	122
Review Article	113	4.09	9,553	9.65	84.54	44
Meeting Abstract	92	3.33	51	0.05	0.55	4
Editorial Material	83	3.00	931	0.94	11.22	13
News Item	34	1.23	111	0.11	3.26	4
Letter	27	0.98	175	0.18	6.48	6

Proceeding Paper	24	0.87	1,607	1.62	66.96	16
Early Access	21	0.76	34	0.03	1.62	3
Correction	17	0.62	9	0.01	0.53	1
Book Review	7	0.25	2	0.00	0.29	1
Book Chapters	3	0.11	1,525	1.54	508.33	3
Reprint	1	0.04	18	0.02	18.00	1
Retracted Publication	1	0.04	4	0.00	4.00	1

TP: Total Publications; %TP=Percentage among Total Publication; TC: Total Citations; %TC=Percentage among Total Citations; CPP: Citations per Paper

Highly productive countries

The authors from 115 countries have published 2,715 research papers on 'Heat Waves'; table 3 presents the list of top 10 highly productive countries. The USA (670) has published the highest number of research papers, followed by China (503) and Australia (409). The USA has received the highest, i.e. 36,564 citations, followed by Australia (21,821) and England (16,998). However, according to the citations per paper, Switzerland leads the table with 103.42 CPP, followed by England (69.66) and Canada (58.24). Similarly, according to the h-index, the USA has led the table with 83 h-index, followed by Australia (71) and England (59). Figure 3 shows a collaborative network map of countries involved in the research publications on 'Heat Waves'.

Table 3: Top 10 highly productive countries

Countries	TP	TC	CPP	H-Index
USA	670	36,564	54.57	83
China	503	13,348	26.54	55
Australia	409	21,821	53.35	71
England	244	16,998	69.66	59
Germany	213	9,900	46.48	46
Italy	199	8,713	43.78	47
Spain	189	8,762	46.36	43
France	164	6,254	38.13	38
Canada	116	6,756	58.24	36
Switzerland	105	10,859	103.42	39

TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

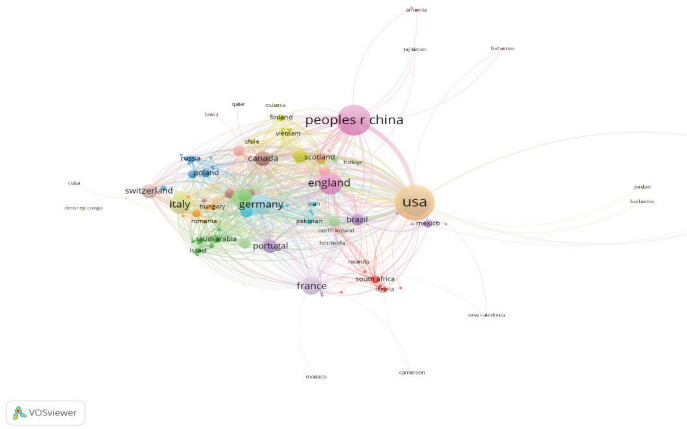


Figure 1: Co-authorship map of highly productive countries

Most productive Organizations

Authors affiliated with 2,688 organizations collaborated to publish 2,715 research papers on 'Heat Waves'. Table 4 presents the list of the top 10 organizations with maximum contributions. Chinese Academy of Sciences has contributed the highest number of 144 research papers, followed by the University of California System (99) and Centre National De La Recherche Scientifique-CNRS (94). However, the University of New South Wales Sydney has received the highest 9,768 citations, followed by the Commonwealth Scientific Industrial Research Organisation-CSIRO (7,300) and National Oceanic Atmospheric Admin-NOAA USA (5,056), and these top 3 highly cited organisations have achieved the highest citations per paper i.e. 109.75, 96.05 and 75.46 CPPs respectively. The University of New South Wales Sydney has achieved the highest (38) h-index, followed by the Commonwealth Scientific Industrial Research Organisation CSIRO (35) and the University of California System (34). The Figure 4 shows a collaborative network map of the top 10 most productive countries involved in the research publications on 'Heat Waves'.

Table 4: Top 10 Most Productive Organizations

Organizations	TP	TC	CPP	H-Index
Chinese Academy of Sciences	144	3,470	24.10	31
University of California System	99	4,073	41.14	34
Centre National De La Recherche Scientifique CNRS	94	3,903	41.52	30
University of New South Wales Sydney	89	9,768	109.75	38
Commonwealth Scientific Industrial Research Organization CSIRO	76	7,300	96.05	35
Nanjing University of Information Science Technology	75	2,625	35.00	24
National Oceanic Atmospheric Admin NOAA USA	67	5,056	75.46	29

China Meteorological Administration	58	1,351	23.29	22
Helmholtz Association	57	2,242	39.33	22
University of Chinese Academy of Sciences	57	1,008	17.68	19

TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

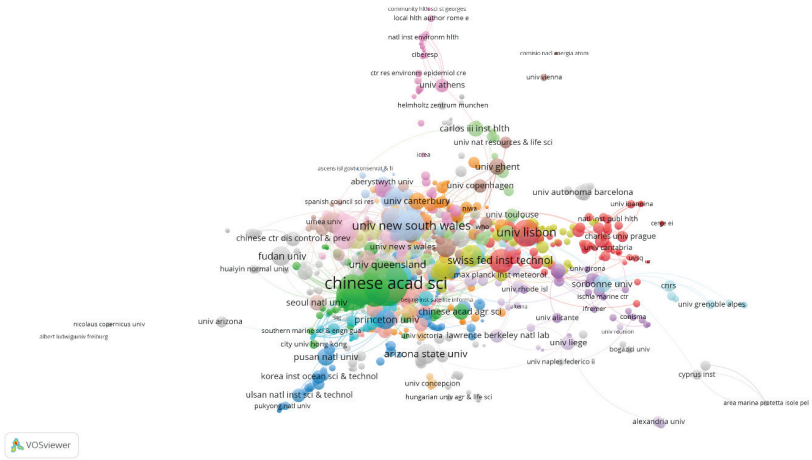


Figure 2: Co-authorship map of highly productive organisations

Most productive authors

A total of 9,011 authors have participated in the publications of 2,715 research papers on 'Heat Waves' with an average of 3.32 authors per paper. Among the 9,011 authors, 157 have published 197 single-authored research papers. The Table 5 presents the top 10 most productive authors. The Cristina Linares of Instituto de Salud Carlos III, Madrid, Spain, has contributed the highest number, i.e. (37) research papers, followed by the Peng Bi of the University of Adelaide, Adelaide, Australia (32) and the Jose Diaz of Universitat de Vic-Universitat Central de Catalunya, Vic, Spain (27). Among the top 10 productive authors, Thomas Wernberg of the University of Western Australia has received the highest (4,841) citations, followed by Eric C. J. Oliver (4,834) and Neil J. Holbrook (4711). According to the citations per paper, Neil J. Holbrook of the University of Tasmania has achieved (254.42) CPP, followed by Neil J. Holbrook (235.55) and Thomas Wernberg (210.48). Cristina Linares of Instituto de Salud Carlos III and Sarah E. Perkins-Kirkpatrick of the University of New South Wales Sydney have achieved the highest 19 h-index. Among the top 10 most productive authors, five were from Australia, two were from Spain and China, and one was from Italy. Figure 5 shows a collaborative network map of authors contributing to the 'Heat Waves' literature.

Table 5: Top 10 Most Productive Authors

Authors	Affiliation	Country	TP	TC	CPP	H-Index
Cristina Linares	Instituto de Salud Carlos III	Madrid, Spain	37	1,013	27.38	19
Peng Bi	University of Adelaide	Adelaide, Australia	32	1,742	54.44	18
Jose Diaz	Universitat de Vic - Universitat Central de Catalunya (UVic-UCC)	Vic, Spain	27	1,219	45.15	15
Sarah E. Perkins-Kirkpatrick	University of New South Wales Sydney	Sydney, Australia	23	3,751	163.09	19
Thomas Wernberg	University of Western Australia	Crawley, Australia	23	4,841	210.48	15
Neil J. Holbrook	University of Tasmania	Tasmania, Australia	20	4,711	235.55	14
Paola Michelozzi	Regional Health Service	Rome, Italy	20	1,013	50.65	7
Eric C. J. Oliver	University of Tasmania	Tasmania, Australia	19	4,834	254.42	18
Shilu Tong	Chinese Center for Disease Control & Prevention	Beijing, China	19	999	52.58	14
Ming Luo	Sun Yat Sen University	Guangzhou, China	18	686	38.11	13

TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

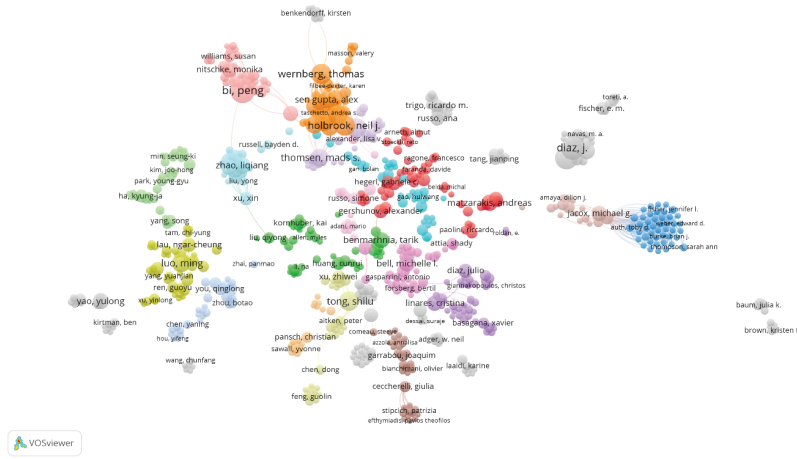


Figure 3: Co-authorship map of highly productive authors

Highly preferred Journals

Out of 659 publication sources, 656 were journals. The highest number of research papers were published in the journal, i.e. *Science of the Total Environment* (90), followed by *Environmental Research Letters* (85) and *Climate Dynamics* (80). Among

the top 10 highly preferred journals, *Environmental Research Letters* has received the highest 5,576 citations, followed by *Climate Dynamics* (3,227) and *Journal of Climate* (3,208). *Environmental Research Letters* has achieved the highest, i.e. 65.60 citations per paper, followed by *Journal of Climate* (59.41) and *Climate Dynamics* (40.34). Similarly, *Environmental Research Letters* has received the highest 36 h-index. Among the top 10 journals, two were published by Elsevier and MDPI. Nine journals were listed in the Journal Citations Reports-2022, and *Science of the Total Environment* has received the highest 9.8 impact factor, followed by the *Environmental Research* (8.3) and the *Environmental Research Letters* (6.7). Figure 8 presents a Co-citation Network map of the journals published research papers on 'Heat Waves'.

Table 6: Top 10 highly preferred journals

Journal Titles	Publisher	IF(2022)	TP	TC	CPP	H-Index
Science of the Total Environment	Elsevier	9.8	90	2,521	28.01	28
Environmental Research Letters	IOP Publishing Ltd	6.7	85	5,576	65.60	36
Climate Dynamics	Springer	4.6	80	3,227	40.34	30
Geophysical Research Letters	Amer Geophysical Union	5.2	79	3,085	38.56	29
Frontiers in Marine Science	Frontiers Media SA	3.7	77	1,554	20.18	21
International Journal of Climatology	Wiley	3.9	69	1,925	27.90	24
International Journal of Environmental Research and Public Health	MDPI	N.A.	63	1,604	25.46	22
Atmosphere	MDPI	2.9	61	905	14.84	20
Journal of Climate	Amer Meteorological Soc	4.9	54	3,208	59.41	28
Environmental Research	Elsevier	8.3	51	2,006	39.33	25

IF(2022): Impact Factor 2022; TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

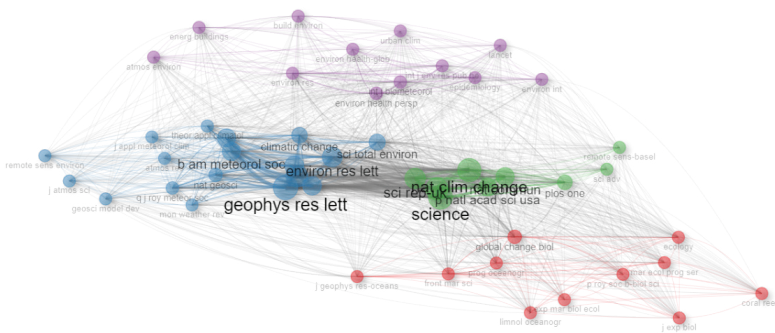


Figure 4: Overlay visualizations map of publication sources

Distribution of research output by the research areas

Each research paper on the 'Heat Waves' under study is indexed across one or more Research Areas by the WoS editorial committee. These 2,715 research papers were indexed across 101 different research areas. The highest number of 1,129 research papers were indexed under the 'Environmental Sciences Ecology' research area, followed by Meteorology Atmospheric Sciences (791) and Public Environmental Occupational Health (319). Similarly, these three research areas have received the highest number of citations and top three h-index. Among the top 10 research areas, 'Science Technology-Other Topics' has recorded a maximum of 76.08 citations per paper, followed by Public Environmental Occupational Health (41.24) and Meteorology Atmospheric Sciences (37.22).

Table 7: Distribution of Research Output by Research Areas

Research Areas	TP	TC	CPP	H-Index
Environmental Sciences Ecology	1129	38,024	33.68	91
Meteorology Atmospheric Sciences	791	29,440	37.22	78
Public Environmental Occupational Health	319	13,155	41.24	53
Geology	242	8,971	37.07	46
Science Technology Other Topics	238	18,106	76.08	55
Marine Freshwater Biology	203	3,454	17.01	30
Engineering	134	2,722	20.31	31
Construction Building Technology	88	2,494	28.34	29
Oceanography	82	2,896	35.32	21
Water Resources	80	1,358	16.98	21

TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

Distribution of research output by funding agency

Out of 2,715 research papers on the 'Heat Waves' considered for the study, 1,912 research papers received funding from one or more funding agencies. Out of 881 funding agencies, the top 10 funding agencies, as per the number of publications, were listed in Table 8. The National Natural Science Foundation of China (NSFC) have funded the highest (310) research papers, followed by the National Science Foundation-NSF (171) and the Australian Research Council (146). Among the top 10, research papers funded by the Australian Research Council have attracted the highest, i.e. 10,978 citations, followed by UK Research Innovation-UKRI (10,664) and National Science Foundation-NSF (10,416). Natural Environment Research Council-NERC led the ranking according to the citations per paper with 126.94 CPP, followed by UK Research Innovation-UKRI (100.60) and Australian Research Council (75.19). Australian Research Council funded research papers have achieved the highest 48 h-index.

Table 8: Distribution of Research Output by Funding Agency

Funding Agency	TP	TC	CPP	H-Index
National Natural Science Foundation of China NSFC	310	8,087	26.09	46
National Science Foundation NSF	171	10,416	60.91	46
Australian Research Council	146	10,978	75.19	48
European Union EU	127	9,417	74.15	45
UK Research Innovation UKRI	106	10,664	100.60	42
Fundacao Para A Ciencia E A Tecnologia FCT	64	1,802	28.16	25
Natural Environment Research Council NERC	63	7,997	126.94	31
Spanish Government	61	2,556	41.90	26
United States Department of Energy DOE	57	3,817	66.96	32
Natural Sciences and Engineering Research Council of Canada NSERC	50	2,339	46.78	26

TP: Total Publications; TC: Total Citations; CPP: Citations per Paper

Conclusion

The present study analysed 2,715 research papers on 'Heat Waves' as indexed in the WoS databases from 2004 to 2023. The study found vicissitudes growth in the number of publications across the study period; however, a continues growth is observed since 2016. More than 84% of the research papers were published in the journals as 'Articles', however recorded three book chapters have recorded highest citations per paper across all the document types. The USA was highly productive country across 115 countries and the Chinese Academy of Sciences was adjudged as the highly productive organization among the 2,688 organisations involved in the research publications. Among the 9,011 authors participated in the research publications under study, Cristina Linares of Instituto de Salud Carlos III, Madrid, Spain found to be the most productive organization. Among the 656 journals, *Science of the Total Environment* has published highest number of articles. The National Natural Science Foundation of China has funded highest number of research papers published on 'Heat Waves'.

Heat Waves are becoming more common and more intense all around the world. According to a recent study by Luo et al. (2024), an average of 98 heat waves per year between 2016 and 2020 lasted an average of 12 days. The study also found a substantial change in contiguous heatwaves have been identified from 1979 to 2020, with longer persistence, longer travelling distance, and slower propagation. Thus, the current study helps researchers and scientist to identify the major research evidences and trends among the research literature published on 'Heat Waves'. The findings may also useful to the climate research community, health care research community, ecologists, environmental consultants and policy makers for evidence-based planning for reduction of intense heat-waves in coming days.

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RETRACTION IN NEUROSCIENCE RESEARCH PAPERS OF G20 COUNTRIES IN SCOPUS DATABASE

Hima K[1] & Dr. R. Jeyshankar[2]

Introduction

Research can be defined as the formation of new knowledge. It also encompasses the use of existing knowledge in an innovative and creative method to give rise to new concepts, understandings, methodologies, and techniques. The quality and quantity of the research in a country is a significant indication of its economic growth. It is worth mentioning that bibliometric and Scientometric tools are increasingly utilized to assess the research output of scientists and the evolution of scientific fields.

In academic and scientific publishing, retraction refers to the mechanism by which a published paper in scientific journals is flagged due to its faulty features that

reach to the extreme of being unreliable in its results and conclusions. It refers to the removal of published articles consisting of significant mistakes or flaws. It is a form of correction in scholarly literature and enlightens the readers about consuming articles with mistakes. This is the procedure adopted by the scholarly world to ensure the integrity of the scientific record that is being put out for the world to consume.

Scientometrics is the quantitative study of science. It aims to analyze and evaluate science, technology, and innovation. Major research includes measuring the impact of authors, publications, journals, institutes, and countries as referenced to sets of scientific publications such as articles and patents. It also aims to understand the behaviour of scientific citations as a means of scholarly communication and map intellectual landscapes of a science. (Kim and Zhu, 2018)

Neuroscience is an interdisciplinary science that works closely with other disciplines, such as mathematics, linguistics, engineering, computer science, chemistry, philosophy, psychology, and medicine. Neuroscientists study the cellular, functional, behavioural, evolutionary, computational, molecular, cellular, and medical aspects of the nervous system. Some neuroscientists are involved in treating patients.

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Review of Literature

Retraction of publications is an issue that has been given attention by many researchers in many fields of study in an attempt to have a more in-depth and informed understanding of the phenomenon. Some of the many prominent contributions in this literature are mentioned further.

Chen, Hu, Milbank, and Schultz (2013) found that it takes about 2 years, on average, to retract an article and another 2 years to see a substantial decrease of citations to the retracted article. They have shown that the rate of retraction is increasing based on the numbers of retraction notices and the total number of publications found in PubMed.

Wang, et al. (2018) In the article, "Retracted Publications in the Biomedical Literature from Open Access Journals" published in Science and Engineering Ethics, point out that the number and rate of retractions have increased since 2010 as well as identified the common reasons for retraction as errors (148), plagiarism (142), duplicate publication (101), fraud/suspected fraud (98) and invalid peer review (93). They also point out that the number of retracted articles from OAJs has been steadily increasing. It was found that misconduct was the primary reason for retraction. The majority of retracted articles were from journals with low impact factors and authored by researchers from China, India, Iran, and the USA.

Elango, Kozak, and Rajendran (2019) conducted a thorough investigation into 239 retractions (195 from journals and 44 from conference proceedings) published between 2005 and 3 August 2018. It was discovered that the earliest retraction notices for an article indexed in SCOPUS and authored or coauthored by an Indian author was published back in 1996. the fewest publications (only one) were retracted in 2005 while the most (45) in 2010. On the one hand, an increasing trend, with 80 retractions issued in 2005–2010 and 159 retractions in 2011–2018 is observed.

In the article titled "Retractions in the Middle East from 1999 to 2018: a bibliometric analysis" by Liu, and Lei, (2021) published in Scientometrics, a total of 563 retractions in the Middle East were identified in the examined span of time. Results showed that both the numbers of publications and retractions in the Middle East increased significantly in the past two decades.

Gholampour, et al. (2022) remarks in their analysis of retracted articles in the field of oncology, that the number of retracted articles in oncology has increased since 1995. Moreover, the results reveal that China, the United States (US), Japan, Iran, and Italy are the countries in which the number of such articles compared to all other countries is the largest.

On the authority of the article "A systematic review of retractions in biomedical research publications: reasons for retractions and their citations in Indian affiliations", where retrieved retracted publications with Indian affiliations indexed in MEDLINE between 1 January 1990 to 31 December 2021 were taken for the review. During this

period a total of 619 papers were considered from 372 different journals. While retractions still account for a small fraction of all publications (0.1%), the overall rate of retractions has been increasing (Sharma, et al., 2023).

As indicated by the analytical study executed on the retracted publications of BRICS countries, the scientific publication of the countries has increased in recent years, which has given way to an increase in retraction. However, much money is being invested in research and development work resulting in more publications by BRICS than any other developing country. Out of 11,764 retracted publications, 72.67% of papers are written by two–five authors, in that 230 retracted articles are published by top 20 authors, it sums up to 1.99% (Siva and Rajendran, 2023).

Rubbo, et al., (2023) in their analysis of retracted papers from Chinese university-affiliated hospitals in the light of spreading misinformation in hospitals, expresses “We found a rapid increase in the number of retracted papers, while the retraction time interval is decreasing.

Methodology

The present study focuses on Neuroscience research publications among G20 countries between the years 2001 and 2024. The data for this study was collected from the Scopus database, which is a bibliographic database containing abstracts and citations for academic journal articles. A search strategy was employed to retrieve data related to Neuroscience research publications among G20 countries during the specified time period. A total of 18,901 retracted/ erratum records were identified and 504 documents among them was filtered pertaining to the Neuroscience field was selected and analyzed in this study. The search strategy was limited to "retract" OR "retracted" OR "retraction”, subject area (Neuroscience), document type, “Erratum”, “Retracted”, affiliation country (G20 countries), period (2001-2024).

Analysis and Interpretation

This chapter deals with the analysis and interpretations of the data analyzed with the help of Biblioshiny. The data collected is in the forms of tables and graphs for analysis and the necessary interpretations.

Table 1. Main information about data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2001:2024
Sources (Journals, Books, etc)	110
Documents	504
Annual Growth Rate %	16.72
Document Average Age	6
Average Citations Per Doc	0.7798
References	1306

DOCUMENT CONTENTS	
Keywords Plus (ID)	1238
Author's Keywords (DE)	399
AUTHORS	
Authors	1879
Authors of Single-Authored Docs	32
AUTHORS COLLABORATION	
Single-Authored Docs	32
Co-Authors Per Doc	5.38
International co-authorships %	15.67
DOCUMENT TYPES	
Erratum	380
Retracted	124

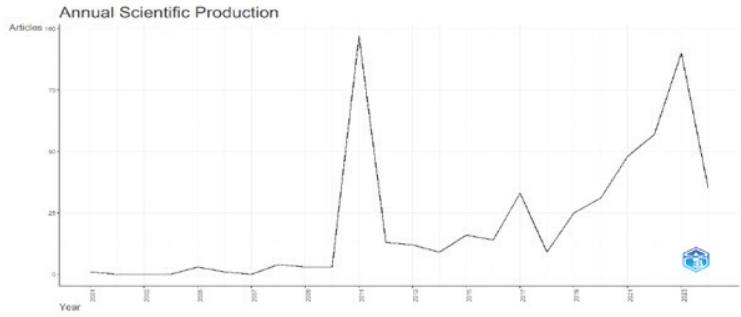


Figure 1 Annual Scientific Production

The data in figure 1 depicts the annual scientific production of retracted articles from 2001. Upon observing, it can be noticed that there was no significant production from the period 2001 to 2010, then the production suddenly peaked to the all-time highest value of 97 in 2011 but faced a downward productivity with a slight increase in 2017 and eventually a gradual growth can be observed throughout the years of 2018 till 2023 where the productivity reached 90. There were periods when the production was at the lowest as 0 in the years 2002, 2003, 2004, and 2007.

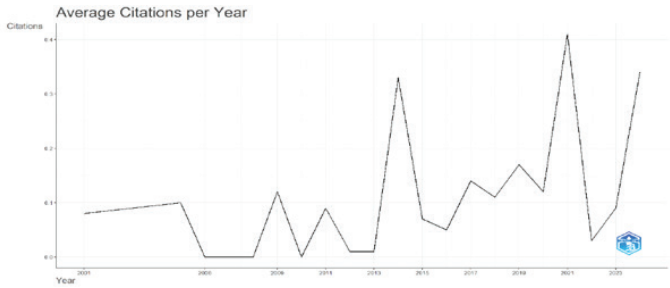


Figure 2 Annual Citation per Year

The figure 2 shows the annual citation of retracted papers per year from the period 2001 to 2023. The study's findings suggest that there were no citations in the years 2006 and 2007. Further, the mean number of citations per article and the mean number of citations per year both was significantly and comparatively the highest in 2021. Hence, it is to be deduced that the publications of the year have an impressionable and long-lasting influence on the field.

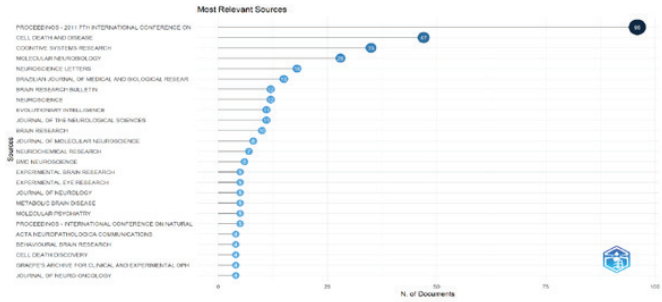


Figure 3. Relevant Sources of Retracted Papers

Figure 2.3 shows that "PROCEEDINGS- 2011 7TH INTERNATIONAL CONFERENCE ON NATURAL COMPUTATION ICNC" demonstrated the highest number of retractions with 96 papers followed by "CELL DEATH and DISEASE" (47 articles), "COGNITIVE SYSTEM RESEARCH" (35 articles), "MOLECULAR NEUROBIOLOGY" (28 articles), "NEUROSCIENCE LETTERS" (18 articles), "BRAZILIAN JOURNAL of MEDICAL and BIOLOGICAL RESEARCH" (15 articles), and "BRAIN RESEARCH BULLETIN" (12 articles).

Table 2. Core Sources Retracted papers by Bradford's Law'

SO	Rank	Freq	Freq	Zone
Proceedings - 2011 7th International Conference on Natural Computation, ICNC 2011	1	96	96	Zone 1
Cell Death and Disease	2	47	143	Zone 1
Cognitive Systems Research	3	35	178	Zone 1
Molecular Neurobiology	4	28	206	Zone 2
Neuroscience Letters	5	18	224	Zone 2
Brazilian Journal of Medical and Biological Research	6	15	239	Zone 2
Brain Research Bulletin	7	12	251	Zone 2
Neuroscience	8	12	263	Zone 2
Evolutionary Intelligence	9	11	274	Zone 2
Journal of the Neurological Sciences	10	11	285	Zone 2
Brain Research	11	10	295	Zone 2
Journal of Molecular Neuroscience	12	8	303	Zone 2
Neurochemical Research	13	7	310	Zone 2
BMC Neuroscience	14	6	316	Zone 2
Experimental Brain Research	15	5	321	Zone 2

Experimental Eye Research	16	5	326	Zone 2
Journal of Neurology	17	5	331	Zone 2
Metabolic Brain Disease	18	5	336	Zone 2
Molecular Psychiatry	19	5	341	Zone 2
Proceedings - International Conference on Natural Computation	20	5	346	Zone 3
Acta Neuropathologica Communications	21	4	350	Zone 3
Behavioural Brain Research	22	4	354	Zone 3
Cell Death Discovery	23	4	358	Zone 3
Graefe's Archive for Clinical and Experimental Ophthalmology	24	4	362	Zone 3
Journal of Neuro-Oncology	25	4	366	Zone 3

The table 2 describes that the most cited publication "(Proceedings- 2011 7th International Conference On Natural Computation, ICNC)" is listed first and the least frequently cited publication is placed last, where the publications are arranged in the decreasing frequency of how many times each journal was cited. The top 25 journals of 110 journals are shown in the table above. It can be noted that the journals are categorized into different Zones (Zone 1, Zone 2, and Zone 3). The Zones indicate the extent of influence possessed by the journals on the field of study with the influence decreasing as Zone number increases i.e., Zone 3 is comprised of comparatively less influential journals than Zone 2.

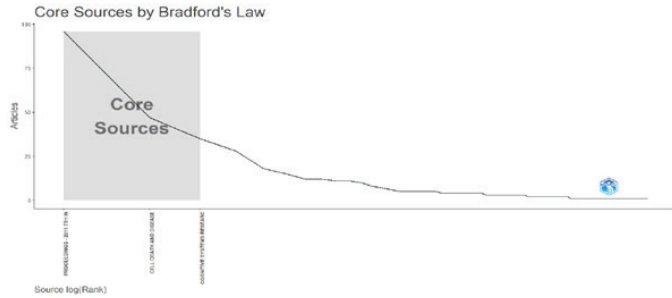


Figure 4 Core Sources Retracted papers by Bradford's Law

Figure 4 exhibits the journals of Zone 1 which have the highest impact factor followed by Zone 2 with lower impact factor and Zone 3 with the lowest impact factor. The "PROCEEDINGS- 2011 7TH INTERNATIONAL CONFERENCE ON NATURAL COMPUTATION, ICNC" is ranked first with a frequency of 96, succeeded by "CELL DEATH and DISEASE" with frequency of 47 and "COGNITIVE SYSTEMS RESEARCH" with frequency of 35 and these three are the only ones that belong to Zone 1.

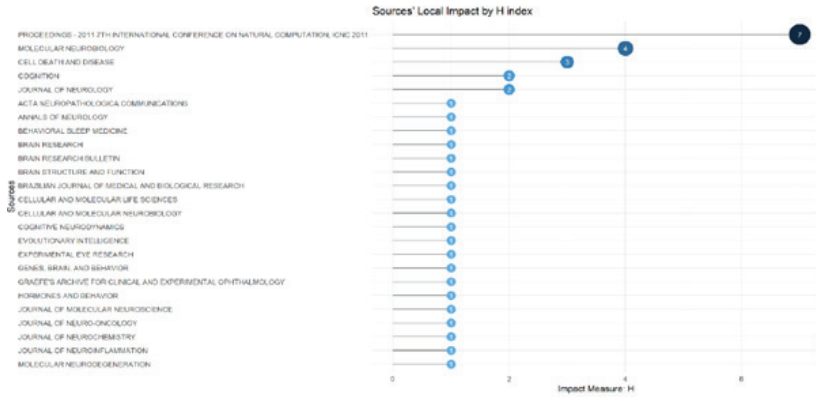


Figure 5. Local Impact by H-index

From figure 2.5, the local Impact by H-index can be observed. According to the depicted data, "Proceedings- 2011 7th International Conference on Natural Computation, ICNC" is evidently the most frequently cited journal with a total of 127 citations and an h-index of 7 along with the highest g- index of 8, not to mention the highest m-index score of 0.5 which is the same score by the journals "Cell Death and Disease", "Behavioral Sleep Medicine", "Evolutionary Intelligence" and "Nature Human Behavior

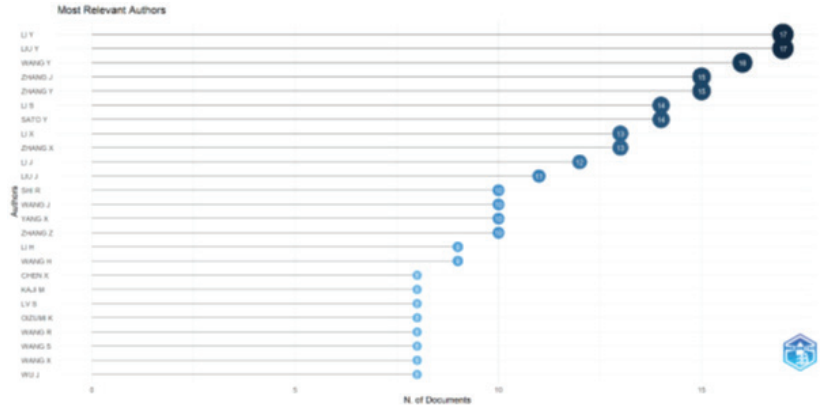


Figure 6. Authors with the most retracted papers

Figure 2.6 shows that Li Y and Liu Y (both 17 articles) have the most retractions and therefore are the most relevant authors. 16 articles of Wang Y have been withdrawn. Both Zhang J and Zhang Y have 15 articles withdrawn. 14 for Li S and Sato Y and 13 for both Li X and Zhang X.

Table 3. Author Productivity through Lotka's Law

Documents written	N. of Authors	Proportion of Authors
1	1508	0.803
2	232	0.123
3	61	0.032
4	23	0.012
5	9	0.005
6	7	0.004
7	12	0.006
8	10	0.005
9	2	0.001
10	4	0.002
11	1	0.001
12	1	0.001
13	2	0.001
14	2	0.001
15	2	0.001
16	1	0.001
17	2	0.001

As demonstrated in table 2.3, a large proportion of authors (80.3%) have authored a single document, while a minority of authors have produced multiple documents, ranging from two (12.3%) to sixteen (0.1%). Particularly, it is to be noted that a negligible proportion of authors produced nine to sixteen documents (0.1%). The deductions extracted are consistent with Lotka's law.

Table 4. Retracted Authors Local Impact

Element	h_index	g_index	m_index	TC	NP	PY_start
LI Y	3	4	0.214	23	17	2011
LIU Y	3	3	0.214	17	17	2011
DAI C	2	2	0.25	5	3	2017
JIA L	2	2	0.333	5	4	2019
JIANG J	2	2	0.143	7	2	2011
LI S	2	3	0.143	16	14	2011
LI W	2	3	0.143	15	6	2011
LI X	2	2	0.143	9	13	2011
LIU B	2	2	0.143	6	4	2011
LIU S	2	2	0.143	5	5	2011
LV S	2	3	0.222	13	8	2016
MA X	2	3	0.25	14	7	2017
SHI R	2	3	0.222	16	10	2016
SONG H	2	2	0.143	8	4	2011

SUN B	2	2	0.25	5	3	2017
SUN J	2	2	0.143	5	2	2011
WANG C	2	3	0.143	9	7	2011
WANG G	2	2	0.125	8	5	2009
WANG R	2	2	0.2	8	8	2015
WANG S	2	2	0.5	6	8	2021
WU J	2	4	0.143	16	8	2011
XU X	2	2	0.143	5	3	2011
ZHANG C	2	3	0.143	11	7	2011
ZHANG L	2	3	0.143	10	5	2011
ZHAO R	2	2	0.2	5	2	2015

Per the data presented in Table 4, it can be observed that LI Y and LIU Y have the highest h-index of 3, an indication of the significant impact their research asserts on the field. LI Y's total citation count (TC) of 23 and their highest number of papers (NP) at 17 suggest a profuse output and meaningful influence in the field. Additionally, LI Y's highest g-index score of 4 also put forward evidence of a significant level of success in the publishing of works that are widely cited by researchers within the field.



Figure 7. Affiliations with the most retracted articles published

As deduced from the figure 2.7, SOUTHERN MEDICAL UNIVERSITY has published the highest number of articles with a count of 46. They are followed by CENTRAL SOUTH UNIVERSITY with 38 articles, DALIAN MEDICAL UNIVERSITY and SECOND MILITARY MEDICAL UNIVERSITY both having published 35 articles each. Closely following them with 34 articles is SHANGHAI JIAO TONG UNIVERSITY SCHOOL of MEDICINE. SHANDONG UNIVERSITY SCHOOL of MEDICINE (31 articles).

Table 5. Contributions of Authors Corresponding to their Countries

Country	Articles	SCP	MCP	Freq	MCP_Ratio
	206	176	30	0.409	0.146
CHINA	188	172	16	0.373	0.085

USA	37	30	7	0.073	0.189
INDIA	19	16	3	0.038	0.158
ITALY	6	3	3	0.012	0.5
JAPAN	6	6	0	0.012	0
KOREA	6	6	0	0.012	0
CANADA	4	1	3	0.008	0.75
GERMANY	3	1	2	0.006	0.667
PAKISTAN	3	1	2	0.006	0.667
SPAIN	3	3	0	0.006	0
SWEDEN	3	2	1	0.006	0.333
AUSTRALIA	2	1	1	0.004	0.5
IRAN	2	0	2	0.004	1
TURKEY	2	2	0	0.004	0
AUSTRIA	1	0	1	0.002	1
BANGLADESH	1	0	1	0.002	1
BELGIUM	1	0	1	0.002	1
BOLIVIA	1	0	1	0.002	1
BRAZIL	1	1	0	0.002	0
CYPRUS	1	0	1	0.002	1
EGYPT	1	0	1	0.002	1
FINLAND	1	1	0	0.002	0
FRANCE	1	1	0	0.002	0
GEORGIA	1	1	0	0.002	0

As observed in table 5, the country leading with the highest Multiple Country Publication (MCP) and Single Country Publication (SCP) is CHINA (MCP-16, SCP-172) followed by the USA (MCP- 7, SCP- 30), and INDIA (MCP-3, SCP-16).

Table 6. Scientific Production of Countries

Region	Freq
China	1608
USA	330
Japan	118
Canada	86
India	81
Germany	55
South Korea	53
Italy	51
UK	29
Austria	23
Sweden	22

France	20
Pakistan	17
Spain	16
Australia	15
Denmark	15
Netherlands	15
Belgium	14
Greece	14
Turkey	14
Egypt	11
Iran	10
Finland	8
Switzerland	8
Romania	7

The data in table 6 expresses that CHINA has the highest contribution of scientific production of a frequency of 1608 and is followed by the countries USA (330), JAPAN (86), CANADA (81), GERMANY (55), SOUTH KOREA (53), ITALY (51), UK (29), AUSTRIA (23), and SWEDEN (22). This data representation declares that CHINA, on a large difference is a recognizable and pivotal influence relative to the global productivity and research output in the subject field.

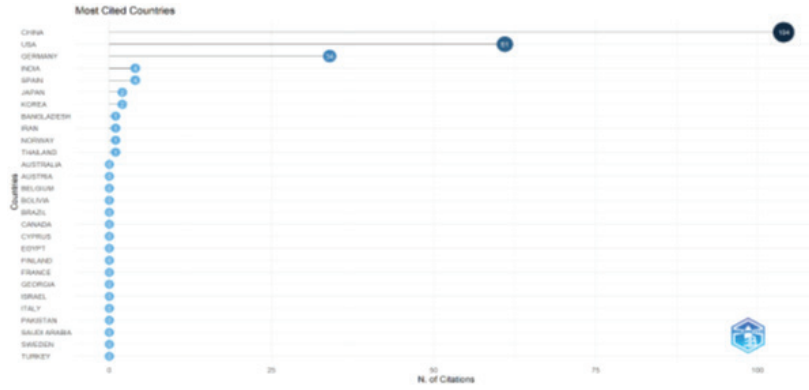


Figure 2.8. Most Cited Countries

The most cited countries can be identified from figure 2.8 which shows all 28 countries and their TC (Total Citations). CHINA leads with TC of 104, followed by USA with TC of 61, then comes GERMANY with TC of 34, followed by INDIA and SPAIN both with TC of 4, then comes JAPAN and KOREA both with TC 2. BANGLADESH, IRAN, NORWAY, and THAILAND all have TC 1. The rest of the countries have TC value 0.



Figure 9. Collaborative network

Figure 9 Presents the measure of closeness centrality for the nodes in the network of the countries and their collaborative activities. The data reveals that node "USA" has the highest closeness value of 0.01754386 which is an indication that this node has the shortest average distance to all other nodes in the network.

Conclusion

The results of this study, which was based on the SCOPUS database, show some absorbing patterns and trends in the distribution of retracted scientific papers. The study focused on factors like sources of retractions, citation patterns and journal impact and was initiated to inspect trends in the retraction of research papers in the field of Neuroscience among G20 countries.

The study's initial finding is that the retracted papers have significantly risen to higher numbers in recent years than other years. This pattern, which shows a growing concern for the integrity of research in G20 countries, is particularly noticeable in the previous ten years. The causes of this elevation in retraction rate are to be investigated and ascertained, even though it is feasible the reasons be the results of evolving publishing and research norms, reinforced vigilance of research misconduct etc.

The second key result of the study is that "Proceedings - 2011 7th International Conference on Natural Computation, ICNC 2011" has the most retractions, an indication that the publishing has put strict controls in place to guarantee the validity of research and preserve the calibre of its content.

The "Proceedings - 2011 7th International Conference on Natural Computation, ICNC 2011" has the highest G-index, which reflects the journal's influence in the field. This highlights how consequential a journal's influence and reputation is to be taken into consideration when publishing research because it can have an astronomical impact on the reach and significance of the work.

Less than 1% of authors have produced 10 or more documents. A large majority of 80% of the author population have only produced one document, this in accordance to Lotka's Law. This analysis uncovered intriguing trends in citation behaviour, with Li Y receiving the most Total Citation and is the most productive and influential author. This emphasises how important it is to select authors and collaborators meticulously to maintain calibre and reliability of research papers.

The next noteworthy finding of the study is that most of the most productive and contributing institutions are the medical and medicine schools and universities of China and only 11 of all G20 countries have been cited among which China dominates the list with 104 Total Citations. This shows that China has an increased production of retracted papers in the field of Neuroscience among the G20 countries.

Another conclusion to be derived from the study is that China and USA are the most impactful and influential geographical areas with high productivity, high closeness values and betweenness values, and also the number of collaboration and cooperation is also considerably predominant with China having cooperated 38 times with 14 different countries while the USA has 36 cooperation instances with 16 countries.

All in all, this analysis provides insightful information regarding the trends, practices and patterns of research publications by G20 countries in Neuroscience that have been retracted, making a point of the exigency requiring additional scrutinization and action to secure the integrity and calibre of research publications.

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ANALYSIS OF THE LITERATURE IN THE FIELD OF PULMONARY TUBERCULOSIS

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Introduction

This paper presents a bibliometric analysis of the literature on Pulmonary Tuberculosis in MEDLINE data, specifically in PubMed. The study focuses on the period from 2012 to 2021. Various bibliometric techniques, such as Relative Growth Rate (RGR), Doubling time (Dt), and Bradford's law of scattering, have been employed to determine the growth rate and identify the core journals in the field of Pulmonary Tuberculosis.

Review of Literature

Previous studies have examined the growth rates in different scientific areas across various fields.Maheswarappa and Ningoji (1992)1 studied the growth of literature in the field of Science and Technology in India.Karki, Garg and Sharma (2000)2 examined the activity and growth of Organic Chemistry Research in India and Rajendran, Ramesh Babu and Gopalakrishnan (2005)3 scrutinized the bibliometric Analysis of "Fiber Optics" literature. Additionally, several authors have conducted studies to identify core journals using Bradford's Law of scattering.RavichandraRao(1998)4has analyzed the Bradford multipliers and a model to explain law of scattering,Burnham (1997)5studied the mapping the literature of respiratory therapy, Slater (1997)6mapped the literature of speech-language pathology, Burnham(1997)7studied the mapping the literature of radiologic technology and Delwiche(2003)8also studied the mapping the literature of clinical laboratory science.

Pulmonary Tuberculosis

Pulmonary Tuberculosis occurs when M. tuberculosis primarily affects the lungs, but it can also spread to other organs. Early diagnosis and antibiotic treatment can effectively cure Pulmonary Tuberculosis. During the 18th and 19th centuries, Pulmonary Tuberculosis, also known as consumption, spread extensively as an epidemic in North America and Europe.9

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Objectives of The Study

The objectives of this study are as follows:

- To analyze the number of literature publications in the field of Pulmonary Tuberculosis.
- To identify the types of publications in the field of Pulmonary Tuberculosis.
- To determine the languages of publication covered by the literature on Pulmonary Tuberculosis.
- To observe the growth of literature in the field of Pulmonary Tuberculosis.
- To identify the core journals in the field of Pulmonary Tuberculosis.

Methodology

The collection of records pertaining to Pulmonary Tuberculosis in the years 2012 to 2021 from the MEDLINE data, which is included in PubMed10, was conducted. These records were then converted into FoxPro and imported into SPSS for analysis purposes. The keyword 'Pulmonary Tuberculosis' was used to gather the available number of records. Bibliometric techniques were employed to analyze the records obtained from the Pulmonary Tuberculosis database. The analysis focused on the growth rate and core journals in the field of Pulmonary Tuberculosis. To assess the growth rate, the bibliometric techniques of Relative Growth Rate (RGR)11 and Doubling time (Dt)12 were utilized. Additionally, Bradford Law13 was used to identify the core journals in the field of Pulmonary Tuberculosis.

The Numberof Pulmonary Tuberculosis Research Productivity

The data presented in Table-1 showcases the research productivity in the field of Pulmonary Tuberculosis. A total of 21,173 records were identified during the study period. Notably, the highest number of records, 2,537, was published in the year 2020, followed by 2,423 records in 2016 and 2,362 records in 2020. However, it is important to note that the distribution of records appears to be inconsistent, as indicated by the analysis (Fig.1).

It also provides a breakdown of the number of literature published in the field of Pulmonary Tuberculosis, categorized by year. The cumulative percentage of records is also included for reference. For instance, in 2012, there were 1,731 records, accounting for 8.2% of the total. This cumulative percentage increases with each subsequent year, reaching 88.8% in 2020. Finally, in 2021, there were 2,362 records, representing 100% of the cumulative total.

Figure-1 visually represents the number of literature published in the field of Pulmonary Tuberculosis, further highlighting the variations in research productivity across different years.

Table-1: Number of Literature published in the field of Pulmonary Tuberculosis

S.No.	Year	No. of Records	%	Cumulative %
1	2012	1731	8.2	8.2
2	2013	1926	9.1	17.3
3	2014	1931	9.1	26.4
4	2015	2157	10.2	36.6
5	2016	2423	11.4	48
6	2017	2010	9.5	57.5
7	2018	1983	9.4	66.9
8	2019	2113	10	76.9
9	2020	2537	12	88.8
10	2021	2362	11.2	100
	Total	21173	100	

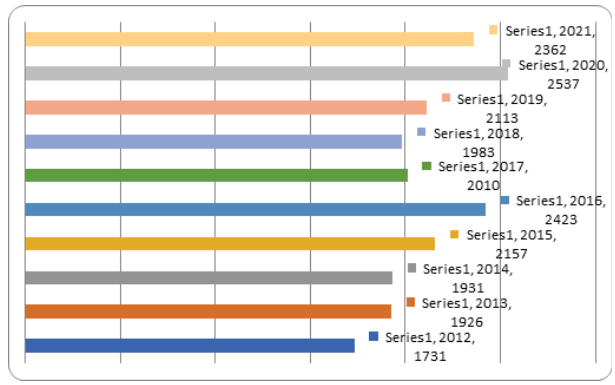


Figure-1:Number of Literature published in the field of Pulmonary Tuberculosis

Publication Types Distribution of Pulmonary Tuberculosis Research

Moving on to Table-2, it presents the distribution of Pulmonary Tuberculosis research output based on various publication types in MEDLINE. The data reveals that Journal Articles accounted for the highest number of records, with 10,232 publications, making up 48.3257% of the total. Other publication types include Research Support, Non-U.S. - Gov't (5,175 records), Review (1,717 records), Case Reports (883 records), Letter (714 records), and several others, each with their respective percentages.

In conclusion, the research productivity in the field of Pulmonary Tuberculosis is reflected in the number of literature published, with variations observed across different years and publication types.

Table-2: Publication Type in the field of Pulmonary Tuberculosis

Publication Type	Total	%
Journal Article	10232	48.3257
Research Support, Non-U.S. - Gov't	5175	24.44151
Review	1717	8.109385
Case Reports	883	4.170406
Letter	714	3.372219
Research Support, N.I.H.,Ex-tramural	411	1.941151
Systematic Review	385	1.818354
Research Support, U.S. Gov't, Non-P.H.S.	272	1.284655
Observational Study	265	1.251594
Editorial	227	1.07212
Multicenter Study	195	0.920984
Research Support, U.S. Gov't, P.H.S.	142	0.670665
Randomized Controlled Trial	135	0.637604
Validation Study	79	0.373117
Research Support, N.I.H., In-tramural	57	0.269211
Meta-Analysis	50	0.23615
Published Erratum	42	0.198366
News	33	0.155859
Portrait	27	0.127521
Practice Guideline	27	0.127521
Video-Audio Media	20	0.09446
Introductory Journal Article	17	0.080291
Book	14	0.066122
Congress	9	0.042507
Personal Narrative	9	0.042507
Historical Article	5	0.023615
Lecture	5	0.023615
Preprint	5	0.023615
Retracted Publication	5	0.023615
Retraction of Publication	3	0.014169
Book Chapter	2	0.009446
English Abstract	2	0.009446
Patient Education Handout	2	0.009446
Classical Article	1	0.004723
Clinical Trial	1	0.004723
Guideline	1	0.004723
Legal Case	1	0.004723

Randomized Controlled Trial, Veterinary	1	0.004723
Twin Study	1	0.004723
Webcast	1	0.004723
Total	21173	100

Distribution of Languages in the literature of Pulmonary Tuberculosis

Table-3 shows the distribution of citations according to language during the study period i.e. from the year 2012 to 2021. As the table shows that out of a total of21173records, 19649 of them were in English language forming 92.80215% of the total followed by Spanish (269 records), French(263 records), Chinese(261 records), Japanese(171 records), Russian(159 records), Portuguese(144 records), German(91 records), Polish(37 records), Turkish(34 records), Ukrainian(23 records), Italian(16 records), Rumanian(13 records), Dutch(8 records), Czech(7 records), Danish(5 records), Hebrew(5 records), Hungarian(5 records), Korean(4 records), Norwegian(4 records), Croatian(3 records), Serbian(1 record) and Swedish(1 record). (Fig.2)

Table-3: Distribution of Languages in the literature of Pulmonary Tuberculosis

S.No.	Language	No. of records	%
1.	English	19649	92.80215
2.	Spanish	269	1.270486
3.	French	263	1.242148
4.	Chinese	261	1.232702
5.	Japanese	171	0.807632
6.	Russian	159	0.750956
7.	Portuguese	144	0.680111
8.	German	91	0.429793
9.	Polish	37	0.174751
10.	Turkish	34	0.160582
11.	Ukrainian	23	0.108629
12.	Italian	16	0.075568
13.	Rumanian	13	0.061399
14.	Dutch	8	0.037784
15.	Czech	7	0.033061
16.	Danish	5	0.023615
17.	Hebrew	5	0.023615
18.	Hungarian	5	0.023615
19.	Korean	4	0.018892
20.	Norwegian	4	0.018892

21.	Croatian	3	0.014169
22.	Serbian	1	0.004723
23.	Swedish	1	0.004723
Total	21173	100	

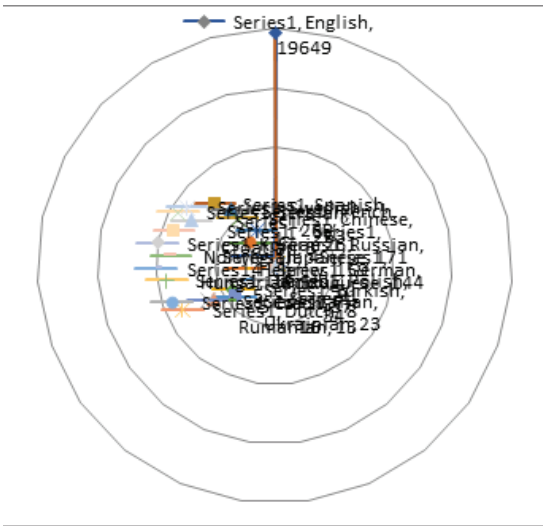


Figure-2: Distribution of Languages in the literature of Pulmonary Tuberculosis

Relative Growth Rate (RGR) and Doubling Time (Dt)

The scrutiny of data in the field of Pulmonary Tuberculosis has been done with the help of parameters such as Relative Growth Rate (RGR) and Doubling Time (Dt). It is presented in Table-4 and Fig.3 that RGR has been decreased from the year 2013 (0.74) to 2021 (0.12), but in an inconsistent manner. On the other hand, the Doubling Time (Dt) has also shown an inconsistent manner. The data in Table-4 exposes that Doubling time (Dt) has increased from 0.93 in the year 2013 to 5.75 in the year 2021 but in an increasing manner. (Fig.4)

Table-4: RGR and Dt for Pulmonary Tuberculosis Research Output by Year-wise

Year	No. of Records	Cumulative Total of Records	W1	W2	RGR	Dt(a)
2012	1731	1731		7.46		
2013	1926	3657	7.46	8.20	0.74	0.93
2014	1931	5588	8.2	8.63	0.43	1.62
2015	2157	7745	8.63	8.95	0.32	2.13
2016	2423	10168	8.95	9.23	0.28	2.50
2017	2010	12178	9.23	9.41	0.18	3.91

2018	1983	14161	9.41	9.56	0.15	4.67
2019	2113	16274	9.56	9.70	0.14	5.05
2020	2537	18811	9.7	9.84	0.14	4.87
2021	2362	21173	9.84	9.96	0.12	5.75

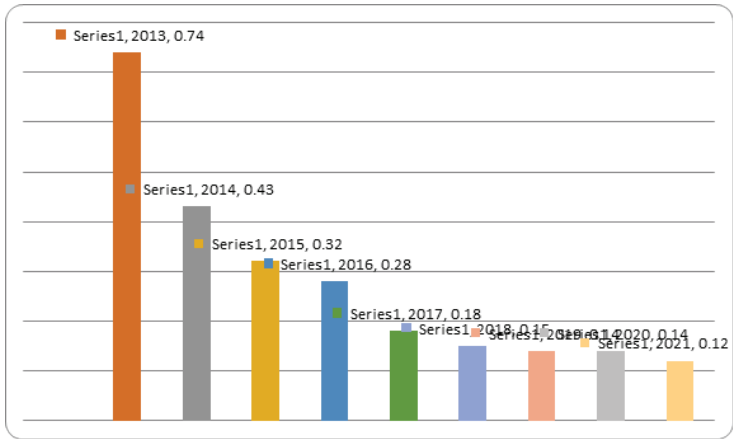


Figure-3: Relative Growth Rate for Research Output in the field of Pulmonary Tuberculosis

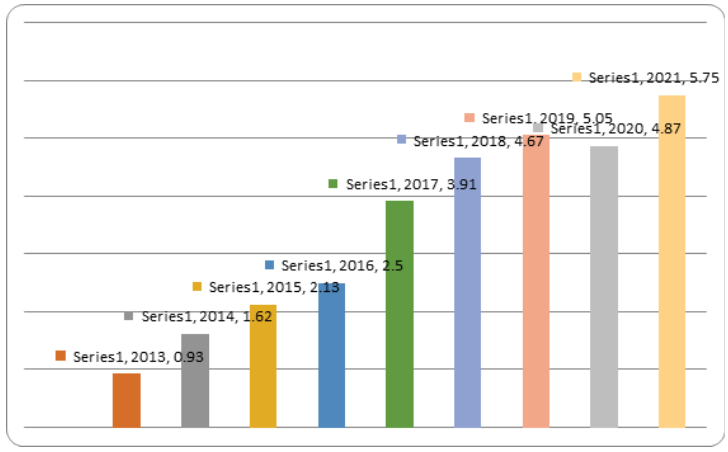


Figure-4: Doubling time for Research output in the field of Pulmonary Tuberculosis

Distribution of Journals in the field of Pulmonary Tuberculosis based on Bradford Law of Scattering

As per the Bradford Law, journal articles (10232records) in the field of Pulmonary Tuberculosis have been selected for this study. The journals are grouped into three zones producing a similar number of journal articles in the field of Pulmonary Tuberculosis. The distribution of the journal by zone-wise is given in Table-5. It has been noticed from Table-5 that 44 journals grouped in zone-1 published 3492 journal articles accounting

for one-third of the total output. Likewise, the second zone contains 271 journals that have published 3667 journal articles, and 1550 journals grouped in the third zone have published 3073 journal articles. Zone-1&2 journals (315 journals) have been identified as core journals in the field of Pulmonary Tuberculosis. (Fig. 5)

Table-5: Distribution by Zone of cited journals and journal articles in the field of Pulmonary Tuberculosis

Zone	No. of Journals	No. of journal articles	Cumulative No. of journal articles		
	No.	(%)	No.	(%)	
Zone 1	44	2.36	3492	34.13	3492
Zone 2	271	14.53	3667	35.84	7159
Zone 3	1550	83.11	3073	30.03	10232
Total	1865	100.00	10232	100.00	

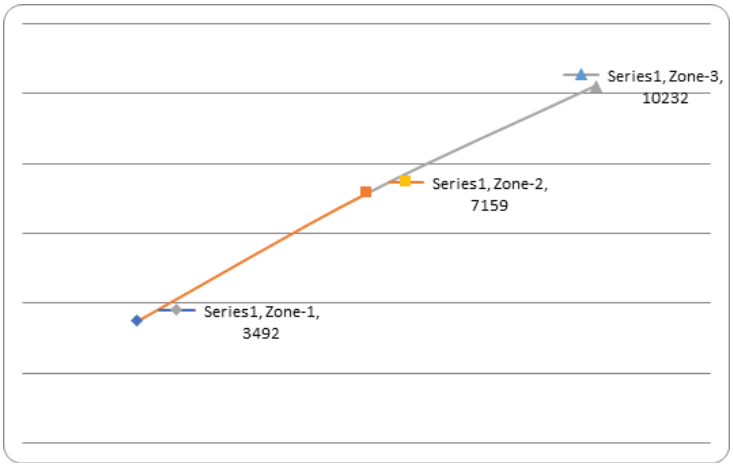


Figure-5: Distributions of Journals by Zones in the field of Pulmonary Tuberculosis

Ranking of Core Journals In Pulmonary Tuberculosis Research

Table-6 presents the ranking of core journals in Pulmonary Tuberculosis research, along with the corresponding research output. The top ten ranked journals are as follows:

1. "PloS One" contributions 269 records accounting for 2.63% of the total contributions.
2. "BMC Infectious Diseases" contributions 243 records accounting for 2.37%.
3. "The Indian Journal of Tuberculosis" contributions 240 records accounting for 2.35%.
4. "The International Journal of Tuberculosis and Lung Disease" contributions 210 records accounting for 2.05%.

5. "International Journal of Mycobacteriology" contributions 168 records accounting for 1.64%.
6. "BMJ Case Reports" contributions 167 records accounting for 1.63%.
7. "International Journal of Infectious Diseases: IJID" contributions 139 records accounting for 1.36%.
8. " Lung India" contributions 131 records accounting for 1.28%.
9. "Kekkaku : [Tuberculosis]" contributions 123 records accounting for 1.20%.
10. "Medicine" and "Public Health Action" each contributions 81 records accounting for 0.79% each.

Table-6: Ranking of Core Journals in Pulmonary Tuberculosis

S. No.	Name of the Journal	No. of Records	%
1.	PloS One	269	2.63
2.	BMC Infectious Diseases	243	2.37
3.	The Indian Journal of Tuberculosis	240	2.35
4.	The International Journal of Tuberculosis and Lung Disease	210	2.05
5.	International Journal of Mycobacteriology	168	1.64
6.	BMJ Case Reports	167	1.63
7.	International Journal of Infectious Diseases : IJID	139	1.36
8.	Lung India	131	1.28
9.	Kekkaku : [Tuberculosis]	123	1.20
10.	Medicine	81	0.79
11.	Public Health Action	81	0.79
12.	The Pan African Medical Journal	77	0.75
13.	BMC Public Health	76	0.74
14.	Journal of Clinical Tuberculosis and Other Mycobacterial Diseases	75	0.73
15.	Journal of Thoracic Disease	73	0.71
16.	Tuberculosis and Respiratory Diseases	71	0.69
17.	BMC Pulmonary Medicine	69	0.67
18.	BMC Research Notes	61	0.60
19.	Frontiers in Microbiology	60	0.59
20.	Tuberculosis Research and Treatment	58	0.57
21.	Infection and Drug Resistance	56	0.55
22.	Journal of Clinical and Diagnostic Research : JCDR	56	0.55
23.	Internal Medicine (Tokyo, Japan)	52	0.51
24.	Tuberculosis (Edinburgh, Scotland)	52	0.51
25.	Advances in Respiratory Medicine	51	0.50
26.	The Clinical Respiratory Journal	50	0.49
27.	Antimicrobial Agents and Chemotherapy	48	0.47
28.	Tanaffos	46	0.45
29.	The American Journal of Tropical Medicine and Hygiene	46	0.45
30.	The Journal of the Association of Physicians of India	43	0.42
31.	Revue De Pneumologie Clinique	42	0.41
32.	Infectious Diseases of Poverty	41	0.40
33.	Clinical Infectious Diseases	40	0.39

34.	Journal of Family Medicine and Primary Care	40	0.39
35.	ZhonghuaJie He He Hu Xi ZaZhi = ZhonghuaJiehe He HuxiZazhi = Chinese Journal	40	0.39
36.	Journal of Infection and Chemotherapy	39	0.38
37.	PneumonologiaI AlergologiaPolska	39	0.38
38.	European Journal of Clinical Microbiology & Infectious Diseases	36	0.35
39.	American Journal of Respiratory and Critical Care Medicine	35	0.34
40.	Revue Des Maladies Respiratoires	35	0.34
41.	Journal of Infection and Public Health	34	0.33
42.	ERJ Open Research	33	0.32
43.	JornalBrasileiro De Pneumologia	33	0.32
44.	Open Forum Infectious Diseases	33	0.32
45.	Journal of Infection in Developing Countries	31	0.30
46.	Cureus	30	0.29
47.	Emerging Infectious Diseases	30	0.29
48.	Journal of Clinical Microbiology	30	0.29
49.	Experimental and Therapeutic Medicine	29	0.28
50.	Infection	29	0.28
51.	Respiratory Medicine	29	0.28
52.	South African Medical Journal = Suid	29	0.28
53.	The American Journal of Case Reports	29	0.28
54.	The Journal of International Medical Research	29	0.28
55.	The Annals of Thoracic Surgery	28	0.27
56.	The Pediatric Infectious Disease Journal	28	0.27
57.	TuberkulozVeToraks	28	0.27
58.	ArchivosDe Bronconeumologia	27	0.26
59.	The Brazilian Journal of Infectious Diseases	27	0.26
60.	The Lancet. Infectious Diseases	27	0.26
61.	Biomed Research International	26	0.25
62.	Frontiers in Medicine	26	0.25
63.	Journal of Korean Medical Science	26	0.25
64.	Journal of the College of Physicians and Surgeons	26	0.25
65.	Microbial Pathogenesis	26	0.25
66.	Respiratory Investigation	26	0.25
67.	ZhonghuaLiu Xing Bing XueZaZhi = ZhonghuaLiuxingbingxueZazhi	26	0.25
68.	African Health Sciences	25	0.24
69.	International Journal of Chronic Obstructive Pulmonary Disease	25	0.24
70.	Scientific Reports	25	0.24
71.	The Indian Journal of Medical Research	25	0.24
72.	Annals of the American Thoracic Society	24	0.23
73.	Ebiomedicine	24	0.23
74.	Indian Journal of Medical Microbiology	24	0.23
75.	MymensinghMedical Journal : MMJ	24	0.23
76.	The European Respiratory Journal	24	0.23
77.	Epidemiology and Infection	23	0.22
78.	The Lancet. Respiratory Medicine	23	0.22
79.	Canadian Respiratory Journal	22	0.22

80.	Clinical Microbiology and Infection	22	0.22
81.	Diagnostic Microbiology and Infectious Disease	22	0.22
82.	JPMA. The Journal of the Pakistan Medical Association	22	0.22
83.	MonaldiArchives for Chest Disease = ArchivioMonaldiPer Le Malattie Del Torace	22	0.22
84.	Thorax	22	0.22
85.	Asian Cardiovascular & Thoracic Annals	21	0.21
86.	Frontiers in Immunology	21	0.21
87.	Journal of Clinical Medicine	21	0.21
88.	Journal of Medical Case Reports	21	0.21
89.	La TunisieMedicale	21	0.21
90.	Le Infezioniin Medicina	21	0.21
91.	Tropical Doctor	21	0.21
92.	ZhonghuaYi XueZaZhi	21	0.21
93.	Chest	20	0.20
94.	Khirurgiia	20	0.20
95.	MikrobiyolojiBulteni	20	0.20
96.	Pneumologia (Bucharest, Romania)	20	0.20
97.	The Indian Journal of Chest Diseases & Allied Sciences	20	0.20
98.	BMJ Open	19	0.19
99.	Journal of Fungi (Basel, Switzerland)	19	0.19
100.	Lancet (London, England)	19	0.19
101.	Sarcoidosis, Vasculitis, and Diffuse Lung Diseases	19	0.19
102.	Tropical Medicine & International Health : TM &IH	19	0.19
103.	Bulletin of Experimental Biology and Medicine	18	0.18
104.	Emerging Microbes & Infections	18	0.18
105.	Euro Surveillance: Bulletin EuropeenSur Les Maladies Transmissibles = European	18	0.18
106.	Georgian Medical News	18	0.18
107.	Infectious Diseases (London, England)	18	0.18
108.	KlinichnaKhirurhiia	18	0.18
109.	QJM : Monthly Journal of the Association of Physicians	18	0.18
110.	Advances in Experimental Medicine and Biology	17	0.17
111.	Biomedica: Revista Del InstitutoNacionalDe Salud	17	0.17
112.	BMC Health Services Research	17	0.17
113.	Journal of Microbiology, Immunology, and Infection = Wei Mian Yu Gan Ran ZaZhi	17	0.17
114.	MedecineEt Maladies Infectieuses	17	0.17
115.	Pneumologie (Stuttgart, Germany)	17	0.17
116.	RevistaChilena De Infectologia : OrganoOficial De La Sociedad ChilenaDe	17	0.17
117.	RevistaDa SociedadeBrasileiraDe Medicina Tropical	17	0.17
118.	Biomedical and Environmental Sciences : BES	16	0.16
119.	International Journal of Environmental Research and Public Health	16	0.16
120.	Medical Science Monitor	16	0.16
121.	PrzegladEpidemiologiczny	16	0.16
122.	RevistaPanamericana De SaludPublica = Pan American Journal of Public Health	16	0.16

123.	The Korean Journal of Internal Medicine	16	0.16
124.	WiadomosciLekarskie (Warsaw, Poland : 1960)	16	0.16
125.	American Journal of Translational Research	15	0.15
126.	European Journal of Case Reports in Internal Medicine	15	0.15
127.	International Journal of Surgery Case Reports	15	0.15
128.	Journal of Ayub Medical College, Abbottabad : JAMC	15	0.15
129.	Journal of Bronchology& Interventional Pulmonology	15	0.15
130.	Journal of the Medical Association of Thailand = ChotmaihetThangphaet	15	0.15
131.	Oncotarget	15	0.15
132.	Pediatric Pulmonology	15	0.15
133.	Pharmaceutics	15	0.15
134.	Annals of Translational Medicine	14	0.14
135.	International Journal of Clinical and Experimental Medicine	14	0.14
136.	Journal of Medical Microbiology	14	0.14
137.	Mycoses	14	0.14
138.	Postgraduate Medical Journal	14	0.14
139.	ZhonghuaLao Dong Wei Sheng Zhi Ye Bing ZaZhi = ZhonghuaLaodongWeisheng	14	0.14
140.	Annals of Thoracic Medicine	13	0.13
141.	Case Reports in Infectious Diseases	13	0.13
142.	Case Reports in Pulmonology	13	0.13
143.	Frontiers in Pharmacology	13	0.13
144.	Infection, Genetics and Evolution	13	0.13
145.	International Journal of Antimicrobial Agents	13	0.13
146.	International Journal of Molecular Sciences	13	0.13
147.	Lung	13	0.13
148.	MemoriasDo InstitutoOswaldo Cruz	13	0.13
149.	Ocular Immunology and Inflammation	13	0.13
150.	Paediatricsand International Child Health	13	0.13
151.	Pakistan Journal of Medical Sciences	13	0.13
152.	Respiration; International Review of Thoracic Diseases	13	0.13
153.	Respiratory Medicine Case Reports	13	0.13
154.	Romanian Journal of Morphology and Embryology = Revue Roumaine De Morphologie Et	13	0.13
155.	Saudi Journal of Kidney Diseases and Transplantation	13	0.13
156.	The Journal of Infection	13	0.13
157.	The Medical Journal of Malaysia	13	0.13
158.	The National Medical Journal of India	13	0.13
159.	Turkish Thoracic Journal	13	0.13
160.	Caspian Journal of Internal Medicine	12	0.12
161.	Clinical Laboratory	12	0.12
162.	Diagnostic Cytopathology	12	0.12
163.	Eastern Mediterranean Health Journal = La Revue De Sante De La Mediterranee	12	0.12
164.	Ethiopian Journal of Health Sciences	12	0.12
165.	Germs	12	0.12
166.	International Journal of Pharmaceutics	12	0.12

167.	International Journal of STD &AIDS	12	0.12
168.	Journal of Clinical Laboratory Analysis	12	0.12
169.	Journal of Epidemiology and Global Health	12	0.12
170.	Journal of Tropical Pediatrics	12	0.12
171.	MedecineEt SanteTropicales	12	0.12
172.	Respirology (Carlton, Vic.)	12	0.12
173.	RevistaDo InstitutoDe Medicina Tropical De Sao Paulo	12	0.12
174.	Saudi Medical Journal	12	0.12
175.	Scandinavian Journal of Immunology	12	0.12
176.	TerapevticheskiiArkhiv	12	0.12
177.	The New England Journal of Medicine	12	0.12
178.	Transactions of the Royal Society of Tropical Medicine and Hygiene	12	0.12
179.	Transplantation Proceedings	12	0.12
180.	Xi Bao Yu Fen ZiMian Yi XueZaZhi = Chinese Journal of Cellular and Molecular	12	0.12
181.	ZhongguoFei Ai ZaZhi = Chinese Journal of Lung Cancer	12	0.12
182.	ActaMedica Portuguesa	11	0.11
183.	Annals of Palliative Medicine	11	0.11
184.	Bulletin De La SocieteDe PathologieExotique (1990)	11	0.11
185.	Bulletin of the World Health Organization	11	0.11
186.	Indian Journal of Critical Care Medicine : Peer	11	0.11
187.	Infection Control and Hospital Epidemiology	11	0.11
188.	International Immunopharmacology	11	0.11
189.	Iranian Journal of Public Health	11	0.11
190.	Japanese Journal of Infectious Diseases	11	0.11
191.	Journal of Immunology Research	11	0.11
192.	Journal of the Indian Medical Association	11	0.11
193.	Journal of the Pediatric Infectious Diseases Society	11	0.11
194.	New Microbes and New Infections	11	0.11
195.	Open Access Macedonian Journal of Medical Sciences	11	0.11
196.	Public Health Reports (Washington, D.C. : 1974)	11	0.11
197.	Pulmonology	11	0.11
198.	RevistaPortuguesa De Pneumologia	11	0.11
199.	Chinese Medical Journal	10	0.10
200.	EnfermedadesInfecciosas Y MicrobiologiaClinica (English Ed.)	10	0.10
201.	European Journal of Pharmaceutics and Biopharmaceutics	10	0.10
202.	European Journal of Radiology	10	0.10
203.	Indian Journal of Pediatrics	10	0.10
204.	International Journal of Clinical and Experimental Pathology	10	0.10
205.	Journal of Cytology	10	0.10
206.	Journal of the Formosan Medical Association = Taiwan Yi Zhi	10	0.10
207.	JundishapurJournal of Microbiology	10	0.10
208.	KyobuGeka. The Japanese Journal of Thoracic Surgery	10	0.10
209.	MedicinaClinica	10	0.10
210.	Microbial Drug Resistance (Larchmont, N.Y.)	10	0.10
211.	Mmwr. Morbidity and Mortality Weekly Report	10	0.10
212.	Respiratory Research	10	0.10

213.	Scandinavian Journal of Infectious Diseases	10	0.10
214.	The Lancet. Global Health	10	0.10
215.	ZhonghuaErKeZaZhi = Chinese Journal of Pediatrics	10	0.10
216.	ActaMedicaIranica	9	0.09
217.	African Journal of Infectious Diseases	9	0.09
218.	Annals of Clinical Microbiology and Antimicrobials	9	0.09
219.	Annals of Thoracic and Cardiovascular Surgery	9	0.09
220.	APMIS: ActaPathologica, Microbiologica, Et Immunologica Scandinavica	9	0.09
221.	ArchivosArgentinos De Pediatria	9	0.09
222.	ClinicaChimicaActa; International Journal of Clinical Chemistry	9	0.09
223.	Communicable Diseases Intelligence Quarterly Report	9	0.09
224.	EnfermedadesInfecciosas Y MicrobiologiaClinica	9	0.09
225.	EpidemiologiaE Servicos De Saude : Revista Do SistemaUnicoDe SaudeDo Brasil	9	0.09
226.	European Journal of Cardio	9	0.09
227.	Human Immunology	9	0.09
228.	Indian Journal of Community Medicine	9	0.09
229.	International Journal of Preventive Medicine	9	0.09
230.	Iranian Journal of Microbiology	9	0.09
231.	JNMA; Journal of the Nepal Medical Association	9	0.09
232.	Journal of Global Infectious Diseases	9	0.09
233.	KardiochirurgiaI TorakochirurgiaPolska = Polish Journal of Cardio	9	0.09
234.	Likars'kaSprava	9	0.09
235.	Multidisciplinary Respiratory Medicine	9	0.09
236.	Pathogens (Basel, Switzerland)	9	0.09
237.	Polish Journal of Radiology	9	0.09
238.	Pulmonary Medicine	9	0.09
239.	Rheumatology International	9	0.09
240.	Singapore Medical Journal	9	0.09
241.	The American Journal of Medicine	9	0.09
242.	The Southeast Asian Journal of Tropical Medicine and Public Health	9	0.09
243.	Vaccine	9	0.09
244.	Western Pacific Surveillance and Response Journal : WPSAR	9	0.09
245.	ZhongNan Da XueXueBao. Yi Xue Ban = Journal of Central South University.	9	0.09
246.	ActaMedicaIndonesiana	8	0.08
247.	ActaRadiologica (Stockholm, Sweden : 1987)	8	0.08
248.	African Journal of Primary Health Care & Family Medicine	8	0.08
249.	American Journal of Infection Control	8	0.08
250.	Annals of Clinical and Laboratory Science	8	0.08
251.	CadernosDe SaudePublica	8	0.08
252.	Clinical Rheumatology	8	0.08
253.	European Review for Medical and Pharmacological Sciences	8	0.08
254.	Indian Journal of Otolaryngology and Head and Neck Surgery	8	0.08
255.	Indian Journal of Pathology & Microbiology	8	0.08
256.	Interactive Cardiovascular and Thoracic Surgery	8	0.08
257.	Iranian Journal of Medical Sciences	8	0.08

258.	Iranian Journal of Pharmaceutical Research : IJPR	8	0.08
259.	Journal of Laboratory Physicians	8	0.08
260.	Journal of Microbiological Methods	8	0.08
261.	Journal of Nepal Health Research Council	8	0.08
262.	Journal of Public Health (Oxford, England)	8	0.08
263.	KlinicheskaiaLaboratornaiaDiagnostika	8	0.08
264.	Molecular Biology Reports	8	0.08
265.	Nan Fang Yi Ke Da XueXueBao = Journal of Southern Medical University	8	0.08
266.	Oncology Letters	8	0.08
267.	OsongPublic Health and Research Perspectives	8	0.08
268.	PostepyDermatologii I Alergologii	8	0.08
269.	Public Health	8	0.08
270.	The British Journal of Radiology	8	0.08
271.	The Journal of Emergency Medicine	8	0.08
272.	The Thoracic and Cardiovascular Surgeon	8	0.08
273.	Transplant Infectious Disease	8	0.08
274.	Tropical Biomedicine	8	0.08
275.	YonseiMedical Journal	8	0.08
276.	Archives of Iranian Medicine	7	0.07
277.	Archives of Medical Science : AMS	7	0.07
278.	Asian Pacific Journal of Tropical Medicine	7	0.07
279.	BMJ (Clinical Research Ed.)	7	0.07
280.	Clinical and Vaccine Immunology : CVI	7	0.07
281.	Clinical Case Reports	7	0.07
282.	Der Internist	7	0.07
283.	Diagnostics (Basel, Switzerland)	7	0.07
284.	General Thoracic and Cardiovascular Surgery	7	0.07
285.	Genetic Testing and Molecular Biomarkers	7	0.07
286.	Infectious Disorders Drug Targets	7	0.07
287.	International Journal of General Medicine	7	0.07
288.	Iranian Red Crescent Medical Journal	7	0.07
289.	Journal of Cardiothoracic Surgery	7	0.07
290.	Journal of Crohn's& Colitis	7	0.07
291.	Journal of Ethnopharmacology	7	0.07
292.	Journal of Postgraduate Medicine	7	0.07
293.	Journal of Tropical Medicine	7	0.07
294.	Medical Archives (Sarajevo, Bosnia and Herzegovina)	7	0.07
295.	Medical Journal of the Islamic Republic of Iran	7	0.07
296.	Medicina	7	0.07
297.	Medicina (Kaunas, Lithuania)	7	0.07
298.	Mediterranean Journal of Hematology and Infectious Diseases	7	0.07
299.	Microorganisms	7	0.07
300.	Molecules (Basel, Switzerland)	7	0.07
301.	Nepal Medical College Journal : NMCJ	7	0.07
302.	Nigerian Medical Journal	7	0.07
303.	Pakistan Journal of Pharmaceutical Sciences	7	0.07

304.	Patient Preference and Adherence	7	0.07
305.	Peerj	7	0.07
306.	Plos Medicine	7	0.07
307.	Springerplus	7	0.07
308.	The American Journal of the Medical Sciences	7	0.07
309.	Trials	7	0.07
310.	Turkish Journal of Medical Sciences	7	0.07
311.	Urologiia (Moscow, Russia : 1999)	7	0.07
312.	Vaccines	7	0.07
313.	VestnikRentgenologii I Radiologii	7	0.07
314.	Voenno	7	0.07
315.	ZhonghuaBing Li XueZaZhi = Chinese Journal of Pathology	7	0.07

Major Findings

- A total of 21,173 records were identified during the study period.
- It highlights the variations in research productivity across different years.
- The data reveals that Journal Articles accounted for the highest number of records, with 10,232 publications, making up 48.3257% of the total.
- Out of a total of 21173 records, 19649 of them were in English language forming 92.80215%.
- RGR has been decreased from the year 2013 (0.74) to 2021 (0.12), but in an inconsistent manner.
- The Doubling Time (Dt) has also shown an inconsistent manner.
- 44 journals grouped in zone-1 published 3492 journal articles accounting for one-third of the total output.
- The second zone contains 271 journals that have published 3667 journal articles.
- 1550 journals grouped in the third zone have published 3073 journal articles.
- 315 journals have been identified as core journals in the field of Pulmonary Tuberculosis.

Conclusion

In the field of medicine, the results showthat Pulmonary Tuberculosis literature growth is in an inconsistent manner throughout the study period. It has been shown in the study that a maximum number of records covered by journal article inthe field of Pulmonary Tuberculosis. The English language dominates literature in the field of Pulmonary Tuberculosis. A total of 315 core journals have been identified in the field of Pulmonary Tuberculosis.

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BIBLIOMETRIC ANALYSIS OF THE SCIENTIFIC RESEARCH ON INFORMATION LITERACY: A GLOBAL PERSPECTIVE

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Introduction

From its oFrom its origin, the concept of 'information literacy' was comprehensively used in the discipline of library and information science and considered as a tool for improving productivity (Zurkowski, 1974). Since its inception, various researchers and reputable agencies tried to define it (Abilock, 2004; American Library Association, 1989; American Library Association & Association for College and Research Libraries, 2000; Eisenberg et al., 2004; Snavely & Cooper, 1997). It is always analyzed by pointing to the abilities an individual required. The practices and processes applied within this concept for the last few decades paved the way for its collaboration with other disciplines. Gradually the concept led its focus outside the academic circle and moved to the workplace and everyday settings. Thus, the concept becomes applicable to all disciplines, learning environments, and all sets of life. The technological advancements in the digital environment transformed the very concept of 'information literacy' to be much more quantifiable and measurable based on the performance of an individual (Sample, 2020).

Information literacy becomes a prerequisite for everyone as it is a skill-based habit and social practice (Addison & Meyers, 2013). There is exponential growth in information; thereby it creates difficulty to identify whether it can be accessed, makes it difficult to verify the authenticity and validity of information, causes difficulty to adopt the right format of the information, and requires competencies to analyze and synthesize information. Therefore, information literacy becomes an inevitable quality for a common man to lead a better life in society in the ever-changing information environment.

The competency-based understanding of 'information literacy' has reconnected the same with other concepts like 'computer literacy', 'media literacy', 'library literacy', 'digital literacy', and 'network literacy' because the extension of information literacy domain is growing due to the technological advancements and practical implications

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(Saunders, 2008). These literacies are interconnected and share common objectives for accessing, evaluating, and using information efficiently and effectively. Each literacy emphasizes various aspects of information. Together they provide a holistic framework through which digitally literate individual would be formed. Therefore, it becomes a complex and multifaceted concept. The ability and skill to handle computers, media, libraries, digital platforms, and cyberspace in producing, processing, storing, and retrieving information correlate in the technological environment.

Various researchers had discussed on concept 'information literacy' from the bibliometric point of view, but none of them synthesized in their studies the other reconnected concepts of literacy all together. Therefore, the competency-related aspect of the topic from the bibliometric point of view, was untouched. There were certain initiatives (Chen et al., 2021; Islam et al., 2022), but they could not cover up all the reconnected terms together. In this regard, publications from 2019 to 2023 indexed in the Web of Science (WoS) database on "information literacy', having a progressive nature in the digital environment are tried to be analyzed from the bibliometric point of view.

Literature Review

The bibliometric analysis of Guerola-Navarro et al. (2023) on media literacy and information literacy, as the role of the citizen is getting changed due to the digitalization of all activities, has analyzed 893 papers from the WoS database related to media literacy and information literacy. It is concluded that media literacy is more oriented toward handling online information whereas information literacy is more related to information management for decision-making.

The data from the WoS database was accessed by Baber et al. (2022) to present a quantitative analysis of the research output on digital literacy by applying bibliometric techniques. The study remarked that the USA and Spain were the top cited and publishing countries. The interesting fact was that the prominent researchers in the area of information literacy were from these countries. The most productive journals were related to the disciplines like education and library and information science.

Islam et al. (2022) examined 928 documents related to the concept 'information literacy' from Scopus database from 2017 to 2021. During the period of study, the concept 'information literacy' had maintained direct connections with other concepts like 'digital literacy', 'media literacy', and 'health information literacy'.

Setyorini (2022) conducted a bibliometric analysis of 999 articles on digital literacy. The data for this study was from Google Scholar and the period of study was from 2017 to 2021. The most frequently searched keywords like 'information literacy', 'media literacy', etc. showed the collaborative nature of the main theme.

Chen et al. (2021) analyzed the information literacy trends in higher education for ten years by applying bibliometric tools. The data for the study was from the WoS database and the authors conducted the content analysis of 371 articles published from

2011 to 2020. The bibliometric mapping of this study noted that the research in the areas of information literacy grew over the period of study. The study deduced that social media and especially the upcoming technologies with artificial intelligence influence the information literacy abilities of students.

Haq et al. (2021) analyzed the scholarly outputs of 2551 indexed in the WoS database on information literacy from 1983 to 2020. The study reported that the USA contributed 42.96% of documents on information literacy. It was interesting that eight institutions and six frequently used journals were from the USA when the top ten most productive institutions and frequently used journals were examined.

Objectives

This study is conducted with the purpose to analyze the size and trends of published literature related to information literacy on the bibliometric ground. Bibliometric analysis, a data-driven method, is a technique to identify literature development in any domain. The study is conducted with the following research questions.

- What is the year-wise distribution and growth of literature on information literacy during 2019-2023?
- What is the Annual Growth Rate (AGR), Relative Growth Rate (RGR), and Doubling Time (DT) of information literacy research output?
- Who are the prolific authors in information literacy research output?
- What are the most impacted documents and journals in the area of study?
- What are the research trends and future directions in the area of information literacy?

The necessity of information literacy from various aspects is studied by many of researchers (Carlson et al., 2011; Leaning, 2019; Limberg et al., 2012; Tewell, 2015). But bibliometric analysis on information literacy is not yet studied. Being literate in cyberspace becomes a necessity and without which the existence will be questioned. This study covers the publications, growth of publication, citation analysis, prolific authors, documents, and journals related to information literacy from 2019 to 2023.

Methodology

This study concentered on the extracted data from the WoS database for five years (2019 to 2023). The data on information literacy was downloaded in plain text format after applying boolean and filtering functions to broaden the scope of the keyword search and to increase the quality of the searched topic (Roshdi & Roohparvar, 2015). The concept 'information literacy' is an ever-increasing topic of study as its similarity to other terms such as 'computer literacy', 'media literacy', 'library literacy', 'digital literacy', and 'network literacy' are pointed by investigators (Guerola-Navarro et al., 2023; Hicks et al., 2022; Karisiddappa et al., 2020). The search string of this study is focused on the above-mentioned terms. The time span of the literature search was five years. The search was performed on 13 May 2024. The flow chart (figure 1) is followed after a primary search of the concept in the WoS database.

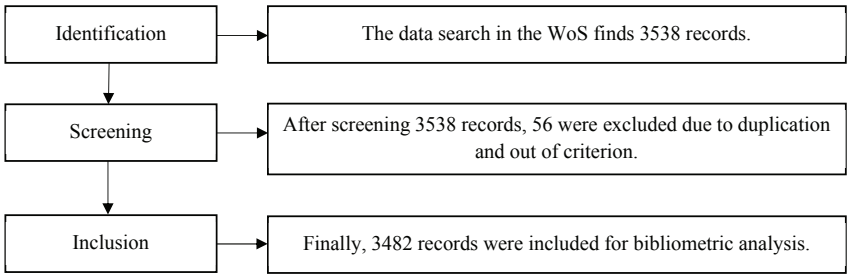


Figure 1. Flow Chart of Study

The searched and collected data were examined and evaluated to find out the document types, authors, journals, countries, and other impact factors. For the graphical presentation and analysis of the data, MS Excel, VOS Viewer, and R Studio software were used. This study has the following limitations. For the data collection, this study has selected the WoS database. There are other databases like Scopus are not discussed in this study. The period of study is limited to five years, from 2019 to 2023. and it is purely a bibliometric analysis where the content analysis of the published papers on information literacy does not become the primary aim.

Analysis and Interpretation

Year-Wise Distribution and Growth of Publications On Information Literacy

Table 1. Year-wise Distribution and Growth of Publications on Information Literacy

Year	No. of Publication	Percentage	Cumulative Publication	Cumulative Percentage	Annual Growth Rate
2019	474	13.61	474	13.61	0
2020	590	16.94	1064	30.55	24.47
2021	694	19.93	1758	50.49	17.63
2022	858	24.64	2616	75.13	23.63
2023	866	24.87	3482	100	0.93
	3482	100			

The data in the Table 1 shows that there were 3842 publications on 'information literacy' from 2019 to 2023. Gradual steady growth in the number of publications is not visible during the period of study. The highest number of publications (866) was in 2023 with 24.87%. The growth rate in any research area is identified when the annual growth rate is analyzed. Here it does not show steady growth. The highest annual growth rate for the period of study is 24.47 in 2020. In 2023 the growth rate is 0.93 though the number of publications in the area of information literacy increases.

Relative Growth Rate (Rgr) and Doubling Time (Dt) of Publications On Information Literacy

Table 2. RGR and DT of Publications on Information Literacy

Year	No. of Publication	Cumulative No. of Publication	W1	W2	RGR	DT
2019	474	474	0	6.16	0	
2020	590	1064	6.16	6.96	0.80	0.87
2021	694	1758	6.96	7.47	0.78	0.89
2022	858	2616	7.47	7.86	0.39	1.78
2023	866	3482	7.86	8.16	0.30	2.31
2019-2023	3482			Mean	0.57	1.46

Table 2 shows the details of the Relative Growth Rate (RGR) and Doubling Time (DT) on the publications in the area of information literacy. The relationship between RGR and DT is in inverse nature. RGR is to measure how quickly the number of publications increase whereas DT shows the time required to double the publications. RGR, a measurement to highlight the growth of publication in any field starts at 0.80 and ends at 0.30; it shows a gradual decrease. and the mean of RGR for the period of study is 0.57. At the same time, DT shows gradual growth from 0.87 to 2.31 and its mean is 1.46.

Document Type In Information Literacy Research

Figure 2 explains the document types in the information literacy research output for the period of five years. In the period of study, there are 3482 various types of documents published globally in relation to information literacy. These 3482 publications are listed in 9 document types. The most prominent type of document is article (2849, 82%), and it is followed by review (220), article early access (202), editorial material (70), and book review (54). Other types of documents were proceeding paper (32), meeting abstract (25), retracted publication (18), and letter (10).

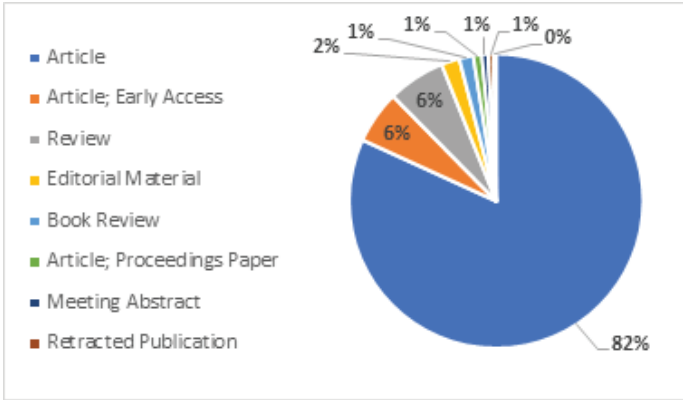


Figure 2. Document Type Distribution of Information Literacy Research Output

Author Impact and Productivity

The top 10 authors in the area of information literacy based on the highest number of publications and citations are listed in Table 3. Among the most productive authors based on the number of papers, three authors are from South Korea and two authors are from England and the Spain respectively. Alison Hicks from England has published 19 papers and has received 112 citations during the period of study. Maria Printo from Spain is the second leading author with 18 papers and 114 citations. Annemaree Lloyd from England has published 13 papers but has received more citations (128) than the second leading author Maria Pinto. Sarah McGrew from USA has the highest number of citations (254). The table also lists the h-index, g-index, and m-index of the top 10 authors. Maria Pinto, Annemaree Lloyd, and Dora Sales are the leading authors when h-index is calculated (Haq et al., 2021; Karisiddappa et al., 2020; Khajuriya & Diksha, 2021). The g-index values show that Annemaree Lloyd and Dora Sales are the leading figures with 11 g-indexes. The highest m-index holders are Maria Pinto (1.33), Annemaree Lloyd (1.17), and Dora Sales (1.17).

Table 3. Author Impact and Productivity

Author	Country	Papers	Citations	h-index	g-index	m-index
Hicks, Alison	England	19	112	6	9	1.00
Pinto, Maria	Spain	18	114	8	10	1.33
Lloyd, Annemaree	England	13	128	7	11	1.17
Park, SungJun	South Korea	12	38	4	5	0.67
Naveed, Muhammad Asif	Pakistan	12	65	5	7	0.83
Sales, Dora	Spain	11	124	7	11	1.17
Lee, Heayon	South Korea	11	38	4	6	0.80
Kim, So Yoon	South Korea	11	66	4	8	0.80
McGrew, Sarah	USA	10	254	6	10	1.00
Wu, Di	China	10	117	6	10	1.00

Top Ten Cited Documents

The top 10 documents that have received the most citations with their publications details are shown in table 4. It is clear that only one document has received more than 300 citations during the period of study; at the same time, all other eight documents have secured more than 200 citations. The document titled “The Psychology of Fake News” by Pennycook & Rand has received 374 citations and its CPY is 93.50. It is followed by the document entitled “Assessing Computational Thinking: A Systematic Review of Empirical Studies” by Tang et al., which has received 254 citations; it is having the second highest number of citations. The third and fourth highest number of citations are secured by the documents titled “Framework for Managing the COVID-19 Infodemic: Methods and Results of an Online, Crowdsourced WHO Technical Consultation” (251) and “Does Media Literacy Help Identification of Fake News? Information Literacy Helps, but Other Literacies Don’t” (242) respectively. The table also gives the details of

the publication through which the top ten documents are published. The first document in terms of citations is published in the medical related publications. The list of top ten cited documents conveyed that the 'information literacy' being a pure library and information science discipline concept gets its transition to other disciplines like medicine, psychology, education etc.

Table 4. Top Ten Cited Documents

Author/Title	Rank	Citation	CPY	NC	Publication
Pennycook & Rand, (2021). The Psychology of Fake News.	1	374	93.50	28.73	Trends in Cognitive Sciences
Tang et al., (2020). Assessing Computational Thinking: A Systematic Review of Empirical Studies.	2	254	50.80	14.87	Computer & Education
Tangcharoensathien et al., (2020). Framework for Managing the COVID-19 Infodemic: Methods and Results of an Online, Crowdsourced WHO Technical Consultation.	3	251	50.20	14.70	Journal of Medical Internet Research
Jones-Jang et al., (2021). Does Media Literacy Help Identification of Fake News? Information Literacy Helps, but Other Literacies Don't.	4	242	60.50	18.59	American Behavior-al Scientist
Schwendicke et al., (2020). Artificial Intelligence in Dentistry: Chances and Challenges	5	238	47.60	13.94	Journal of Dental Research
Guess et al., (2020). A Digital Media Literacy Intervention Increases Discernment between Mainstream and False News in the United States and India	6	212	42.40	12.41	Proceedings of the National Academy of Sciences of the United States of America
Cheng et al., (2019). Effects of the Flipped Classroom Instructional Strategy on Students' Learning Outcomes: A Meta-analysis.	7	209	34.83	13.24	Educational Technology Research and Development
Goldfarb & Lieberman (2021). Three Decades of Research: The Case for Comprehensive Sex Education	8	203	50.75	15.60	Journal of Adoles-cent Health
Franke et al., (2019). A Personal Resource for Technology Integration: Development and Validation of the Affinity for Technology Interaction (ATI) Scale	9	200	33.33	12.67	International Journal of Human-Comput-er Interaction
Falloon (2020). From Digital Literacy to Digital Competence: The Teacher Digital Competency (TDC) framework.	10	198	39.60	11.59	Educational Technology Research and Development

(CPY - Citation Per Year; NC - Normalized Citations)

Leading Journals in Information Literacy Research

Table 5 shows the top leading journals in information literacy from 2019 to 2023. 824 journals published 3482 documents during the period of study. During the period of study, the 'Journal of Academic Librarianship' becomes the leading journal with 117 publications and Elsevier Science Ltd. is its publisher. It is followed by the journals named 'Sustainability', 'Education and Information Technologies', and 'Journal of Medical Internet Research' with 86, 77, and 71 publications respectively and have secured the second, third, and fourth places. Though the source named 'Computers & Education' has only 50 published documents, it has secured the highest number of citations (1164) and its publisher is Pergamon-Elsevier Science Ltd. and 'Journal of Medical Internet Research' (1125), 'Sustainability' (863), and 'Education and Information Technologies' (857) are the other leading sources based on the number of citations. Among the top ten journals, three of them are directly related to library and information science discipline. Though 'information literacy' corporates to other domains, its importance in library and information science discipline is more visible.

Table 5. Leading Journals in Information Literacy Research

Sources	Documents	Citations	Publishers
Journal of Academic Librarianship	117	726	Elsevier Science Inc.
Sustainability	86	863	MDPI
Education and Information Technologies	77	857	Springer
Journal of Medical Internet Research	71	1125	JMIR Publications Inc.
Journal of Librarianship and Information Science	68	460	Sage Publication Ltd.
College & Research Libraries	64	168	Assoc Coll Research Libraries
International Journal of Environmental Research and Public Health	63	588	MDPI
Reference Services Review	54	210	Emerald Group Publishing Ltd.
Journal of Documentation	53	424	Emerald Group Publishing Ltd.
Computers & Education	50	1164	Pergamon-Elsevier Science Ltd.

5.7 Global Collaboration of Documents

The top ten countries based on the number of productivities in the area of information literacy are displayed in Table 6. Among the top ten countries, four countries such as England, Spain, Germany and Sweden are European countries; whereas China, South Korea, and Taiwan are from the Asian continent. Further, USA and Canada are from North America and Australia is from Oceania. The study states that the USA is first among the top ten counties with 1141 documents, having a huge difference from the second top country China (404 documents). England and Australia with 264 and 243 documents respectively occupy the next places in the table. Analysis in terms of citations also proves that the USA has the highest number of citations (10742) and compared to other countries, the difference is huge. China (3186) and England (3077) secure the second and third positions respectively.

Table 6. Global Collaboration of Documents

Name of the Country	Documents	Citations	Links	Total Link Strengths
USA	1141	10742	49	1682
China	404	3186	48	862
England	264	3077	48	623
Australia	243	2651	45	477
Spain	221	2119	48	514
Germany	160	2232	39	310
Canada	140	1925	44	314
South Korea	111	688	38	215
Taiwan	77	675	31	180
Sweden	71	623	35	166

The network visualization of co-authorship collaboration of country (Figure 3) represents 61 countries out of 109 that fall into eight clusters when the consideration was of a minimum of ten documents and five citations per country. This shows the type and degree of collaboration and the relationship between countries in information literacy research. The thickness of the line shows the collaborative nature among the countries whereas the number of published documents is represented by the size of the node. There are four countries which has more than 500 total link strengths. The USA has the highest Total Link Strengths (1682) compared to other countries.

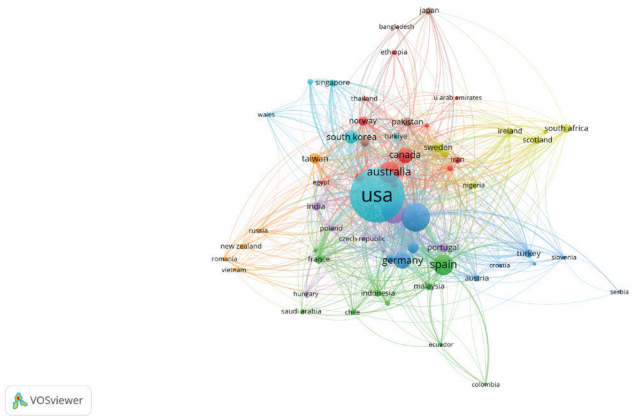


Figure 3. Global Collaboration of Documents

Co-occurrence of Author Keywords

Table 7 shows the co-occurrence analysis of 7911 authors' keywords by 8015 authors. The table displays the top 10 author keywords with their occurrences and link strengths. It is clear that the authors' keyword 'digital literacy' has listed 519 occurrences (1141 LS). It is followed by 'information literacy' with 503 occurrences (1166 LS), 'media literacy' with 322 occurrences (1021 LS), 'COVID-19' with 191 occurrences (486 LS), and 'social media' with 187 occurrences (522 LS). The keyword co-occurrence

analysis helps to identify the most popular terms and their relationship among themselves to the subject under study.

Table 8. Co-occurrence of Author Keywords

Keyword	Occurrences	Link Strengths (LS)
Digital Literacy	519	1141
Information Literacy	503	1166
Media Literacy	322	1021
COVID-19	191	486
Social Media	187	522
Misinformation	112	349
Fake News	101	335
Higher Education	92	242
Disinformation	81	30
Digital	48	446

The interconnection among the author keywords like 'digital literacy', 'information literacy', etc. is shown in figure 4. The keywords that appeared at least five times are included in this part of the study. The different nodes in the figure show of the most frequent author keywords. They are grouped differently in terms of node size, font size, and colour. The similarity among the terms is in the lines by which the keywords are linked. The size of the node is related to the frequency of the terms whereas the number of links among the nodes is associated with the occurrences of the keywords.

Network visualization represents the occurrences of the terms together. The analysis of the figure 4 shows of 9 clusters, and occurrences of terms in each cluster is as follows: cluster 1 (503 occurrences), cluster 2 (191 occurrences), cluster 3 (322 occurrences), cluster 4 (57 occurrences), cluster 5 (75 occurrences), cluster 6 (48 occurrences), cluster 7 (44 occurrences), cluster 8 (49 occurrences), and cluster 9 (27 occurrences).

Cluster 1 (Red colour) includes 88 items. It has 'digital literacy' as the major node that incorporates other keywords such as 'academic library', 'digital learning', ICT literacy etc. It is in the digital learning era; the digital and information literacy get importance. Digital literacy becomes a necessity as e-commerce and e-governance practiced in daily life.

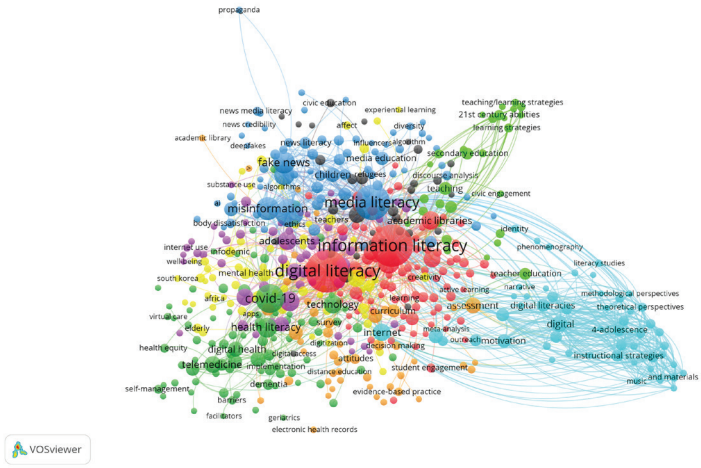


Figure 4. Co-occurrence of Author Keywords

Cluster 2 (Green colour) is centered on the term 'COVID-19' as the major node that incorporates other keywords such as 'health literacy', 'digital divide' etc. It was during the COVID-19 pandemic, the digital and information literacy get importance. There was a lot of misleading information during the pandemic, the digital platform was necessary for survival as everything was locked, and being literate especially in cyberspace became a must.

The third cluster is identified by blue colour. This cluster is centered by the term 'media literacy' and connects with 73 items. 'Data literacy', 'media education', 'fake news', 'disinformation', etc. are the other related terms in this cluster.

'Education', 'digital divide', 'digital writing', 'assessment', 'critical thinking', and 'teaching' are the central terms of the fourth, fifth, sixth, seventh, eighth, and nineth clusters respectively. The significant keywords are grouped in 9 clusters and show their relationships to one another. In addition, to literacy in information and media, the terms like 'social media', 'higher education', and 'misinformation' frequently co-occur. It is an indication that in future, researchers must show more interest in identifying the right information sources.

Conclusion

Information rules the world. The one who has the access to more information becomes the ruler and has control over the decision-making process. Being literate in identifying what happens around the world is the best way to prove one's existence. Digital technology is being applied everywhere and technologies like the internet of things (IoT), cloud computing, artificial intelligence (AI) etc. design the theoretical and practical aspects of all academic and non-academic realms.

In this study, the dynamic nature of information literacy is tried to be analyzed from the bibliometric point of view. The study refers to the period of 2019-2023. The study found that there was a gradual increase in the number of publications. Most of the prolific authors are from the European continents but the contribution of Asian authors cannot be minimized. The assessment of the top ten cited documents marked the transition of 'information literacy' as being a pure library and information science concept to the medical area; and its correlation with other fields in the digital environment was reported in this study. Five of the top journals based on the number of publications were directly from the library and information science discipline. The USA was placed in the top position in the case of publications and citations. 'Information literacy', 'digital literacy', and 'media literacy' were the most occurred author keywords when the co-occurrences of 10075 author keywords were analyzed and the network visualization of the co-occurrences of author keywords was fallen into nine clusters. The exploration of new domains, areas, concepts, and fields was listed in the bibliometric analysis on 'information literacy' from 2019 to 2023.

The study finds that the area of information literacy is still growing. The analysis and discussions on information literacy need more attention. Measuring the scope and influence of technological advancements in information literacy from different aspects, the correlation of information literacy with other emerging concepts, and the necessary skills and competencies needed for an individual in the information age are the areas to be considered for further study. Being a bibliometric analysis, the content part of the publications is not discussed in detail in this study; therefore, a detailed and systematic analysis of the content of the publications is needed in the future.

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A SOCIAL NETWORK APPROACH TO SCIENTOMETRICS

Dr. E. Nishavathi[1]

Introduction

With the advent of science and technologies, there are enormous bibliometric and scientometrics measures/indicators proponed to studies the present state of science to assists the stakeholders, administrators, and policymakers in decision making, formulating strategic planning, policies, and setting research priorities. However the scientometrics indicators alone insufficient, it can be used along with other indicators like Social Network Analysis (SNA).

During the twentieth century, the mapping of science slowly adopted the network analysis, which significantly analyzes the cohesive structure of collaborators, identifies the research communities or invisible elite groups, and studies the intellectual structure of any given subject. The availability of large datasets and software programs made it possible to construct networks for any bibliographical entities (author, citation, keywords, and journal) as a unit of analysis to study collaborative pattern and their implications in terms of network theory. Thus, SNA predominantly helps to identify the core authors/research teams, and their linkages, detecting research hotspots, weaknesses, the knowledge diffusion pattern, and dynamics of science. SNA is now becoming a powerful technique in research management and science policy.

The main objective of this study is to sensitize SNA measures among the library and information science communities to enhance the quantification of scientific research building upon the foundation of scientometric analysis. The aims are to demonstrate the construction of co-authorship, co-occurrence and citation network to deploy the cohesive, intellectual structure by applying the SNA measures to the published scientific literature on chromosome anomalies. This study delves into application of fundamental properties; metrics of network and their importance within scientometric research.

Social Network Approach To Scientometrics

SNA has emerged as multi-interdisciplinary subject from the amalgamation of various subjects such as sociology, anthropology, biology, information science, mathematical science, communication, law and economics. It is "a set of methods for the analysis of social structures, methods that specifically allow an investigation of the

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relation aspects of these attributes" (Scott, 2000). A social structure of individual / organization / nation represented by nodes and relationship among them are denoted by ties (edges) analyzed with graph / network models to study spread of communicable diseases, communication pattern, social media analysis, trace the vulnerability in online financial fraud transactions, identify the terrorism networks. In scientific research SNA provides a methodology to analyze social relationship of scientists / researchers in co-authorship network at various levels, conceptual relationship of keywords / themes in co-occurrence network and intellectual relationship of publications in citation network.

It also facilitates visualization of those relations in terms of networks to identify and interpret the pattern of relationships among them. Advancement in information technology invented many network analyzing software for example UCI NET, Node XL, Gepi and Pajek which are versatile software can handle any kind of entity in a complex network. Conversely, bibliometric mapping software such as VOS viewer, biblioshiny, CiteNet Explorer focuses on bibliometric data and confined to bibliometric / scientometric network. This research utilized Pajek software to explore relationship within bibliometric dataset.

Basically, three types of networks can be constructed in scientometrics such as co-authorship network, co-occurrence network and citation network to analysis the research trend and collaborative behaviors. These networks may also be known as bibliometric / scientometrics network. The fundamental network properties of scientometrics networks are provided in the table 1.

Table 1. Network Properties

S. No	Network Properties	Co-authorship network	Co-occurrence network	Citation network
1	Vertex: Node or an actor	It represent an author	Word or keyword	Article / Document / Cited reference
2	Edge: It's a line connecting an author / article / word	Undirected Edge: It runs both directions. Ex. Co - authorship	Undirected Edge: It runs both directions. Ex. Co –occurrence of words	Directed Edge: It runs only one direction. ex. citations
3	Degree: No of edges connected to the vertex	No of authors collaborated in a publication (co-authors)	No of words / keywords co-occurred in an article (co-occurrence)	No of citations that cites an article. In-degree: No of publications that cite an article. Out-degree: No of publications cited by that article (references)

4	Components: it's a group of vertices connected by edges and there exists at least one path from each member of that group.	Giant Component: a largest group of authors connected by publications. It denotes core research community in a particular field. Small Components: there are small group of authors collaborated among themselves frequently and less among members of giant components. Ex. Experts in subfields. Isolates: Single authored publications.	Giant Component: represent thematic component in which words / concepts are co-occur frequently with each other and denotes specific concept. Small Components: word / concept are co-occur less frequently with each other and denotes broader concept. Isolates: an individual concept / word that are not connected with any other in the group.	Giant Component: a largest group of scholarly publications that cites one another and indicates a strong subjective, conceptual relationship among them. Small Components: it's a cluster of cited publications that are highly interconnected in a specific sub field of study. Isolates: Indicates the un cited publications or newly published article.
5	Geodesic Path: it is a shortest path through the network from one vertex to another	A shortest path between two authors in the co-authorship network derived from their collaborative history	A shortest path between two keywords / concept in the co-occurrence network. However geodesic path is not an appropriate method for this network.	A shortest path through the citation network from citing to cited publications. It indicates the flow of knowledge.

Co-authorship Network: It maps the collaborative pattern of authors in any field of study. The network consists of nodes represent authors connected by the line or link or edges indicates collaboration between the authors and the width of lines shows that number of times they have collaborated to publish one or more articles. It is also known as a non-directional network because the links between the authors don't have the direction. Figure 1 exemplified the process involved in the construction of a coauthorship network. The retrieved dataset from the WoS database was exported to bibexcel software for removing the duplicates records, standardizing the name of the authors.

Co-occurrence Network: It is also another type of non-directional network, where the keywords are nodes and the occurrence of the set of keywords are connected by the line or link indicates co-occurrence relationships in the selected publication. The co-occurrence of network assists to identify the related cognitive structure of the subject. A comparison of SNA measures to the non-directional network is illustrated in the table 2. Figure 1 presents the process involved in construction of co-occurrence networks of keyword and subject categories for the publications on chromosome anomalies.

Citation Network: The citation network analysis is dated back to the 1960s, Garfield et al (1964) laid the foundation for citation network analysis, Price (1963) studied the relationship between references and citations (citing / cited matrix) of the articles, Garner (1967) applied graph theory to the citations. Subsequently, overwhelming research on citation network at all level of aggregation on the different subject field are studied and analyzed from different perspectives. The citation network is a directed network consist

of vertices and arcs that represent citing and cited documents connected by the directed arcs to denote the citation relationship between the documents. The documents are treated as vertices in the citation network and identified by the first author of the publication.

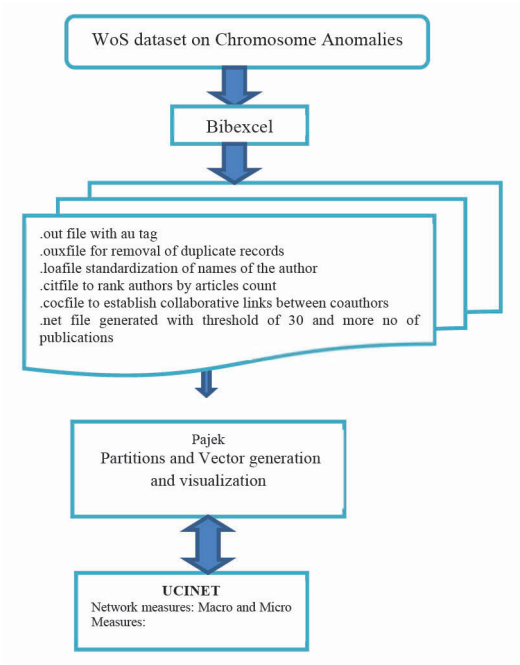


Figure.1 Flow Chart for Construction of CoauthorshipNetwork

Citation networks are acyclical nature since it cites only the previously published documents. self-citations, and an author cited and published the articles that appeared in the same year are represented by the loops in the network which prevent from acyclic network, hence loops must be removed either by shrinking or deleting the arc to avoid the cyclical structure of the network. Figure 3 visualize the process involved in the construction of citation network in the field of chromosome anomalies.

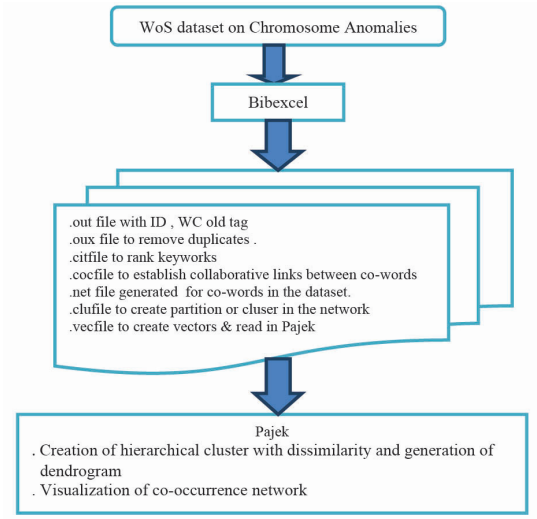


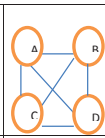
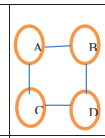
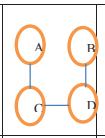
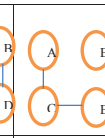
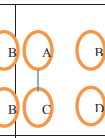
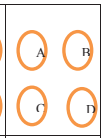
Figure.2 Flow Chart for Construction of Co-Occurrence Network

SNA Measures/ Metrics

SNA measures broadly categorised into micro, meso and macro. Each category offers enumerous metrics to analyze the network. Some of the measures are applicable to all level.

Micro Network Measures: Micro or node level measures are used to study the attributes of the individual unit or node in the network. The most common such measures are centralities utilized to identify the most important or prominent central node, one who involved in many ties in the network. This measure is more appropriate for a non-directional network where there is no direction in the relationship (Wasserman & Faust 1994), such as co-authorship or co-occurrence network. Freeman (1979) categorized centrality measures into three basic types: 1. Degree centrality, 2. Closeness centrality and Betweenness centrality. Table 3 portrays the role of centrality measures in scientometrics analysis.

Table. 2 A Comparison of SNA Measures to the Non-directional Network (adapted from Scott, 2000)

Networks						
No Connected of Vertices / Nodes	4	4	4	3	2	0
No of Links or Edges	6	4	3	2	1	0
Density	1	0.67	0.50	0.33	0.17	00
Degree Centrality for Node A	1 (B,C,D)	0.67(B,C)	0.3,C)	0.3(C)	0.3(C)	0

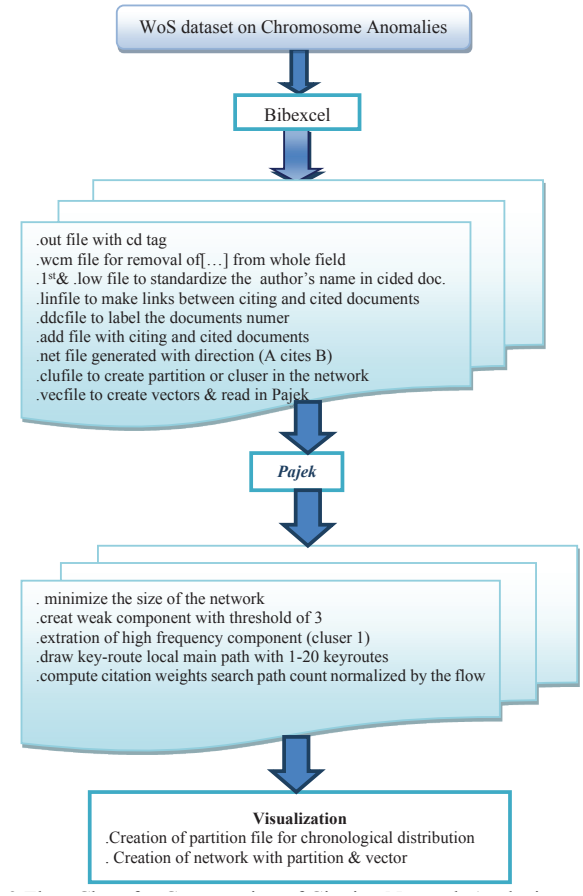


Figure.3 Flow Chart for Construction of Citation Network Analysis

Table 3. Centrality Measures in Scientometrics Networks

Micro metrics	Co-authorship network	Co-occurrence network	Citation network
Degree Centrality: calculated by the number of ties a vertex connected	It indicates the number of times an author collaborated with others to produce or publish a research article.	It indicates that the number of times keywords occurred together in the co-occurrence network	It can also be calculated for citation networks by deriving In degree and Out degree centralities. In the citation network, In degree is nothing but number of documents cites a particular document or vertex (inward link), and out-degree is the number of citing documents to a particular document or vertex (outward link).

Closeness (Cc): It focuses on how close an actor is for all the other actors in the set of actors. It cannot be computed when there are disconnected vertices or presences of isolated nodes in the network.	Cc of an author indicates that the distance or geodesic path between an author to all others in the network. Unlike degree centrality, it calculates the indirect link between the authors in the network. It identifies the most influential authors who can able to extend the research ideas across the network more quickly.	Not applicable	Not appropriate. Cc cannot be computed as the network is disconnected.
Betwenness (Bc): It is the number of shortest paths passing through a node. This measure takes into account the connectivity of the neighbors of the node, giving a higher value for nodes, which bridge clusters.	Bc calculated by the number of the shortest path that transit through a particular author. A high value of betweenness for an author indicates that the author plays the role of connecting different subgroups in the network as middleman or intermediary. These authors can control the flow of information in the network. if those authors have removed from the network then the distance between others would have gone high and the density of the network drastically reduced.	Not applicable	A high value of Bc for an article implies that it perform an important role in connecting different research areas and facilitates the flow of knowledge across the network. It is used to exhibits inter disciplinary research trends.
Hub & Authority: the authority centrality of a document is proportional to the sum of the hub centralities of the document. The hub centrality is proportional to the sum of the authority centrality of the document.	May not applicable for large co-authorship network due to the computation algorithms	Not applicable	In degree of the documents directly implies the authority score, similarly Out degree implies the hub of the citation network. The hub scores represent central documents and authority for prominence documents in the research field.

so Network Measures: Meso level network measures concentrate on the performance of a group of nodes/authors in all networks. The clustering techniques are used to categorize the group of nodes based on the common attributes that exist among them.

***K*-core:** A k-core is a maximal subnetwork in which each vertex has at least degree k within the subnetwork (Nooy, Mrvar & Batagelj 2005, p. 70). This clustering algorithm identifies the degree of vertices that have higher than k-core, in other words removing the vertices/nodes from the network whose degree is lesser than k-core. K-core is a technique to detect the cohesive structure of the subnetworks based on density and connectedness. It may not be applicable for co-occurrence network. Figure 4. exemplify the K-core technique in collaborative countries in the field of chromosome anomalies.

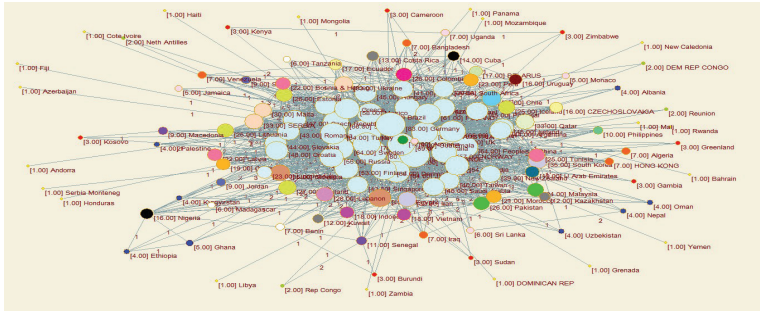


Figure.4 K-core countries in the field of chromosome anomalies.

Main Path Analysis: The basic centrality measures, degree, closeness, and betweenness are insufficient to mesures the augmenting growth of knowledge in any field of study. In addition they failed to consider the time taken into account in knowledge flow. Hummon et al (1990) addressed by proposing the main path analysis method to trace the flow of knowledge and identify one or more research specialties through the most influenctial document in any given field of study. In the citation network, the main path is calculated by the maximum traversal weight on the arc between source and sink vertex. Source vertex is a vertex whose indegree value is zero, similarly whose outdegree is zero known as sink vertex. Traversal weight is the propotion of all paths between sink and source vertex. It is solely applicable to citation network. Figure 5 illustrates the main path of chormosome anomalies research.

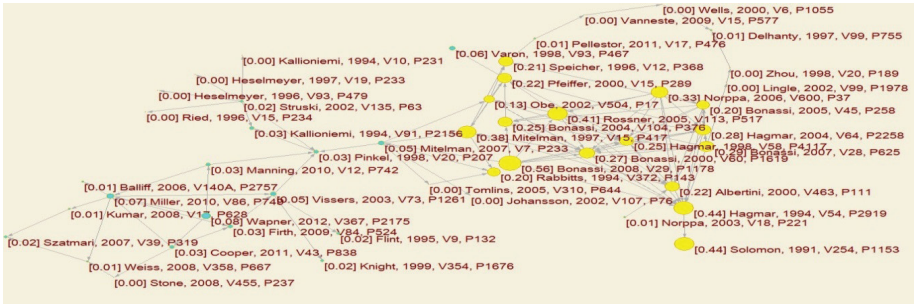


Figure.5 Main Path for the Research Output on Chromosome Anomalies

Hierarchical clustering: The hierachical clustering is the most appropriate meso measures to analyse co-occurrence network, used to demonstrate variuos clusters with common features and structural relationship with others in the network. This technique first identify the keywords / concept that co-occurred or similar are grouped into a cluster and moved on to next most similar pairs of keywords to form a cluster. This process continues until it reaches all keywords and joined in the cluster. A dendrogram is one of the visualizing tool in the SNA widely used in hierarchichal clustering algorithm which group the words by similarities and dissimilarities. It is used to identify the clustering of subject categories and their interrelationship exists between them. A dendrogam for the high frequency words in chromosome anomalies is drawn in the figure 6.

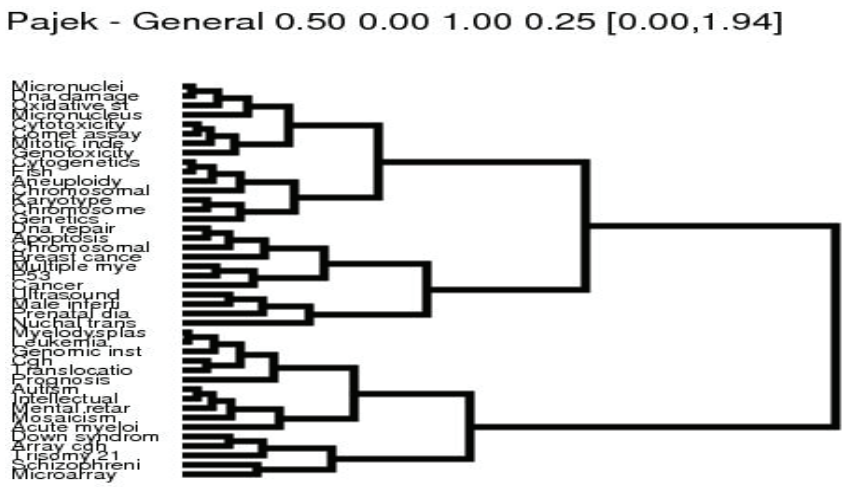


Figure.6 Dendrogram of High Frequency Words in the Field of Chromosome Anomalies

Macro Network Measures: Macro network measures are used to find out the structural attributes of the whole network. It can also be known as global network measures. The following are the basic macro metrics that reveals the cohesive structure of the bibliometric networks.

Density: The density implies the completeness of the network where every node in the network is directly connected with each other.

Diameter: The diameter of a graph is the length of the longest geodesic path between any pair of vertices in the network for which a path actually exists (Newman, 2010). The diameter of a network ranges between minimum of 1 when the network is complete and maximum of g-1 when the network is not connected and diameter is infinite. It is significant to find the diameter of a network because it calculates farthest nodes in the network.

Distance: The distance between two nodes simply means the length of the geodesic of two nodes and geodesics means shortest path between two nodes in a network.

Cluestering Coefficient: This measures can also applied to individual node level (local) and to whole network level (global) which measures the degree of nodes that tends to cluster together in the network. It is the probability of two of node's associates have themselves connected may result in a triangle shape. In topological term, it is a measure of the density of triangles in a network, atriangle being formed every time two of one's collaboratorscollaborate with each other (Newmen, 2010).

Connectedness: A strongly connected network ensures that information or resources reaches directly to all nodes in the network and form as a single component in global network. Conversly a weakly connected network form a multiple components in global network and connect the nodes with semipaths.

Table.4 Importance of SNA Measures in Scientometric research

SNA Measures	Co-authorship network	Co-occurrence network	Citation network
Micro	Helps to identify the most central, influential, and intermediary researcher and research communities and collaboration pattern in the field To trace the development of interdisciplinary research and growth of sub fields.	Helps to identify the core keyword / concept in the research domain Facilitates to study about the relationship between concept and bridge different concepts in the network	Helps to identify the most influential and core publication in the research domain. Recognize the citation pattern Map the flow of knowledge
Meso	Explores potential research communities / cluster and their collaborative pattern among the discipline. Identify the core knowledge creation communities in the research domain Facilitates to study about the dynamics of research communities.	Identity intellectual influence in the research field. Trace the thematic evolution. Reveals the semantic relationship	Helps to understand the research specialities /sub fields in any discipline Trace the Intellectual landscape of the discipline and identify the emerging trend in the research domain.
Macro	Trace the flow of knowledge Study the dynamic of the discipline.	Expose hidden themes and concepts. Explore thematic structural relationship	Used to evaluate impact of scientific research. Trace the mainstream of the discipline and research paradigm.

Table 4 illustrates the significance of SNA measures in scientometric networks.

Conclusion

This study explicitly illustrates the deployment of social network measures into scientometrics research. It also proposes methodological framework to construct different types of scientometrics networks by using Pajek network software. This study extends the scope of scientometrics research by using the SNA measures and uncovers the social and intellectual relationships that underlie research activity.

NOTE: This study is based on the Thesis "Research Output on Chromosomal Anomalies: An Empirical Analysis" submitted to Alagappa University in partial fulfillment for the award of the Degree of Doctor of Philosophy in Library and Information Science.

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EVALUATING DIGITAL INCLUSIVITY: ACCESSIBILITY ASSESSMENT OF LIBRARY WEBSITES OF CENTRAL UNIVERSITIES IN INDIA

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Introduction

In an increasingly digital world, people across the globe rely on websites to access a vast array of information. These online platforms serve as gateways to knowledge, offering users instant access to news, educational resources, entertainment, and much more. However, it can be observed that a group of individuals always get discriminated when attempting to access information from such platforms. Among the most affected are persons with disabilities, who consistently encounter significant barriers in this regard. Persons with disabilities are individuals who require special assistance to perform various daily tasks due to existing barriers. They often use different types of assistive technologies to access information. Various types of disabilities, including hearing impairment, visual impairment, and locomotor disabilities, present different accessibility challenges in the web environment. These challenges manifest as color contrast issues, the absence of text alternatives for non-text content, and the lack of subtitles for audio/ video content. These barriers hinder individuals from utilizing assistive technologies like screen reading programs on websites, resulting in unjustified discrimination in the web environment. Urgent action is needed to address these digital inequalities and ensure digital inclusion for all.

In universities across the country, digital information content is primarily provided through their institutional libraries. In other words, libraries serve as the primary repositories of information for universities. Hence, there arises a need to evaluate the accessibility status of university library websites because libraries are meant to provide equal access to all of their users. As centrally funded institutions governed by the national government, the study used selected central university library websites for evaluation. The study uses the National Institutional Ranking Framework (NIRF) 2023 list as a standardized framework to select the highest-ranked central universities in the country. To evaluate these universities against another internationally recognized standard, the study used version 2.1 of the Web Content Accessibility Guidelines (WCAG 2.1). This

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standard provides a set of clearly defined checkpoints or success criteria to evaluate websites. Accessibility status is determined using how well the web content is compiled with the WCAG 2.1 standard.

In summary, this study will provide proper insight into the level of web content accessibility of Central University library websites based on the Web Content Accessibility Guidelines (WCAG) 2.1 standards. Despite its limitations, the study serves as a robust tool for monitoring accessibility issues and advocating for digital inclusivity.

Related Studies

The amount of digital content is increasing tremendously in the educational environment. Higher educational institutions, including universities, are committed to ensuring Digital inclusivity in academic settings. As libraries serve as the storehouse of information in universities, checking the accessibility of library websites is one of the primary tasks in achieving digital inclusion. This literature review examines the body of research on digital inclusion, university library web accessibility, website accessibility evaluation tools, and more in a systematic manner.

The process of establishing digital inclusion in higher education starts with accessibility. There must be equitable access to information and technology. Using clearly defined frameworks, institutions can work towards this goal. As proposed by (Jane Seale et al., 2010), Such a framework can be drafted around several key components, like technology, Personal factors, contextual factors, resources and choices. More clearly, Technology-enabled teaching, Accessible digital content, Digital literacy and training, Internet access, technical support, and Assistive technologies are all part of digital inclusion.(Way Kiat Bong & Weiqin Chen, 2024)Observe that, over the past 20 years, several barriers have arisen along with the benefits gained from the growth of ICT in higher education. It also highlights the need to train faculties about digital inclusion practices. The study shows that such training should contain topics on disability awareness, policies and legislation, the production of accessible digital materials, etc.(Sloan, 2002) In his chapter, he stated that institutions must offer all users equitable access to e-learning platforms. The web is a powerful platform for e-learning; hence, strengthening web accessibility is paramount. This chapter lists significant web accessibility barriers and solutions to overcome these barriers. Many literatures clarified that persons with disabilities always get unequal access to digital information.(Yesilada et al., 2013) found out that persons with disabilities are not the only community that benefits from accessible websites; it benefits everyone.

There are several quantitative accessibility metrics used to evaluate accessibility websites.(Markel Vigo et al., 2007)in their study says that accessibility metrics can be used for three different purposes: quality assurance within web engineering, information retrieval, and accessibility monitoring. They examined 15 websites using the proposed metric based on the results from two automatic tools: EvalAccess and LIFT. They concluded that the proposed metric is reliable in the cases of both accessibility monitoring and information retrieval.(Parmanto & Zeng, 2005) also proposed an accessibility metric

as an alternative that reduces the shortcomings of other metrics presented at that time. The metric was operated based on WCAG criteria. This metric is tested on a large number of websites to ensure reliability. But(Song et al., 2017)took another initiative by the insignificant correlation between checkpoints or priority levels and user experience. The result was another accessibility metric called WAEM (Web Accessibility Experience Metric). As multiple numbers of metrics start to claim they have more reliability than others(Vigo & Brajnik, 2011) created a framework to choose a metric based on four scenarios. They have created this framework by examining more than 1500 websites.

As stated by (Paz et al., 2021) there are several software tools used to run automatic accessibility evaluations. In accordance with international standards, the W3C offers a list of tools that automate the accessibility review process. The result from all tools will be different,(Abduganiev, 2017)did a comparative study using popular tools to check differences in their results. The study used AChecker, Cynthia Says, EIII Checker, MAUVE, SortSite, TAW, Tenon, and WAVE. The findings of (Padure & Pribeanu, 2020) also point out differences in the results given by several automatic tools. The study explored Romanian Municipal websites by using six different automatic tools and found large differences in errors reported. In this regard (Vargas et al., 2017) stated that we cannot conclude accessibility issues only on the basis of results obtained from automatic tools. Alternatively, some user-centered and heuristic methods are needed for efficient evaluation.

Since libraries are the providers of digital information in higher educational institutions, assessing the accessibility of library websites is very crucial.(Panda & Chakravarty, 2020) studied the accessibility status of IIT libraries in accordance with WCAG 2.1 standard using the Siteimproveweb tool.The conclusion was that there are significant accessibility limitations related to the three conformance levels of the WCAG standard. The results showed that the severity scores were 14.4 (Error), 3.9 (Warning), and 5.2 (Review); the responsibility scores were 6, 9.3 (Webmaster), and 8.3 (Developer), in that order. Another exploratory study done by (Yoon et al., 2016) investigated accessibility issues that visually impaired users face while accessing selected library websites. The study found that web content is not accessible to persons who use screen readers.

Despite the extensive research on digital inclusivity in higher education, several gaps remain unaddressed. The scarcity of research specifically focused on the accessibility of central university libraries is one among them. This present study will primarily focus on central university library websites, an area that has not received adequate attention in accessibility research. By doing this, the study will provide a comprehensive understanding of the digital status of countries' premier institutions.

Methodology

The study population includes the top 100 universities from the NIRF 2023 ranking. The researchers have chosen a sample consisting solely of central universities using a non-probability sampling technique. A total of 11 central universities are part of

this list. To evaluate the accessibility of their home pages, the researchers used the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) developed by W3C/ WAI. The data was collected on the date 28/11/2023. The evaluation method is based on the website's compliance with the WCAG 2.1 standard. To ensure a comprehensive and accurate website accessibility evaluation, this study used an automatic evaluation tool: WAVE. The tool allows users to enter the website address into the box provided to run the test. This tool can visually represent accessibility issues and has a more intuitive user interface. In the final stage of the study, Spearman's correlation test is used to check the correlation between NIRF rank and accessibility score.

The key objectives of the study are :

- To identify the major accessibility issues of the central university library websites.
- To determine the type of accessibility barriers that are greater in number.
- To determine the most neglected accessibility principle of the WCAG 2.1 standard.
- To evaluate how well the content meets the requirements of WCAG standards.
- To check whether there is a correlation between the NIRF rank of universities and the accessibility score of their websites.

Results and Discussions

The findings obtained from the study are discussed in this section. The primary objective of this study is to identify the accessibility status of central university library websites. The result obtained from the WAVE tool is arranged at the beginning of this section. This is followed by a detailed exploration on the basis of the WCAG 2.1 standard. Table 1 lists the URLs of the library home pages, ordered by the NIRF ranks of the central universities from highest to lowest.

Table 1:List of Central Universities

Sl .No	Name of the University	NIRF Rank	Library URL	Acronym
1	Jawaharlal Nehru University	2	/http://lib.jnu.ac.in	JNU
2	Jamia Millia Islamia	3	https://jmi.ac.in/ACADEMICS/University-Library	JMI
3	Banaras Hindu University	5	https://www.bhu.ac.in/Site/UnitHomeTemplate/1_3240_4531_Central-Library-Home	BHU
4	Aligarh Muslim University	9	https://www.amu.ac.in/libraries/maulana-azad-library/home-page	AMU
5	University of Hyderabad	10	/http://igmlnet.uohyd.ac.in:8000	UOH
6	Delhi University	11	https://crl.du.ac.in/index.htm	DU
7	Tezpur University	69	/https://www.tezu.ernet.in/Library	TEZU
8	Mizoram University	76	/https://lib.mzu.edu.in	MZU
9	North Eastern Hill University	80	/https://www.nehu.ac.in/library	NEHU
10	Central University of Tamil Nadu	89	/http://82.180.173.110	CUTN
11	Central University Punjab	100	http://cup.edu.in/library.php	CUP

The accessibility evaluation of library home pages using the WAVE tool is organized in Table 2. The WAVE tool categorizes its results into six distinct categories. These are Errors, Contrast errors, Alerts, Features, Structural elements, and Aria. Errors and Contrast Errors are the serious barriers identified in the evaluation. These are failures to meet WCAG. Alerts are elements that may cause accessibility problems. Features are elements that can improve accessibility when implemented correctly. Structural Elements Shows HTML & ARIA pages and regions, shows the heading structure, identifies hidden elements, Lists regions and headings in order, etc. ARIA Presents accessibility information. It reduces accessibility when used incorrectly.

Table 2: Wave Evaluation

University	Errors	Contrast Errors	Alerts	Features	Structural Elements	ARIA
JNU	8	7	136	3	56	2
JMI	22	5	35	2	49	4
BHU	3	21	43	11	66	85
AMU	122	56	276	78	38	27
UOH	14	33	22	3	8	0
DU	19	2	55	3	1	0
TEZU	164	3	345	15	43	115
MZU	34	38	33	22	29	41
NEHU	11	5	40	46	3	0
CUTN	10	0	34	8	37	34
CUP	215	6	177	44	44	49
Total	622	176	1196	235	374	357

Table 2 shows that the CUP and TEZU websites have a large number of errors, 215 and 164, respectively. AMU website has greater contrast errors(56); at the same time, the CUTN website didn't report any contrast errors. Both the errors and contrast errors need immediate attention because they contribute to serious accessibility barriers. In the case of Alerts, the TEZU website scored the highest number (345) and AMU scored 276. Since alerts may cause accessibility problems in the future, it will be a good move if developers try to reduce their number. AMU website has a greater number of Features, and BHU has a greater number of structural elements. TEZU has the highest counts for ARIA elements. It can also be seen that the tool didn't identify the existence of ARIA elements in the library websites of UOH, DU, and NEHU. This means they lack critical accessibility features that help users with assistive technologies. For understanding, a high-level summary of the WAVE evaluation results of university library websites is given in Table 3.

Table 3:Summary of WAVE evaluation

Barriers	Number	Percentage
Error	622	21.01
Contrast Error	176	5.95
Alerts	1196	40.41
Features	235	7.94
Structural Elements	374	12.64
Aria	357	12.06
Total	2960	100.00

Table 3 summarizes the distribution of accessibility elements obtained by WAVE evaluation. It can be seen that the warning element, "Alerts," is the greatest in number (40.41%). Alerts are the elements that may cause an accessibility problem. Developers can consider these warnings while improving accessibility. "Errors" (21.01%) and "Contrast errors" (5.95%) are the serious barriers identified by the tool. These elements need immediate attention because these are obstacles for disabled persons in accessing information. Features that are the positive elements of accessibility are only 7.94 %. The Structural elements and ARIA are 12.64% and 12.06%, respectively. As both are positive elements, addressing their lower percentage on university library websites is also relevant.

Figure 1 gives a graphical summary of the WAVE evaluation result.

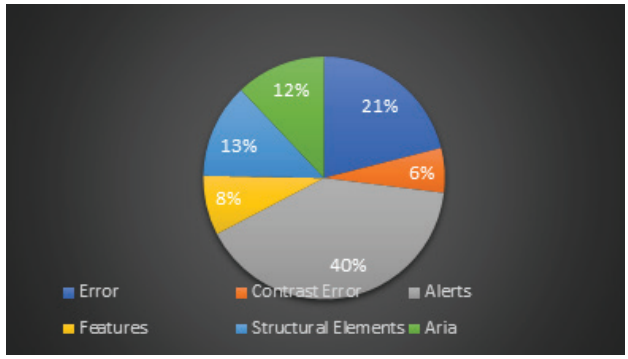


Figure 1 Wave Evaluation

For further analysis, only the number of Errors and Contrast Errors are used, As Errors and Contrast errors are critical accessibility barriers identified in the study. They can significantly hinder user interaction and comprehension of web content. Besides that, in order to have a single composite metric, namely the accessibility score, contrast errors are incorporated with general errors. Table 4 below gives a graphical representation of the accessibility scores of universities.

Table 4: Accessibility score

Name of the University	Accessibility score	Percentage
JNU	15	1.88
JMI	27	3.38
BHU	24	3.01
AMU	178	22.31
UOH	47	5.89
DU	21	2.63
TEZU	167	20.93
MZU	72	9.02
NEHU	16	2.01
CUTN	10	1.25
CUP	221	27.69
Total	798	100.00

Table 4 indicates that the library website of CUTN has the lowest accessibility score of 10, accounting for 1.25% of the total. This indicates that CUTN's library website has the fewest accessibility issues. JNU and NEHU follow with scores of 15 and 16, representing 1.88% and 2.01% of the total, respectively. These scores suggest relatively better accessibility compared to other universities. TEZU (167, 20.93%) and AMU (178, 22.31%) show higher levels of accessibility issues. While **CUP** has the highest accessibility score of 221, representing 27.69% of the total score. This indicates that CUP's library website has the most significant accessibility barriers among the universities listed.

The WAVE Tool not only provides the number of detected errors but also identifies the types of errors found. The types of accessibility errors detected from Central University Library websites using the WAVE tool are summarized in Table 5 below.

Table 5: Errors v/s Number violations

Sl.No.	Name of the Error	No. of violation	Mean	Success criteria
1	Missing alternative text	48	4.36	1.1.1
2	Empty button	10	0.91	1.1.1, 2.4.4
3	Blinking content	1	0.09	2.2.2
4	Marquee	4	0.36	2.2.2
5	Contrast error	176	16	1.4.3
6	Linked image missing alternative text	276	25.09	1.1.1, 2.4.4
7	Missing form label	197	17.91	1.1.1, 1.3.1, 2.4.6, 3.3.2
8	Empty Link	65	5.91	2.4.4
9	Language missing or invalid	4	0.36	3.1.1
10	Missing or uninformative page title	2	0.18	2.4.2

11	Empty table header	6	0.55	1.3.1
12	Spacer image missing alternative text	7	0.64	1.1.1
13	Broken skip link	1	0.09	2.1.1, 2.4.1
14	Broken ARIA reference	1	0.09	1.3.1, 4.1.2

Table 4 shows that 14 types of errors are identified in the WAVE website accessibility evaluation of Central University Library websites. The result is depicted as the total number of violations made by each type of error and the respective success criteria violated in each case. It can be seen that the most commonly occurring error is a Linked image missing alternative text (25.09), followed by this Missing form label (17.91), Contrast errors (16), Empty link (5.91), and Missing alternative text (4.36). Blinking content, broken skip links, and broken ARIA references each have a mean score of 0.09, making them the errors with the fewest violations. In order to determine the most neglected accessibility principle of the WCAG 2.1 standard, the types of errors detected are arranged according to WCAG success criteria in Table 6 below.

Table 6: Most neglected Accessibility principle.

Sl. No.	Barrier	Success Criteria	Level	Principle	Total
1	Non-Text content	1.1.1	A	Perceivable	538
2	Info and Relationships	1.3.1	A	Perceivable	204
3	Contrast (minimum)	1.4.3	AA	Perceivable	176
4	Keyboard	2.1.1	A	Operable	1
5	Pause, Stop, Hide	2.2.2	A	Operable	5
6	Bypass Blocks	2.4.1	A	Operable	1
7	Page Titled	2.4.2	A	Operable	2
8	Link Purpose (in context)	2.4.4	A	Operable	351
9	Headings and Labels	2.4.6	AA	Operable	197
10	Language of Pages	3.1.1	A	Understandable	4
11	Labels or Instructions	3.3.2	A	Understandable	197
12	Name, Role, Value	4.1.2	A	Robust	1

Table 6 says that non-text content (1.1.1) is the most violated success criterion (538). If this success criterion gets violated, it will be very hard for all disabled users who need a text alternative to understand non-text content to access web content. Also, assistive technologies like screen readers cannot be operated in such situations. Link Purpose (in context) (351), Info, and Relationships (204) also show a high level of violation. Ambiguous or unclear link text may cause confusion and hinder the ability of persons with cognitive disability to comprehend the content. A greater number of violations of Info and Relationships criteria will aid the difficulty in navigation through web content. Also, it can be seen that the violations of success criteria and violations of accessibility principles are interconnected.

Table 6 summarizes violations of accessibility principles more clearly. The table is arranged in the form of the number of errors detected against each principle.

Table 7: Accessibility principles v/s number of errors

Principle	Errors	Percentage
Perceivable	918	54.74
Operable	557	33.21
Understandable	201	11.99
Robust	1	0.06
Total	1677	100.00

Table 7 shows that the most neglected accessibility principle is Perceivable (54.74%). This means that, from the websites evaluated, about 54.74% of information and user interface components are presented in a way that users cannot perceive. 33.21% of user interface components and navigation are not operable, and 11.99% of information and user interfaces are not understandable to persons with disabilities. The least neglected accessibility principle is Robust (0.06%), which means 0.06% of contents are not robust enough that they can be interpreted by a wide variety of user agents, including assistive technologies.

Figure 2, given below, is the graphical representation of violations of accessibility principles.

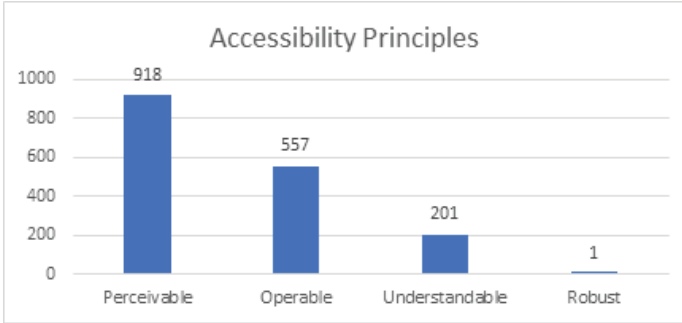


Figure 2:Accessibility Principles

A conformance evaluation was conducted based on the number of errors found at each conformance level to evaluate how well the content of university library websites meets WCAG standards.WCAG 2.1 has three levels of conformance: A, AA, and AAA. Additionally, the requirement states that conformance is not possible without at least satisfying all Level A success criteria. The result obtained from the conformance evaluation is given in Table 6.

Table 8: Conformance Evaluation

Conformance	A	AA
Errors	1304	373
Mean	94.00	33.91

Table 8 shows that average accessibility errors across all websites for levels A and AA are 94 and 33.91, respectively. Most of the accessibility errors are level A, which is the minimum conformance level that websites must satisfy for essential web accessibility. Its clear from the table that University Library websites are struggling to reach even level A conformance. None of the web pages had accessibility errors based on level AAA. Conformance to level AAA is not required generally because it's impossible to satisfy level AAA success criteria for some content.

Spearman's correlation test was used to check the correlation between accessibility score and NIRF rank. The result obtained from the test is depicted in Figure 3, given below.

Correlations

			Rank	Accessibility score
Spearman's rho	Rank	Correlation Coefficient	1.000	.155
		Sig. (2-tailed)	.	.650
		N	11	11
	Accessibility score	Correlation Coefficient	.155	1.000
		Sig. (2-tailed)	.650	.
		N	11	11

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Figure 3: Spearman's Correlation test

Figure 3 shows that there exists only a Very weak correlation (0.15) between the NIRF ranks of universities and accessibility errors found, and the p-value is not significant. It means that the website's higher NIRF rank doesn't mean it has greater accessibility

Conclusion

In conclusion, this study has examined the accessibility of Central University library websites in accordance with the Web Content Accessibility Guidelines (WCAG) 2.1 standards. The study identified 14 types of accessibility errors in websites. Among the errors detected, Linked images missing alternative text, Missing form labels, Contrast errors, Empty links, and Missing alternative text are the major accessibility barriers. The compliance test with the WCAG 2.1 standard reveals a predominant occurrence of errors related to the absence of text alternatives for non-text content. This underscores the significance of the Non-text content (1.1.1) success criterion as the most frequently

violated aspect of the WCAG 2.1 standard. As a result, screen reader users and persons with hearing disability will find it difficult to access important information. Following the evaluation, Link Purpose (in context) (2.4.4) and Info and Relationships (1.3.1) emerged as the next most violated success criteria after Non-text content (1.1.1), indicating prevalent accessibility issues in these areas. If 2.4.4 is violated, screen reader users won't get sufficient information about the purpose or destination of the link. Similarly, the violation of 1.3.1 creates difficulty in navigating and understanding the web content.

Understanding the broader context of web accessibility, it's essential to examine how these violations align with the underlying accessibility principles and conformance levels of the WCAG 2.1 standard. It has been found that the most neglected accessibility principle is Perceivable 54.74% and the least neglected is Robust 0.06%. It is clear that more than half of these websites' content is presented in a way users can not perceive. Furthermore, the majority of accessibility errors correspond to level A, which represents the fundamental conformance level required for basic web accessibility. This alarming trend suggests that many websites fall short of meeting even the minimum accessibility standards mandated. Spearman's correlation test found that there is only a very weak correlation between NIRF rank and accessibility score. It summarises that having a good rank doesn't mean the website is accessible.

Digital accessibility has a more significant role in providing equal or inclusive education to all. Digital libraries are the doorstep to digital accessibility in higher education institutions. But the irony is that even top-ranked universities in the country do not have an accessible library website. In order to meet at least the minimum level of accessibility, developers and host institutions should check the compliance of their websites to accessibility standards like WCAG, Section 508, etc.

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THE ROLE OF ELSEVIER IN UNIVERSITY OF KERALA'S SCHOLARLY EVOLUTION: A SCIENTOMETRIC PERSPECTIVE

Rajesh Kumar. K[1] & Dr. P. Padma[2]

Introduction

The University of Kerala, renowned for its academic excellence and research prowess, has been a beacon of knowledge dissemination and scholarly inquiry in the region. Over the past decade, the University has demonstrated a remarkable commitment to advancing the frontiers of knowledge across various disciplines, solidifying its position as a leading academic institution in India. From 2014 to 2023, the University of Kerala witnessed a surge in research productivity, as evidenced by the prolific output of scholarly publications indexed in databases such as the Science Citation Index Expanded. Notably, the University's researchers, including prominent figures such as Anirudhan TS, Sankararaman S, and Shiblili SMA, have made significant contributions to the academic discourse, with their works spanning diverse fields of study.

Meanwhile, Elsevier, a globally recognized scientific publisher, has been instrumental in disseminating cutting-edge research from the University of Kerala and other academic institutions worldwide. With a commitment to fostering innovation and excellence in scholarly communication, Elsevier has played a pivotal role in amplifying the impact of Kerala's research endeavors on the global stage. Notably, a substantial portion of the University's scholarly output, including works authored by prolific researchers such as Anirudhan TS, Sankararaman S, and Shiblili SMA, has been published by Elsevier, underscoring the publisher's significance in the academic ecosystem.

Recent reporting by the leading Indian daily, The Hindu, further accentuates the burgeoning research landscape of Kerala's universities. According to The Hindu's coverage of Elsevier's assessment, Kerala's academic institutions, including the University of Kerala and CUSAT, have witnessed a commendable growth trajectory in research output, with a notable emphasis on fields such as Material Science, Chemistry, Engineering, and Astronomy. Moreover, the report highlights the increasing prominence of international collaborations in enriching Kerala's research ecosystem while advocating

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for strengthened academia-industry partnerships to unlock untapped potential and drive societal impact.

This study seeks to delve deeper into the research productivity of the University of Kerala during the specified period, focusing on its engagement with Elsevier as a key publishing partner. By examining the scholarly contributions of prolific authors and assessing the broader implications of Kerala's research endeavors, this research endeavor aims to offer valuable insights into the University's evolving research landscape and its impact on academia and beyond.

Review of Literature

In recent years, a growing body of literature has explored various dimensions of research productivity, innovation, and scholarly impact across different contexts. Akhmetshin[1] et al. (2024) delve into the strategic imperative of research and innovation in education policy, emphasizing the need to integrate universities' research activities into unified innovation processes. Through regression analysis, they establish a relationship between Hirsch index values from Scopus and Google Scholar, highlighting Google Scholar's potential to efficiently evaluate research and innovation activities, particularly in medical universities. This aligns with the entrepreneurial university model, allowing for considering Russian-language publications in indexing-similarly, Ali, M. F. [2](2024) investigates the impact of adopting scientometric evaluation in academic promotion within Egyptian higher education. The study examines the hypothesis that this approach intensifies international publications and alters publication patterns in Egyptian universities compared to research centers not employing this evaluation method. Findings demonstrate positive effects on Web of Science (WoS) publications, with significant differences observed across examined variables, underscoring the evaluation's role in fostering international productivity.

Raman [3]et al. (2024) conducted a bibliometric analysis of reviews on Sustainable Development Goals (SDGs) and Sustainability. They report substantial growth in publications and citations from 2016 to 2022, identifying key countries, institutions, and thematic areas contributing to SDG-related research. The study underscores the importance of interdisciplinary research in achieving a sustainable future. Alfirević, N[4]. et al. (2023) conducted a bibliometric analysis of global research on the UN Sustainable Development Goals (SDGs) and the United Nations sustainability agenda. Leveraging Elsevier Scopus-indexed outputs, their study focuses on productivity, impact, influential authors, publication outlets, collaboration patterns, and intellectual structure of SDG-related research, revealing insights into the research landscape in 2017–2022.

Basumatary [5]et al. (2023) present a state-of-the-art scientometric study focusing on research growth, trends, and key players in genomics research in India. They identify increasing publications and citations in the field, focusing on genetic diversity, polymorphism, comparative genomics, and other genomic topics. The study sheds light on the strengths and weaknesses of the research infrastructure in India and the

effectiveness of government policies and funding mechanisms. Cabanillas-Lazo [6]et al. (2023) perform a scientometric analysis of scientific production by 27 Scientific Societies of Medical Students (SOCEM) between 2011 and 2020. Document analysis and SciVal tool utilization highlight publication patterns, citation impact, and collaboration dynamics within the undergraduate scientific community, identifying leading authors, impactful journals, and productive scientific societies. Damaševičius and Zailskaitė-Jakštė [7](2023) analyzes the impact of the ongoing war in Ukraine on academic productivity and collaboration networks of Ukrainian researchers. Through bibliographic analysis of open-access MDPI journals, they observe a decline in international collaboration diversity in 2022. This study emphasizes the necessity of international research collaboration during national crises.

Kifor[8] et al. (2023) investigate research productivity among Romanian public universities for 2012–2020. Employing canonical multivariate methods, they analyze institutional and bibliometric data to understand the predictors of research productivity. The study highlights the influence of university category, institutional public budget, teaching workload, and PhD student engagement on research output indicators. A study conducted by Kutnjak Ivković, S[9]. et al. (2023) explore faculty publication patterns in the top 21 doctoral programs in criminology and criminal justice in the U.S. Using latent profile analysis, they identify distinct profiles of faculty productivity based on publication types. Their study emphasizes multidimensional measures of publication productivity over rank-order metrics. Li and Yin [10](2023) investigate the influence of publication on university ranking using the 2020 US News Best Global Universities Ranking results. Their study analyzes publication-related criteria, including discipline coverage, publication productivity, research impact, interdisciplinary research, and research collaboration, highlighting the significance of multidisciplinary research in enhancing publication quality and university ranking.

Methodology

The research methodology employed in this article involved a systematic process for analyzing scholarly publications affiliated with the University of Kerala from 2014 to 2023. A comprehensive search was conducted using the Web of Science Core Collection, identifying 2283 documents. Subsequently, the dataset was refined to focus exclusively on publications from the top ten publishers, considering their significant influence in the academic landscape. This refinement ensured that the study prioritized high-impact journals and reputable publishing houses. Additionally, the dataset was further narrowed down to include only publications within the specified timeframe, ensuring relevance to the study period. Following these steps, a final dataset comprising 1836 unique documents was obtained. Before analysis, diligent efforts were made to remove duplicate entries from the dataset, ensuring data integrity and accuracy. Statistical tools and Microsoft Excel were then utilized for in-depth analysis of the refined dataset. Various analytical techniques were applied, including calculation of publication counts by publisher and author, examination of publication trends over time, identification of prolific authors,

and comparative analysis of publication output across publishers. Visual aids such as charts, graphs, and tables were generated using Excel to present the findings clearly and concisely. The methodology aimed to provide a rigorous and systematic approach to understanding the research productivity of the University of Kerala and its engagement with top publishers, facilitating insightful interpretations and implications for scholarly discourse.

Objectives

- To analyze the publication trends of the University of Kerala over ten years with a specific focus on Elsevier's contributions.
- To identify and analyze the top authors, productive journals, and prevalent research areas.
- To assess the University's research alignment with Sustainable Development Goals (SDGs) established by the United Nations.
- To analyze the role of Elsevier in shaping the research environment of the University of Kerala.

Scope and Limitations

This article aims to provide a comprehensive analysis of the research productivity of the University of Kerala from 2014 to 2023. The scope of the study encompasses the examination of scholarly publications affiliated with the University, focusing particularly on those published by the top publishers in the academic domain. Through systematic data collection and analysis, the study seeks to identify publication trends, prolific authors, and the distribution of research output among the selected publishers. By delving into the University's research landscape, the article aims to offer valuable insights into its scholarly endeavors and the extent of its engagement with prominent publishers.

The study was conducted using Web of Science (WoS) with the specified parameters, including the affiliation with the University of Kerala, the period from 2014 to 2023, and refinement with the top 10 publishers' publications. The reliance on WoS as the sole database may result in the exclusion of relevant publications that are not indexed within its database. This could potentially overlook significant contributions from researchers affiliated with the University of Kerala, especially if they publish in journals or platforms not covered by WoS. Refining the search to the top publishers can help focus the analysis on reputable sources; it may inadvertently exclude valuable research published by smaller or emerging publishers, thereby limiting the comprehensiveness of the dataset. Finally, the data downloaded on April 2nd, 2024, at 4 pm IST, might not reflect updates or additions made to the WoS database after that time, potentially missing out on new publications or corrections that could affect the findings of the study.

Discussions

Table 1 Publication Output by Top 5 Publishers: University of Kerala (2014-2023)

Pub Years	Records	Elsevier	Springer Nature	Taylor & Francis	Wiley	Royal Soc Chemistry
2023	317	147	63	27	25	11
2022	269	120	56	29	17	9
2021	286	141	67	29	12	6
2020	226	103	61	24	14	8
2019	155	62	39	27	13	3
2018	145	77	29	12	10	3
2017	144	67	47	13	4	2
2016	97	49	19	10	5	7
2015	110	53	24	18	4	3
2014	87	45	16	10	8	4
Total	1839	864	421	199	112	56

Over the period from 2014 to 2023, the University of Kerala demonstrated a consistent commitment to research, as evidenced by its publication output across various publishers (Table 1 in reverse chronological order). Elsevier emerged as the most prolific among the top ten publishers, contributing substantially to the University's scholarly endeavors with 864 documents. Springer Nature and Taylor & Francis contributed significantly, with 421 and 199 papers, respectively. These publishers played instrumental roles in disseminating the University's research output across diverse fields. Notably, the publication counts fluctuated over the years, with peaks observed in 2023 and 2021 and a notable increase in 2020 despite the challenges posed by the COVID-19 pandemic. This data underscores the University's commitment to advancing knowledge and highlights the importance of strategic partnerships with leading publishers in amplifying research visibility and impact.

Table 2: Publication Output of Top Ten Authors by Top 5 Publisher Affiliation

Top ten authors	Elsevier	Springer Nature	Taylor & Francis	Wiley	Royal Soc Chemistry
Anirudhan TS	64	2	11	2	5
Sankararaman S	18	38	2	0	1
Shibli SMA	47	3	0	3	7
Pillai VPM	41	15	0	0	2
Nair AS	13	13	18	4	4
Swapna MS	11	24	2	0	0

Sajinkumar KS	21	15	2	1	0
Kumar AB	5	7	10	1	0
Gopchandran KG	28	3	0	1	2
George S	13	16	1	7	3

Table 2 illustrates the Publication Output of Top Ten Authors by Publisher Affiliation. The analysis of publication output by the top ten authors affiliated with the University of Kerala reveals a valuable understanding of their scholarly contributions across various publishers. Among these authors, Anirudhan TS emerges as a prolific contributor, with a significant presence in Elsevier publications, totaling 64 documents, alongside notable contributions to journals from Springer Nature, Taylor & Francis, Wiley, and the Royal Society of Chemistry. Similarly, Sankararaman S demonstrates a diverse publishing portfolio, with a notable emphasis on Springer Nature publications, totaling 38 documents, while contributing to Elsevier and Taylor & Francis journals. Notably, Sankararaman S has fewer publications in Elsevier due to his expertise in optoelectronics, which might have led to a more substantial presence in Springer Nature journals.

On the other hand, authors like Anirudhan TS and Shibli SMA, whose research areas are predominantly in chemistry, exhibit a higher number of publications in Elsevier journals. Shibli SMA's publication profile, characterized by a substantial presence in Elsevier journals with 47 documents, supplemented by contributions to Wiley and the Royal Society of Chemistry publications, underscores the influence of research focus on publication trends. This observation highlights the exact relationship between research specialization and publishing preferences among the top authors at the University of Kerala.

Figure 1 Top author's contribution to Elsevier publications

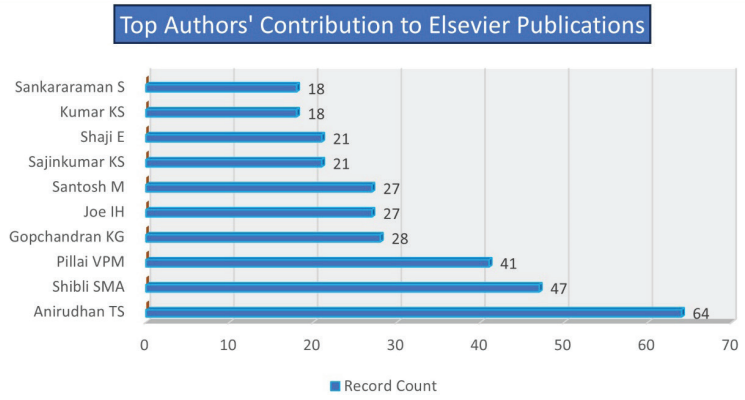


Figure 1 highlights the contribution of top authors affiliated with the University of Kerala to Elsevier publications. Sankararaman S's relatively lower publication count of 18 in Elsevier journals can be attributed to his specialization in optoelectronics, which aligns

with the observation that the other top two authors, Anirudhan TS and Shibli SMA, whose research areas predominantly lie in chemistry, exhibit a higher number of publications in Elsevier journals. Anirudhan TS is a leading contributor with 64 publications, followed by Shibli SMA with 47 publications.

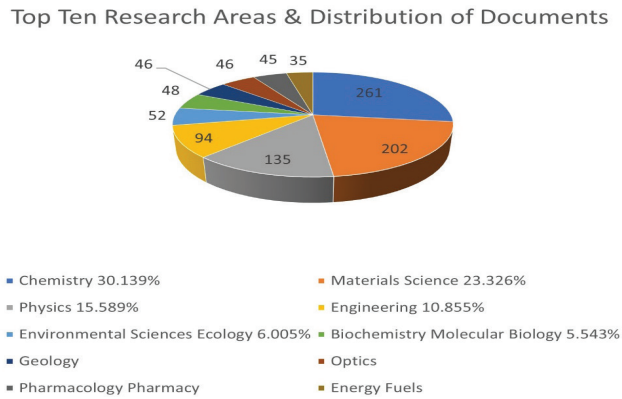
Table 3. Top Ten Elsevier Journals and Citations

JOURNAL	Record Count	% of 866	Times Cited	Average per item
Journal of Molecular Structure	40	4.619%	240	6
Journal of Alloys and Compounds	32	3.695%	584	18.25
Ceramics International	22	2.540%	243	11.05
Spectrochimica Acta Part A Molecular and Biomolecular Spectroscopy	22	2.540%	332	15.09
International Journal of Biological Macromolecules	20	2.309%	403	20.15
Applied Surface Science	19	2.194%	418	22
Materials Chemistry and Physics	18	2.079%	178	9.89
Marine Pollution Bulletin	16	1.848%	268	16.75
Materials Science and Engineering B Advanced Functional Solid-State Materials	16	1.848%	76	4.75
Discrete Applied Mathematics	14	1.617%	18	1.29

Table 3 lists the top ten Journals associated with Elsevier. The University of Kerala's research productivity, as reflected in its contributions to the top 10 journals published by Elsevier, presents an intriguing narrative of quantity versus impact. While some journals exhibit fewer publications, they tend to garner more citations per item, indicating their impact and influence within their respective fields. Some of these journals show a lower publication count but a higher average citation per item, indicating their significant influence despite a smaller count. Journals with a specialized focus may attract a dedicated readership and foster a citation culture within the research community, leading to higher citation rates despite lower publication volumes. Journals like "Journal of Alloys and Compounds" and "Applied Surface Science" boast fewer publications, with 32 and 19 records, respectively, attracting notable citation counts of 584 and 418, with average citations per item of 18.25 and 22. This discrepancy underscores the quality and impact of the research published in these journals, suggesting that they serve as vital platforms for disseminating high-impact research from the University of Kerala across diverse scientific domains.

Conversely, journals with a higher publication count may exhibit a lower average citation per item, reflecting a broader but potentially less influential scope of research. For example, "Journal of Molecular Structure" and "Ceramics International" have higher publication counts of 40 and 22 records, respectively, yet their average citations per item are comparatively lower at 6 and 11.05. This phenomenon underscores the importance of considering quantity and quality when evaluating research impact.

Figure 2 Top Ten Research Areas: Distribution of Documents Published by Elsevier



The distribution of documents across the top ten research areas, as published by Elsevier from the University of Kerala, provides insights into the University's scholarly pursuits (Figure 2). Chemistry is the most prominent research area, constituting 30.139% of the total documents, followed closely by Materials Science at 23.326% and Physics at 15.589%. Engineering, Environmental Sciences, and Biochemistry Molecular Biology also feature prominently, underscoring the University's diverse research interests and contributions across various scientific disciplines. This distribution reflects the institution's commitment to advancing knowledge and addressing complex challenges ranging from fundamental sciences to applied research.

Table 4 Research Alignment with Sustainable Development Goals.

No.	SDG	Documents	% of 866
1	No Poverty	1	0.115
2	Zero Hunger	6	0.693
3	Good Health and Well-Being	321	37.067
4	Quality Education	1	0.115
5	Gender Equality	4	0.462
6	Clean Water and Sanitation	92	10.624
7	Affordable and Clean Energy	80	9.238
8	Decent Work and Economic Growth	1	0.115
9	Industry, Innovation and Infrastructure	7	0.808
10	Reduced Inequalities	0	
11	Sustainable Cities and Communities	86	9.931
12	Responsible Consumption and Production	15	1.732
13	Climate Action	68	7.852

14	Life Below Water	13	1.501
15	Life on Land	21	2.425
16	Peace, Justice, and Strong Institutions	0	

The Sustainable Development Goals (SDGs) established by the United Nations in its 2030 Agenda aim to address pressing global challenges and promote sustainable development worldwide. These 17 goals encompass various social, economic, and environmental dimensions, ranging from poverty alleviation to climate action, aiming to create a more equitable and sustainable world. Each goal represents a call for action by all countries to tackle specific issues and improve the well-being of people and the planet.

Table 4 offers insights into the alignment of research published by Elsevier from 2014 to 2023 with the SDGs. The categorization of documents according to the SDGs allows for a comprehensive understanding of the research landscape about sustainable development priorities. Analysis reveals varying levels of focus across different goals, with some goals such as "Good Health and Well-Being" and "Clean Water and Sanitation" accounting for a significant proportion of research output, while others like "No Poverty" and "Quality Education" have comparatively fewer publications. This distribution underscores the diverse research efforts to address specific SDGs, ranging from health and environmental sustainability to social and economic development. Notably, some goals, such as "Reduced Inequalities" and "Peace, Justice and Strong Institutions," have zero representation in these crucial SDGs, indicating potential areas for further research and exploration. It suggests the need for deeper investigation into the underlying factors contributing to this disparity. Understanding why certain SDGs, especially those rooted in social science and humanities, receive less research attention can inform strategies to enhance academic engagement and foster multidisciplinary collaboration to address pressing societal challenges.

Figure 3 NIRF ranking of the University of Kerala 2017-2023

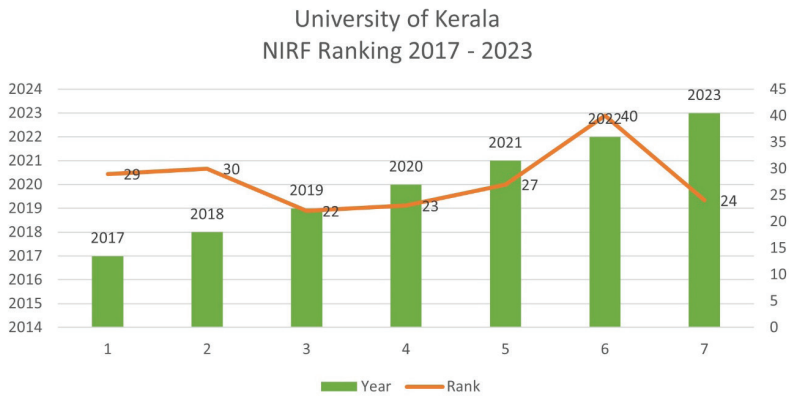


Figure 3 represents the NIRF ranking from 2017 to 2023. The University of Kerala's publication output and NIRF ranking demonstrate a nuanced relationship between research productivity and institutional ranking. Despite fluctuations in publication counts, with notable increases in 2020 and 2023, the University's NIRF ranking exhibited variations, reaching a peak of 22 in 2019 and 24 in 2023 and dipping to 40 in 2022. The dominance of Elsevier as the leading publisher underlines the significance of collaboration with reputable publishing houses in driving research output, with Elsevier contributing the highest number of documents (864) during the study period. While higher publication output may positively influence ranking, other factors such as research quality, impact, and academic reputation also play pivotal roles. Thus, the University's academic standing reflects a complex interplay of various factors beyond sheer publication counts, highlighting the multifaceted nature of institutional assessment and the importance of strategic collaboration with top publishers in enhancing research visibility and impact. This suggests that while publication output is a contributing factor, it may not be the sole determinant of NIRF ranking.

The Role of AI Tools in Driving Research Productivity at the University of Kerala

This section of the article explores the impact of AI tools on the research output of the University of Kerala over the specified period. The research output of the University of Kerala exhibits a notable upward trend from 2014 to 2023, as evidenced by the increasing number of publications each year. This growth trajectory aligns with the advancements in artificial intelligence (AI) tools and their integration into academic research processes. Over the past decade, AI technologies have gained prominence in various fields, including academia, offering researchers powerful tools for data analysis, text generation, literature review, and more.

Moreover, using AI tools significantly enhanced the quality and depth of research conducted at the University of Kerala. AI-powered tools can aid researchers in conducting comprehensive literature reviews, identifying relevant sources, and extracting key insights from vast data. By leveraging AI algorithms for tasks such as plagiarism detection, grammar checking, and data analysis, researchers can ensure their work's accuracy, integrity, and rigor, thereby increasing the likelihood of publication acceptance and citation. AI tools such as Grammarly and plagiarism checkers are available through IP-based access within university systems. Such tools enable researchers and students to refine their writing and ensure academic integrity without additional costs or barriers. With Grammarly, for instance, scholars can receive instant feedback on grammar, punctuation, and style, enhancing the clarity and coherence of their research papers. Similarly, plagiarism checkers empower researchers to uphold academic honesty by verifying their work's originality and identifying any unintentional plagiarism before submission. By integrating these AI tools into the University's infrastructure, the University of Kerala fosters an environment conducive to scholarly excellence, thereby facilitating the growth of research output over the specified period.

Table 5: Types of AI tools commonly used in research writing

Type	Description	AI Tools
Text Generation Tools	Utilize natural language processing (NLP) techniques to generate text based on given prompts or inputs.	OpenAI's GPT, Google's BERT
Grammar and Style Checkers	Help ensure writing is grammatically correct and adheres to appropriate style guidelines. Can identify errors and offer suggestions for improvement.	Grammarly, ProWritingAid, Microsoft Word's grammar checker
Plagiarism Checkers	Compare text against a database to identify instances of plagiarism or improper citation.	Turnitin, Copyscape, Plagscan
Reference Management Tools	Assist in organizing and managing reference materials, citations, and bibliographies. Streamline citing sources and creating bibliographies.	Zotero, Mendeley, EndNote
Data Analysis Tools	It is essential for analyzing quantitative data, creating visual representations, and interpreting results.	RStudio, Python libraries (e.g., Pandas, Matplotlib, Seaborn), Tableau
Language Translation Tools	Translating documents or communications accurately is especially useful for international collaborations or dealing with literature in multiple languages.	Google Translate, DeepL, Microsoft Translator
Research Collaboration Platforms	Facilitate collaboration among researchers by providing tools for document sharing, version control, communication, and project management.	Google Workspace, Microsoft 365, Slack
AI-based Literature Review Tools	Automate searching, filtering, and summarizing relevant academic papers and articles to conduct literature reviews more efficiently.	Iris.ai, Meta, Semantic Scholar

AI tools for research writing have become increasingly prevalent, aiding researchers in various aspects of their work, from generating ideas to refining drafts. Table 5 represents the types of AI tools commonly used in research writing and their uses.

Findings

The findings reveal a vibrant academic landscape at the University of Kerala characterized by prolific research output. Elsevier emerged as a significant contributor, publishing nearly half of the documents analyzed. The top authors, Anirudhan T S, Shiblili SMA, and Pillai VPM, played instrumental roles in driving research productivity. Journals such as the Journal of Molecular Structure, Journal of Alloys and Compounds, and Ceramics International were prominent platforms for disseminating research findings. The University demonstrated strong alignment with SDGs, notably making substantial contributions to SDG 3, SDG 6, and SDG 7 through impactful publications.

Conclusion

The University of Kerala has demonstrated remarkable academic performance over the past decade, bolstered by strategic partnerships with influential publishers such as Elsevier and leveraging cutting-edge AI tools. These partnerships and technological advancements have played a pivotal role in advancing research excellence across various

disciplines. Moreover, the University's dedication to addressing global challenges is evident through its contributions to the Sustainable Development Goals (SDGs), underscoring its commitment to promoting sustainable development and societal well-being. Moving forward, efforts to enhance research diversity, particularly in areas related to social sciences and humanities, will be essential for fostering a comprehensive and inclusive research agenda.

Furthermore, as the University looks to the future, it must recognize the transformative role of artificial intelligence (AI) in shaping research endeavors. AI tools have become indispensable assets, empowering researchers to streamline workflows, enhance data analysis capabilities, and improve the quality of research output. Therefore, alongside efforts to strengthen research diversity, social sciences, and humanities in particular, continued integration of AI into research practices will be crucial for driving impactful collaborations with industry and policymakers. Together, these endeavors will propel the University towards its mission of advancing knowledge and making meaningful contributions to the global community's pursuit of sustainable development goals.

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Uncovering the Online Audience of Pondicherry University Research: A Study Based on Mendeley and Altmetrics

Ghazzali N N[1] & Dr. R Sevukan[2]

Introduction

Analyzing research impact ensures that research efforts always lead to tangible benefits in the real world, aligning with the growing demands from the funding bodies, governments, and taxpayers for value of money in research investments(Ambrosini et al., 2023). It helps in planning and implementing strategies that can translate research findings into practical applications, thereby improving societal outcomes(Dokter, 2023). Traditional metrics sch as citation counts and journal impact factors have long been used to measure research impact, but they failed to capture broader influence of research in the digital age. Social media platforms like twitter, Facebook, etc. enable researchers to reach diverse, non-academic audiences, thereby increasing the accessibility and visibility of their work(Headley Johnson & Jones, 2023). Social media platforms enables researchers to disseminate their work to a broader audience, including the general public and early career researchers, thereby increasing the reach and accessibility of their research(Sedighi, 2020).

Mendeley, a free web-based reference manager, targeted at academics, allows researchers to organize scholarly literature and track how often their work is saved by users. It enhances the research visibility by providing a platform for early impact and assessment and facilitating collaboration and citation management, thereby supporting the academic reward system and scholarly communication (Thelwall, 2018). Mendeley attracts a diverse audience of scholars from various academic fields worldwide (Zahedi & Costas, 2014), Consequently, numerous studies have explored scholars' usage patterns and the motivations behind their use of Mendeley (Mohammadi et al., 2014). The extensive data collection of Mendeley allows to track who reads the article and the context in which they are reading, providing a valuable information about the Impact and the use of publication across different fields and countries.(Filho & Vanz, 2021). The

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number of registered Mendeley users who bookmarked a paper may indicate readership, although some users may have bookmarked the article without reading it or with the intention of reading it later(Thelwall, 2019).

The growing importance of research impact and need of effective dissemination strategies have led to the development of innovative tools such as Mendeley. By utilizing these platforms, researchers can increase the visibility and accessibility of their work, ultimately contributing to the broader understanding and application of their findings. The study aims to investigate the altmetric mentions and Mendeley readership of articles affiliated with Pondicherry university that are indexed in Scopus, providing valuable insights into the online readership and mentions of these articles across different social media platforms.

Research Questions

RQ. 1: Who are the significant Mendeley readers for articles from Pondicherry university?
RQ .2: Which academic disciplines show the most interest in reading articles from Pondicherry University on Mendeley?
RQ. 3: How many countries have readers who access articles from Pondicherry University through Mendeley?
RQ.4: What is the major platform that mentions about articles from Pondicherry university?
RQ. 5: To find out the relation between Mendeley readership and citation

Literature review

Haustein & Lariviere (2014) analyzed the Mendeley readership statistics of 1.2 million articles from PubMed and Web of Science, finding that 65.9% of the articles received Mendeley readership, with an average of 9.6 readers per article. The majority of readers consisted of researchers and PhD students, aligning with the results of Haunschild et al. (2015) analysis of the readership of 1,133,224 articles and 64,960 reviews indexed in WoS in 2012. Zahedi & Costas (2020) through their analysis that helps in understanding the usage patterns of research articles, revealing that the majority of readers are PhD students, postgraduates, and postdocs, which indicates the educational value of the research. In addition, the readership data from Mendeley can provide insights into the geographical distribution of users, showcasing the worldwide reach and impact of research results (Mohammadi & Thelwall, 2019). Maleki (2015) has studied the Mendeley readership impact of articles published in Iran from 2000 to 2012 found that 16667 (53%) of the articles got at least one reader on Mendeley.

The integration of reference managing and social media tools into the research workflow has significantly impacted academia, particularly in terms of scholarly communication and impact assessment(Hapsari et al., 2023). Mendeley readership and social media mentions, also known as altmetrics, have emerged as valuable indicators of research impact, complimenting traditional citation metrics (Taylor, 2023). Study by Chingath & Ramya (2023) shows that Mendeley readership scores are more effective in identifying highly cited publications compared to journal citation scores, with a high correlation between Mendeley readership counts and citations across various disciplines. These findings indicate that the readership of Mendeley can serve as a reliable measure of usage, similar to the influence of traditional citations. This is particularly true when considering readers who are also authors.

Wasike (2019) demonstrated that altmetrics can predict short term and long term citations, with Mendeley readership being a strong predictor of early citations. The research by Krause, (2012) states that platforms like Mendeley and research gate facilitate collaboration and networking among researchers, allowing them to share bibliographic references and engage in discussions. Previous research conducted by Eldakar, (2019; Haustein & Lariviere, (2014) and Nath et al., (2020) demonstrated promising results when linking Mendeley bookmarks with citations, suggesting these bookmarks can serve as a supplemental tool to traditional metrics. Overall, Mendeley readership analysis provides a comprehensive and nuanced understanding of research impact, aiding researchers in academia to better assess and enhance their scholarly contributions.

Methdology

The methodology employed in this study consisted of three sequential steps: first, data were extracted from Scopus; second, Mendeley readership statistics were obtained; and finally, social media mentions were retrieved from Altmetric Explorer. To achieve this goal, the Scopus database was chosen as the source for data collection, Webometric Analyst 4.1 software was subsequently used to extract Mendeley readership data and finally Altmetric Explorer was used to obtain altmetric data based on the DOI (Digital Object Identifier) of the articles. For the data collection advanced search option of the scopus online was used to retrieve all articles affiliated to Pondicherry University. The data was extracted using the search strategy AFFILORG (pondicherry AND university) AND (EXCLUDE (PUBYEAR, 2024)) AND (LIMIT-TO (DOCTYPE, “ar”)) AND (LIMIT-TO (AF-ID, “Pondicherry University” 60013919)) AND (LIMIT-TO (AFFILCOUNTRY, “India”)) AND (LIMIT-TO (LANGUAGE, “English”)) to extract the data. The data retrieval process yielded a total of 6923 articles, with 6092 articles having a DOI.

In the second step, with webometric analyst 4.1 software (lexiurl. wlv.ac.uk) the DOI of the articles were uploaded to the software and corresponding readership statistics of the articles (6092) were extracted. The results, which were initially extracted in .txt file format, were subsequently copied for further analysis. Subsequently, the DOIs of the publications were queried using the Advanced Search option in Altmetric Explorer, which is accessible to researchers through their Researcher Data Access programme.

Results

Occupation- wise readers of articles from Pondicherry university on Mendeley

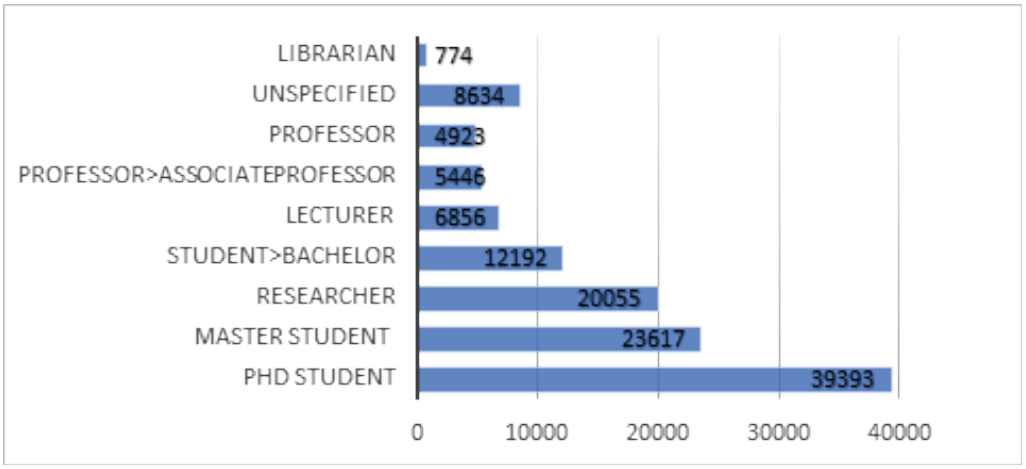


Figure 1. Occupation- wise readers of articles from Pondicherry university on Mendeley

Figure 1 illustrates nine categories of readers after merging Ph.D. students with doctoral students and postgraduate with master's students. The unspecified and other categories were also merged and treated as unspecified, as occupation is not a mandatory field when registering(Chingath & Ramya, 2023; Nath et al., 2020). The figure shows that the Ph.D students are the largest group, accounting for 39,393 (32.32%) readers. Masters' student and researchers follow with 23,617(19.37%) and 20,055(16.45%) readers respectively. The remaining categories have significantly fewer readers, with the smallest group being librarians at 774(0.63%) readers

Discipline-wise readers of articles related to Pondicherry university on Mendeley

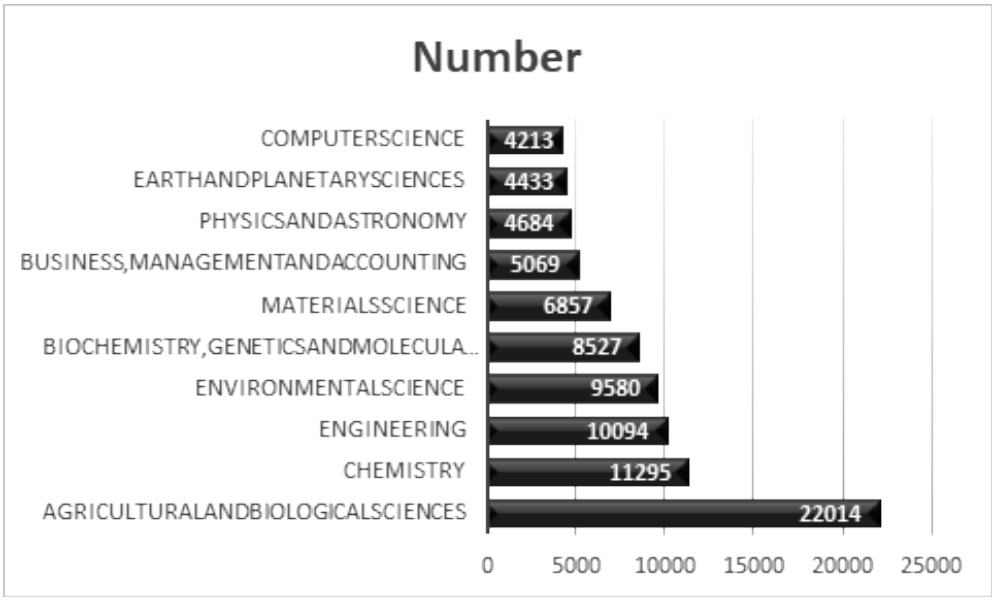


Figure 2. Discipline- wise readers of PU articles on Mendeley

Figure 2 displays the categorization of readers of articles associated with Pondicherry University based on their academic disciplines. The dataset encompasses 29 unique fields of study, with the picture displaying the top 10 domains. The publications affiliated with Pondicherry University had the biggest number of readers from the fields of agricultural and biological sciences, with a total of 22,014 readers. Chemistry had 11,295 readers, while engineering had 10,094 readers. Computer science was among the subjects with the lowest readerships, with a total of 4213 readers. The remaining disciplines with significant reader engagement were biochemistry, genetics, and molecular biology, with 8,527 readers; materials science, with 6,857 readers; business, management, and accounting, with 5,069 readers; physics and astronomy, with 4,684 readers; and earth and planetary science, with 4,433 readers.

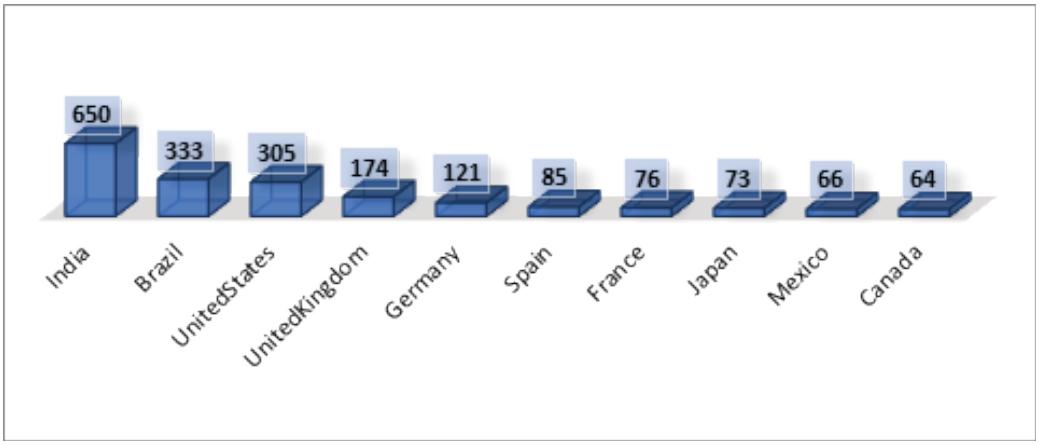


Figure 3. Country-wise readers of PU articles on Mendeley

Readers from 98 countries have engaged with articles related to PU on Mendeley. Figure 3 illustrates the top 10 countries by readership. India leads with 650 readers, followed by Brazil with 333 readers and the United States with 305 readers. Significant readership is also seen in the United Kingdom (174 readers), Germany (121 readers), Spain (85 readers), France (76 readers), Japan (73 readers), Mexico (66 readers), and Canada (64 readers).

Platforms that mention about PU articles

The data in Table 1 indicates that Mendeley readers are the most prominent group engaging with articles affiliated with Pondicherry University, with a total of 80,697 readers. The number of mentions on X is significant, with 10,158 interactions. News mentions and patent mentions also exhibit notable engagement, with 1,235 and 1,026 mentions, respectively. Wikipedia and Facebook platforms contribute moderately to the engagement, with 240 and 223 mentions, respectively. Other platforms, including blogs, policy documents, peer reviews, and Reddit, demonstrate varying degrees of interaction. Platforms such as video mentions, Google+, F1000, and Q&A exhibit relatively low engagement figures.

Table 1. Number of mentions across different platforms

Platform	Number of mentions
Mendeley readers	80697
X mentions	10158
News mentions	1235
Patent mentions	1026
Wikipedia mentions	240
Facebook mentions	223
Blog mentions	186
Policy mentions	77
Peer review mentions	61
Reddit mentions	27
Video mentions	19
Google+ mentions	9
F1000 mentions	4
Q&A mentions	2

Correlation between Mendeley readership and citation

To determine whether the data were normally distributed, the Kolmogorov-Smirnov test was employed. Since the data did not exhibit a typical distribution, the Spearman's rho correlation coefficient was used to investigate the relationship between Mendeley readers and citations received for articles affiliated to Pondicherry university.

Table 2 Correlation between Mendeley readers and citation of PU publications

	Correlation	Association between citations and readership	Citations	Readers
Number of Articles (n=6092)	Spearman's rho	Citations	1.000	.713** <0.01
	Spearman's rho	Readers	.713** <0.01	1.000

The results, as presented in Table 2, indicate a statistically significant positive correlation between the number of Mendeley readers and the number of citations for the Pondicherry university's articles. the Spearman's rho correlation coefficient is r=0.713 with a significance level of p<0.01. This strong correlation suggests that articles with a higher number of Mendeley readers are likely to receive more citations.

Table 3. linear regression analysis on Mendeley readers and citations received for Pondicherry university publications

	Variables	*(B(95%CI*	*SD. Error*	*β*	*t*	*p*
Total articles ((n=6092	***constant***	*6.798*	*363.*		*18.75*	***000.*
R=.374, Adjusted R^2 =.533, F=6945.52, P< .001	*Readers*	*005.*	*047.*	*730.*	*83.34*	***000.*

The table 3 presents the results of a linear regression analysis examining the relationship between Mendeley readership and citation of articles published by the Pondicherry University (PU). The analysis includes a total of 6092 articles. The adjusted R^2 value of 0.533 indicates that approximately 53.3% of the variation in readership can be explained by the model. The F-statistic, 6945.52, further supports the significance of the model, indicating that the relationship between readership and citation is highly significant. Overall, the analysis suggests that there is a strong and statistically significant positive prediction between Mendeley readership and citation of PU articles

Findings and Discussion

This study offers a comprehensive analysis of Mendeley readership and the platforms that mention publications linked with Pondicherry University, taking into account the occupation, discipline, and country of the readers. The study also aimed to determine whether early Mendeley readership has any influence on citation. The study shows Mendeley and X- platform has received the highest mentions among different social media platform. Mendeley is a key platform for academic readership and citation metrics, Twitter plays a crucial role in the social dissemination and visibility of scholarly articles, making both platforms essential for different aspects of scholarly communication and impact(Maleki, 2015).

The PhD students were the highest number of Mendeley readers occupation-wise and librarians were the lowest. This result aligns with other studies, which have also found similar trends (Chen et al., 2021; Nath et al., 2020; Vysakh & Rajendra Babu, 2021). The reason may be the young phd students are adapted to new technologies more readily, and are often engaged in extensive literature reviews and research projects (Eldakar,

2019). The top disciplines that read Pondicherry University articles on Mendeley are Agricultural and Biological Sciences, Chemistry, and Engineering, which can be linked to the institutions strong emphasis on multidisciplinary research(Mohammadi & Thelwall, 2019).

This disparity could be attributed to several factors, such as the relevance and practical applications of the subjects, the level of complexity and interest among students and researchers, and the availability of resources and research opportunities within these fields (Zahedi & Haustein, 2018).

Country-wise interest of readers of articles on Mendeley affiliated to Pondicherry university were primarily within the home country, indicating a strong local academic engagement. Further the readership extended to Brazil and USA and other countries, similarly Egyptian academic articles also found that while these publications had a global reach, the majority of readers were from the USA, indicating a significant local and international academic interest (Eldakar, 2019).

The findings from the study also reveals a significant positive correlation between the Mendeley readership and citation that predicts the Mendeley readership as a early indicator of citation (Parabhoi et al., 2023). The study by Chingath & Ramya (2023) also revels similar result which suggest the possibility of using Mendeley metrics for large scale scientometric studies. Mendeley readership has been highlighted as a valuable tool for assessing research impact, especially for outputs poorly covered in citation indexes or typically excluded from citation analysis, such as non-English language outputs and social sciences publication (Zahedi & Costas, 2020). Overall, these findings underscore the utility of Mendeley readership as a complementary metric to traditional citations for assessing research impact.

Conclusion

Overall, this study highlights the complex and diverse influence of Mendeley reading on comprehending the scholarly and societal significance of publications associated with Pondicherry University. The findings illustrate that Mendeley, along with other platforms like X platform, plays a crucial role in both academic readership and social dissemination, emphasizing their complementary functions in scholarly communication. The prevalence of PhD students as Mendeley readers and the substantial involvement from disciplines like as Agricultural and Biological Sciences, Chemistry, and Engineering demonstrate the university's focus on interdisciplinary research. Moreover, the university's research output is globally significant and relevant, as evidenced by its substantial local readership and notable worldwide attention. The strong positive association seen between early readership on Mendeley and future citation rates provides additional evidence supporting the effectiveness of Mendeley metrics as an early predictor of research impact. These observations confirm the importance of integrating altmetrics with conventional citation analysis, providing a more refined and comprehensive assessment of the impact and distribution of research.

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BIBLIOMETRIC ANALYSIS OF KL UNIVERSITY'S DOCTORAL THESES IN MATHEMATICS THROUGH INFLIBNET: SHODHGANGA

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Introduction

The Information and Library Network (INFLIBNET) is an autonomous inter-university centre of the University Grants Commission (UGC). The Centre aims to modernize libraries and information centers to facilitate information transfer and access. Mathematics Theses and dissertations are primary sources of research materials that originate from doctoral theses and dissertations submitted to universities for the reference to scholars. It is mandatory to submit electronic versions of theses and dissertations by researchers in universities into a national repository to facilitate open access to Indian theses and dissertations for the academic community worldwide. We request universities to host a soft copy of their awarded theses in Shodhganga, a central repository for Indian theses and dissertations. Since January 2010, the number of theses has grown progressively, and the repository reached above 50,000+ theses in November 2015, which makes Shodhganga the largest repository of PhD theses in India. This target is achieved by the immense contributions of research scholars, supervisors, librarians, research cells, and other university officials..

KL University (KLU) is the first private university in Andhra Pradesh, located at Vaddeswaram Guntur. Since its inception in 2009, the university has significantly advanced its research and development activities over the past 15 years. During the last few years, as many as 47 doctoral theses in Mathematics Department were submitted and awarded

Researchers in India and abroad have conducted numerous bibliometrics and citation analysis studies on doctoral theses across various subject fields. The present study focuses on the bibliometric analysis of doctoral theses in mathematics submitted to KL University, Andhra Pradesh, as reflected in an INFLIBNET. Shodhganga

Objectives

- The goal is to examine the contributions made by the Department of Mathematics at KL University, using data from INFLIBNET-Shodhganga.

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- The goal is to identify the chapter-wise distribution of the submitted doctoral theses.
- Determine the duration of doctoral theses.
- The goal is to identify the most productive research guides in the Department of Mathematics at KL University, Vaddeswaram, using doctoral theses from the Shodhganga.
- To recognize gender-wise contributions in research work

Methods and Materials Used

Data Collection

Collect data on PhD theses in mathematics from from Shodhganga theses repository The Present study covers the 47 doctoral theses records available in Shodhganga from the Department of Mathematics, as of 02-2-2024. The data of Doctoral theses of Mathematics was collected from the Shodhganga bibliographic database hosted by INFLIBNET http:// http://shodhganga.inflibnet.ac.in in which is a major source of bibliometric information of the Doctoral theses that are submitted to various Universities, Institutions in India which come under the shodhganga

Analysis and Findings

Table1: Year Wise Submission of Mathematics Ph. D Thesis

S. No	Year wise submission of Thesis	No of Thesis submitted	Percentage
1	2015	3	6.38
2	2016	2	4.26
3	2017	5	10.6
4	2018	2	4.26
5	2019	3	6.38
6	2020	9	19.1
7	2021	8	17
8	2022	6	12.8
9	2023	8	17
10	2024	1	2.13
	Total	47	100

Table 1: Shows the year-wise distribution of a total of 47 theses of Mathematics. This table shows the highest number of theses submitted in the year 2020; Second position goes to the years 2021 and 2023 this year's 8 theses submitted. The third rank goes to the year 2022 this year 6 thesis submitted.

Table 2: Length of Mathematics PH.D. Thesis

S. No	Length of Chapter	Total No. of Thesis	Percentage
1	100-150	17	36.17
2	151-200	14	29.79
3	201-250	5	10.64
4	251-300	3	6.38
5	301-350	3	6.38
6	351-400	2	4.25
7	401-450	2	4.25
8	451-500	0	0
9	501-550	0	0
10	551-600	1	2.12
Total			100

Table 2: Shows the length of papers of a total of 47 theses of Mathematics, KL University, Guntur during the period 2009-2024. The table shows the length of Mathematics Ph.D. Theses 47. The length of 17 theses is around 35 (36.17021) 100-150 pages, and the lowest number of theses (1)

Table 3: Line View of Chapter Distribution

S. No	Chapters	Total No. of Thesis
1	6	24
2	7	8
3	5	7
4	4	4
5	8	4
Total		47

Table 3: The table shows the distribution of these chapters. This table shows that, out of 47 theses, the first has the greatest number of chapters (8 in 4 theses), while the second has 7 chapters in 8 theses. The third-highest number of chapters is 6 in 24 theses, while the fourth-highest number is 5 in 7 theses. The smallest number of theses, consisting of four chapters in four theses, is the lowest.

Table: 4. Ranking of Most Productive Research Guide

S.No	Author Name	Contribution to theses	Percentage
1	Dr G Suresh Kumar	5	10.7
2	Dr. GV Ramana Reddy	5	10.7
3	Dr. GNV Kishore	4	8.51
4	Dr Y Sarala	3	6.38

5	Dr VS Bhagavan	3	6.38
6	Dr V Vasantha Kumar	2	4.26
7	Dr T Eswarlal	2	4.26
8	Dr B Srinivasa Kumar	2	4.26
9	Dr BV Apparao	2	4.26
10	Dr K Jayarami Reddy	2	4.26
11	Dr T Nageswara Rao	2	4.26
12	Dr KV Chandra Sekhar	2	4.26
13	Dr K Rajyalakshmi	2	4.26
14	Dr SV Subrahmanyam	2	4.26
15	Dr I Ramabhadra Sarma	1	2.13
16	Dr R Raghavendra Rao	1	2.13
17	Dr DRV Prasada Rao	1	2.13
18	Dr B Ramakrishna	1	2.13
19	Dr N Konda Reddy	1	2.13
20	Dr Perugupalli Hari Prasad	1	2.13
21	Dr T Srinivasa Rao	1	2.13
22	Dr W Sridhar	1	2.13
23	Dr MP Mallesh	1	2.13
	Total	47	100

The table reflected the research productivity of the Department of Mathematics among the comprehensive list of 47 Research guides Dr. G Suresh Kumar and Dr. GV Ramana Reddy are at the top of the list, producing 5 doctoral theses with a major share of 10.64; Dr. GNV Kishore ranks second in the table with 4 doctoral theses, accounting for 8.51% of the total contribution; and the rest of the research guides follow in their respective rankings. Dr. Y Sarala and Dr. VS Bhagavan rank third, followed by Dr. V Vasantha Kumar. Dr. T. Eswarlal Dr. B. Srinivasa Kumar Dr. BV Apparao, Dr. K. Dr. T. Nageswara Rao, Jayarami Reddy, and Dr. KV Chandra Sekhar Dr. K. Rajyalakshmi is producing two theses, and the remaining nine authors are producing one theses.

Table: 5 Author- wise distributions of Theses

S.No	No of Authors	No of theses	Percentage
1	Single	9	19.5
2	Joint	38	80.5
	Total	47	100

Table-5 showed that out of 47 theses, 9 theses have single authors and 38 theses have joint authors guidance to scholars.

Table 6.Gender wise Author contribution

S.No	Gender	No of Authors	Percentage
1	Male	2	8.6
2	Female	21	91.4
	Total	23	100

The Table-6 showed that out of 23 authors, two persons are female while the rest of 38 (80.5%) persons were male

Conclusion

Bibliometric analysis of PhD theses in mathematics provides valuable insights into doctoral research trends, institutional productivity, and academic networks. Despite challenges in data accessibility and citation tracking, this analysis can inform academic planning, highlight influential research, and identify emerging areas within mathematical sciences. By leveraging bibliometric tools and methodologies, stakeholders can better understand and support the development of doctoral research in mathematics.

Bibliographic databases are a vital source of secondary information for researchers and academicians to search for and access the most relevant literature in their area of interest. However, with the advent of computer applications, traditional printed publications gave way to electronic databases in most cases. Shodhganga is a major source of bibliographic information on Indian universities and institutions, hosted by INFLIBNET, for scholarly communication among academic communities in India. This article aims to analyses the records of doctoral theses submitted to KL University, Guntur, from departments within the mathematics stream. We also observe that the Soudhganga Bibliographic Database, a major source of bibliographic information in India, requires regular updates, and there is a need to mandate the submission of doctoral theses records after the award of doctoral degrees at various universities and institutions under INFLIBNET.If updated regularly, Shodhganga can be a vital bibliographic tool to measure the research productivity of different universities, institutions, departments, and individuals.

RESEARCH PRODUCTIVITY IN EXPERT SYSTEM LITERATURE DURING 2014-2023 WITH HITSCITE : A BIBLIOMETRIC APPROACH

Hemavathy. C[1] & Dr. R. Prabhu[2]

Introduction

Expert systems can be rule-based, where decision-making is guided by a set of predefined rules, or they can include machine learning techniques to learn from data and adapt to new situations. In either case, the objective is to capture and influence the knowledge of human experts to supply intelligent solutions to difficult problems. An expert system is a computer-based system that emulates the decision-making capability of a human expert in a precise domain. It integrates knowledge, rules, and problem-solving strategies to provide expert-level guidance or solutions to users. Expert systems are considered to solve intricate troubles by reasoning through knowledge and rules acquired from human experts.

The early development (1960s-1970s) of expert systems can be traced back to research in artificial intelligence (AI) and cognitive science. In 1965, Herbert Simon and Allen Newell developed the General Problem Solver (GPS), a computer program able to solve a extensive range of troubles by simulating human problem-solving processes. DENDRAL(1965) developed at Stanford University by Edward Feigenbaum, Joshua Lederberg, and others, was one of the first successful expert systems. It was designed to examine mass spectrometry data and recognize the molecular arrangement of organic compounds. DENDRAL demonstrated the prospective of expert systems to carry out complex responsibilities in specialized domains. MYCIN (1976) developed at Stanford University by Edward Shortliffe, was a pioneering expert system in the ground of medicine. It was considered to diagnose bacterial infections and suggest antibiotic treatments based on patient symptoms and medical history. MYCIN demonstrated the sensible applications of expert systems in healthcare. In the 1980s, expert systems became more extensive with the growth of rule-based systems. These systems used a set of rules programmed in a knowledge base to guide reasoning and decision-making. Rule-based expert systems were useful in various domains, including finance, engineering, and customer support. The 1980s and 1990s saw the commercialization of expert systems, with companies like Expert Systems Corporation (XCON) and IntelliCorp

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contribution expert system development tools and consulting services. Expert systems were deployed in industries such as finance, telecommunications, and manufacturing to automate decision-making processes and develop efficiency. In recent years (2000 onwards) expert systems have been incorporated with other AI technologies such as machine learning and natural language processing. This has enabled expert systems to learn from data, interact with users in natural language, and adjust to new situations more efficiently. Expert systems keep on to be used in a variety of applications, together with healthcare, finance, cybersecurity, and knowledge management.

Review of Literature

S. No.	Year	Author Name	Findings
1.	2021	R.Sebastiyan, V.Rameshbabu and T.M.Surulinathi	Studies the food economic output from scopus database from 1935 to 2021using Scientometrics techniques and HitsCite software tools. From the study they found that Popkin, Drewnowski, and Kesselheim are the top authors in the field. University of Washington, AMP, and Cornell University are the top institutions American Journal of Agricultural Economics, Public Health Nutrition, and PLoS One are the most popular journals and United States is the most productive country and more research production is 2021 during the period of study.
2.	2018	Daniel Andres Barreto Ramirez … [et al.]	Investigates electric vehicles literature from Web of Science Database from 2007 to 2016 and analysis done through HitsCite software to determine the bibliographic indicators such as Author, publication year, Journals and so on.
3.	2019	Rony Escobar Yonoff … [et al.]	Anayses the proton exchange membrane fuel cells (PEMFCs) literature from Web of Science Database from 2008 to 2018. Hitscite, CiteSpace, ArcGIS and Ucinet 6 are the tools were used to analyse the data and found that the USA is the more productive country during the study period
4.	2019	M. A. Pachón Colmenares … [et al.]	This article presents a bibliometric analysis on the various alternatives to replace cellulose acetate, with a tool known as HitsCite. The articles have been investigated by bibliometric, trend and cluster analysis with 361 articles. Data has been downloaded from web of science to identify the main trends of the scientific literature.
5.	2022	James Torres Moreno, Carlos Acevedo Peñaloza and Milton Coba Salcedo	Anayses the the field of Solar Energy with Web of Science Database between 2010 and 2020 and the data analysis has been done through of HitsCite and VOSviewer and Ms-Excel for futher analysis and found that research in the particular field is in progressive way.

Aim and Objective

The specific objectives of the study are:

- To examine the Relative growth rate and doubling time of Expert System literature.
- To find the most productive authors and most prolific Journal
- To study the most productive Institution, most prolific keyword and the language of publications in the field of expert system research and
- To find the most productive country in the area of expert system literature.

Scope and Methodology

The Web of Science citation database is used to retrieve the bibliographical data and the keyword used to find the results are "Expert System" with the search menu. The year has been restricted from 2014 to 2023. Totally 5069 records were found and the data was analysed through histcite software to find out the indicators such as most prolific author, most prolific journal, keyword, country and distributed in MS Excel for further statistical analysis to find out the Relative Growth Rate (RGR), Doubling Time (Dt) and the bibliometric networks are visualized using VOS viewer. Out of 5069 records, only 5020 records were taken for consideration, 49 records were eliminated due to the lack of year (2 records) and 47 records come under 2024. This study helps to identify the authorship pattern, most productive country, most productive journal and the major research areas in the field of Expert System.

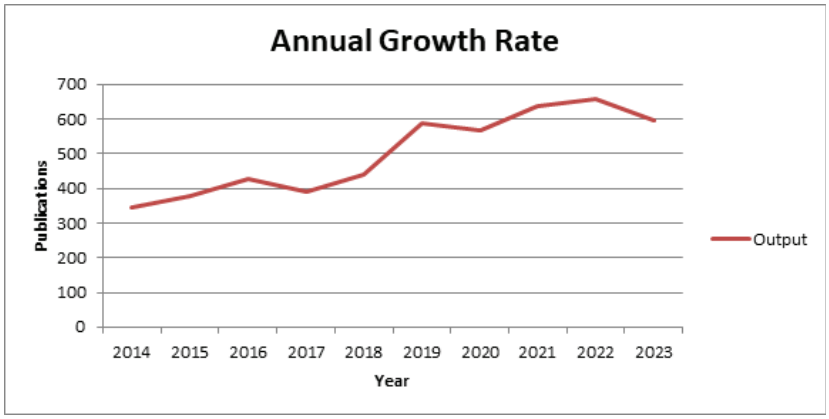


Fig. 1 - Annual Growth rate of Expert System literature

Table 1 - Relative Growth Rate (RGR) and Doubling Time (DT) of Expert System literature

S. No.	Year	Output	Cumulative Output	Percentage	Cumulative percentage	ARoG	W1	W2	RGR	Mean RGR (5 years)	Dt	Mean Dt (5 years)
1	2014	345	345	6.8725	6.8725	1.0000	0.0000	5.8435	5.8435	1.5182	0.1186	1.5362
2	2015	379	724	7.5498	14.4223	1.0986	5.8435	6.5848	0.7412		0.9349	
3	2016	425	1149	8.4661	22.8884	1.1214	6.5848	7.0466	0.4619		1.5005	
4	2017	390	1539	7.7689	30.6574	0.9176	7.0466	7.3389	0.2922		2.3713	
5	2018	440	1979	8.7649	39.4223	1.1282	7.3389	7.5903	0.2515		2.7559	
6	2019	588	2567	11.7131	51.1355	1.3364	7.5903	7.8505	0.2601	0.1862	2.6639	3.9394
7	2020	565	3132	11.2550	62.3904	0.9609	7.8505	8.0494	0.1989		3.4836	
8	2021	636	3768	12.6693	75.0598	1.1257	8.0494	8.2343	0.1849		3.7485	
9	2022	656	4424	13.0677	88.1275	1.0314	8.2343	8.3948	0.1605		4.3178	
10	2023	596	5020	11.8725	100.0000	0.9085	8.3948	8.5212	0.1264		5.4832	
		5020		100.0000						1.7044		2.7378

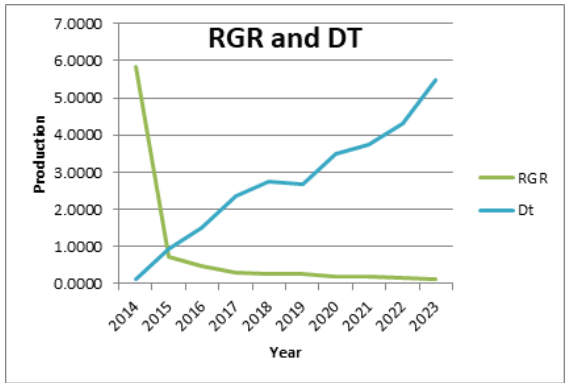


Fig. 2 - Relationship between RGR and DT

Data Analysis and Interpretation

Relative Growth Rate and Doubling Time

Relative Growth Rate (RGR) means the increase in the number of articles per unit of time. Further, the mean of RGR of articles over a specific period can be calculated by using the following formula given by Mahapatra,

$$\bar{R}\ (1\text{-}2) = (W_2\text{-}W_1) / (T_2\text{-}T_1)$$

where, $\bar{R}(1\text{-}2)$ = mean relative growth rate over the specified period of interval
W_1 = Log W1 (natural log of the initial number of publications)
W_2 = Log W2 (natural log of final number of publications)
T_2-T_1 = Unit difference between the initial time and final time.

Doubling Time (Dt) for publication is calculated by,

$$Dt = \frac{0.693}{\bar{R}}$$

where 0.693 is obtained from the value of Log e^2
$\bar{R}$ (1-2) = mean relative growth rate over the specified period of interval.

The data in Table 1 have evinced that the Relative Growth Rate was high in 2014and a decreasing trend was observed between 2015 and 2023. It is also witnessed that the Doubling time shows that the fluctuating trend between 2017 and 2019. From the year of 2020, the rate has increased gradually.

Author's Productivity Analysis

Table 2 reveals the top 10 productive authors in the field of Expert System. The most productive author was identified based on the research papers published by them during the said years. According to the analysis, Zhou ZJ top the table with 30 publications with TLCS of 237 and TGCS of 751 (0.5976%), succeeded by Chang LL and Hossain MS with publications of 20 with TLCS of 255 and TGCS of 619 (0.3984%) and 19 with TLCS of 46 and TGCS of 338 (0.3785%) respectively.

Table 2 - Most Productive Author

S. No.	Author	Records	TLCS	TGCS	Percentage
1	Zhou ZJ	30	237	751	0.5976
2	Chang LL	20	255	619	0.3984
3	Hossain MS	19	46	338	0.3785
4	He W	18	29	166	0.3586
5	Wang J	17	25	594	0.3386
6	Yang LH	17	178	439	0.3386
7	Zhang Y	17	22	266	0.3386
8	Chytry M	16	64	518	0.3187
9	Hu CH	16	107	448	0.3187
10	Liu HC	16	100	411	0.3187

Most Prolific Journal

The top 10 journals are given in Table 3. The highest number of publications was brought out by Expert System with Applications Journal. It has published 568 research papers followed by IEEE Access which reported 105 publications and the Applied Sciences-Basel Journal with 80 publications.

Table 3 - Most Prolific Journal

S. No.	Journal Name	Records	TLCS	TGCS
1	Expert Systems With Applications	568	424	15907
2	Ieee Access	105	37	1172
3	Applied Sciences-Basel	80	0	455
4	Expert Systems	64	16	353
5	Knowledge-Based Systems	51	198	1326
6	Applied Soft Computing	43	29	1460
7	Sensors	43	0	733
8	Energies	42	0	440
9	Engineering Applications of Artificial Intelligence	38	36	708
10	International Journal of Advanced Manufacturing Technology	38	28	576

Most Prolific Institution

Table 4 indicates the top 10 institutions that are producing the highest number of publications in the research field of Expert System. Islamic Azad University has contributed 56 papers (1.1155%), followed by Univ Complutense Madrid 36 papers 0.7171(%) and Chinese AcadSci, contributions 35 papers (0.6972%). Except the firtst one the other institutions has contributed less than 1%, during the study period.

Table 4 - Most Prolific Institution

S. No.	Institution	Records	Percentage	TLCS
1	Islamic Azad Univ	56	1.1155	33
2	Univ Complutense Madrid	36	0.7171	11
3	Chinese AcadSci	35	0.6972	4

4	Univ Malaya	35	0.6972	42
5	Univ Seville	34	0.6773	55
6	Univ Tehran	31	0.6175	11
7	AmirkabirUnivTechnol	30	0.5976	15
8	King AbdulazizUniv	29	0.5777	47
9	NatlInstTechnol	29	0.5777	5
10	Russian AcadSci	29	0.5777	11

Most Prolific Keyword

The top 10 keywords are tabulated in Table 5. From the table, we can conclude that the field of expert system is dominated by the keyword called system with 1500 records followed by based keyword has 1291 records and Expert with the records of 1118 records respectively.

Table 5 - Most Prolific Keyword

S.No.	Keyword	Records	TLCS	TGCS
1	System	1500	1382	18713
2	Based	1291	975	22514
3	Expert	1118	1166	11991
4	Using	796	448	17908
5	Fuzzy	653	545	10197
6	Systems	424	376	8688
7	Learning	405	141	8050
8	Analysis	350	225	6355
9	Diagnosis	350	298	9364
10	Artificial	331	146	11973

Most Prolific Language

Out of 13 languages the top 10 languages are given in Table 6. The highest number of publications was brought out by English language. In English language 4954 research papers (98.6853%) was published during the study period. Maximum number of publications is in English language, other languages are less than 1% of publications. Other than English the Russian which reported 30 publications (0.5976%) and Spanish with 27 publications with a percentage of 0.5378%.

Table 6 - Most Prolific Language

S. No.	Language	Records	Percentage	TLCS	TGCS
1	English	4954	98.6853	2971	95725
2	Russian	30	0.5976	0	27
3	Spanish	27	0.5378	0	61
4	Portuguese	17	0.3386	5	93

5	German	16	0.3187	1	23
6	French	6	0.1195	0	4
7	Chinese	5	0.0996	0	14
8	Turkish	5	0.0996	0	28
9	Italian	2	0.0398	0	0
10	Polish	2	0.0398	0	26

5.7. Most Prolific Country

The top 10 countries that have contributed to the Expert System are listed in Table 7. Based on the analysis, the Peoples R China has produced the highest number of publications i.e. 918 with a percentage of 18.2869. Nearly 20% of the research productivity in Expert System has been given to the world by the Peoples R China which is also graphically visualized through Vos viewer (Fig. 4) by a big circle. It is trailed by the USA with the publications of 689 (13.7251%). Followed by India with the publications of 492 (9.8008%). India, Spain, UK and other countries have contributed less than 10% of publications in the Expert System research. India acquired the 3rd position with the contribution of 492 publications.

Table 7 - Most Prolific country

S. No.	Country	Records	Percentage	TLCS	TGCS
1	Peoples R China	918	18.2869	872	19075
2	USA	689	13.7251	484	17373
3	India	492	9.8008	228	7792
4	Spain	349	6.9522	238	8647
5	UK	288	5.7371	369	10200
6	Iran	282	5.6175	145	4893
7	Germany	218	4.3426	165	7306
8	Italy	211	4.2032	120	6096
9	Australia	207	4.1235	150	6214
10	Brazil	181	3.6056	76	3727

Most Prolific Article based on Local Citation Score

Based on Local Citation Score indicator Table 8 clearly shows the top 10 locally cited articles with their author, title, year of publication and source of the document. The table also denotes that the article how many times cited by researchers through LCS indicator, which is the advantage of this software.

Table 8 - Most Prolific Article based on LCS

S. No.	Date / Author / Journal	LCS	GCS	LCR	CR
1	Chang LL, Zhou ZJ, You Y, Yang LH, Zhou ZG	48	77	2	49

	Belief rule based expert system for classification problems with new rule activation and weight calculation procedures				
	INFORMATION SCIENCES. 2016 APR 1; 336: 75-91				
2	Wagner WP	38	97	4	169
	Trends in expert system development: A longitudinal content analysis of over thirty years of expert system case studies				
	EXPERT SYSTEMS WITH APPLICATIONS. 2017 JUN 15; 76: 85-96				
3	Wang YM, Yang LH, Fu YG, Chang LL, Chin KS	30	44	3	48
	Dynamic rule adjustment approach for optimizing belief rule-base expert system				
	KNOWLEDGE-BASED SYSTEMS. 2016 MAR 15; 96: 40-60				
4	Li GL, Zhou ZJ, Hu CH, Chang LL, Zhou ZG, et al.	27	85	2	41
	A new safety assessment model for complex system based on the conditional generalized minimum variance and the belief rule base				
	SAFETY SCIENCE. 2017 MAR; 93: 108-120				
5	Chang LL, Zhou ZJ, Chen YW, Liao TJ, Hu Y, et al.	25	58	3	49
	Belief Rule Base Structure and Parameter Joint Optimization Under Disjunctive Assumption for Nonlinear Complex System Modeling				
	IEEE TRANSACTIONS ON SYSTEMS MAN CYBERNETICS-SYSTEMS. 2018 SEP; 48 (9): 1542-1554				
6	Chang LL, Zhou ZJ, Liao HC, Chen YW, Tan X, et al.	23	40	10	38
	Generic Disjunctive Belief-Rule-Base Modeling, Inferencing, and Optimization				
	IEEE TRANSACTIONS ON FUZZY SYSTEMS. 2019 SEP; 27 (9): 1866-1880				
7	Yang Y, Fu C, Chen YW, Xu DL, Yang SL	22	47	3	38
	A belief rule based expert system for predicting consumer preference in new product development				
	KNOWLEDGE-BASED SYSTEMS. 2016 FEB 15; 94: 105-113				
8	Saur J, Milln D, Su-Negre JM, Prez-Lozano P, Sarrate R, et al.	21	25	0	19
	The use of the SeDeM diagram expert system for the formulation of Captopril SR matrix tablets by direct compression				
	INTERNATIONAL JOURNAL of PHARMACEUTICS. 2014 JAN 30; 461 (1-2): 38-45				
9	2Zhou ZJ, Hu GY, Hu CH, Wen CL, Chang LL	21	66	22	121
	A Survey of Belief Rule-Base Expert System				
	IEEE TRANSACTIONS ON SYSTEMS MAN CYBERNETICS-SYSTEMS. 2021 AUG; 51 (8): 4944-4958				
10	Chang LL, Sun JB, Jiang J, Li MJ	20	34	0	41
	Parameter learning for the belief rule base system in the residual life probability prediction of metalized film capacitor				
	KNOWLEDGE-BASED SYSTEMS. 2015 JAN; 73: 69-80				

Most Prolific Article based on Global Citation Score

Based on Local Citation Score Table 9 undoubtedly show the top 10 globally cited articles in the field of expert system with their author, title, year of publication and source of the paper. The table also denotes that the article how many times cited by researchers through GCS indicator globally.

Table 9 - Most Prolific Article based on GCS

S. No.	Date / Author / Journal	LCS	GCS	LCR	CR
1	Biasini M, Bienert S, Waterhouse A, Arnold K, Studer G, et al.	1	2921	0	35
	SWISS-MODEL: modeling protein tertiary and quaternary structure using evolutionary information				
	NUCLEIC ACIDS RESEARCH. 2014 JUL 1; 42 (W1): W252-W258				
2	Arrieta AB, Daz-Rodrguez N, Del Ser J, Bennetot A, Tabik S, et al.	15	2506	0	422
	Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI				
	INFORMATION FUSION. 2020 JUN; 58: 82-115				
3	Gao ZW, Cecati C, Ding SX	15	1683	1	60
	A Survey of Fault Diagnosis and Fault-Tolerant Techniques-Part II: Fault Diagnosis With Knowledge-Based and Hybrid/Active Approaches				
	IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS. 2015 JUN; 62 (6): 3768-3774				
4	Dwivedi YK, Hughes L, Ismagilova E, Aarts G, Coombs C, et al.	0	746	5	322
	Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy				
	INTERNATIONAL JOURNAL of INFORMATION MANAGEMENT. 2021 2021 APR; 57: Art. No. 101994				
5	Duan YQ, Edwards JS, Dwivedi YK	11	705	0	83
	Artificial intelligence for decision making in the era of Big Data - evolution, challenges and research agenda				
	INTERNATIONAL JOURNAL of INFORMATION MANAGEMENT. 2019 OCT; 48: 63-71				
6	Kaplan A, Haenlein M	10	681	0	26
	Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence				
	BUSINESS HORIZONS. 2019 JAN-FEB; 62 (1): 15-25				
7	Wang YZ, Chen C, Wang JH, Baldick R	3	588	0	84
	Research on Resilience of Power Systems Under Natural Disasters-A Review				
	IEEE TRANSACTIONS ON POWER SYSTEMS. 2016 MAR; 31 (2): 1604-1613				
8	Chen C, Wang JH, Qiu F, Zhao DB	4	544	1	32

	Resilient Distribution System by Microgrids Formation After Natural Disasters				
	IEEE TRANSACTIONS ON SMART GRID. 2016 MAR; 7 (2): 958-966				
9	Luz EJD, Schwartz WR, Camara-Chvez G, Menotti D	9	484	1	165
	ECG-based heart beat classification for arrhythmia detection: A survey				
	COMPUTER METHODS and PROGRAMS IN BIOMEDICINE. 2016 APR; 127: 144-164				
10	Yaseen ZM, Sulaiman SO, Deo RC, Chau KW	3	431	1	171
	An enhanced extreme learning machine model for river flow forecasting: State-of-the-art, practical applications in water resource engineering area and future research direction				
	JOURNAL of HYDROLOGY. 2019 FEB; 569: 387-408				

Findings and Conclusion

During the study period, the year 2022 is recognized as a highly productive year with 656 publications. In the literature of Expert system, the Relative Growth Rate and Doubling time reflect a fluctuating trend and are inversely proportional to each other. According to the analysis most prolific author has been found is Zhou ZJ with the publications of 30 research papers. Most prolific journal analysis discloses that Expert Systems with Applications is the top journal which produced more number of scientific papers in the field of expert system during the study period. The most productive institution is Islamic Azad University which produces 56 research papers and the most prolific keyword is system which occurs 1500 times during the study period. The most prolific language in the research field of expert system is considered as English which includes nearly 99% of research papers and the most significant country which produces around 20% of the research work in the field of expert system is Peoples R China. India holds 3rd position during the study period in the expert system field, which denotes if our country invest more funding than current, the outcome will be more and more opportunities are there that India could lead the foreign countries than now through their research and scientific publication in the said field.

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PH.D. THESES OF CHEMICAL ENGINEERING AWARDED BY THE UNIVERSITIES IN ANDHRA PRADESH: A BIBLIOMETRIC STUDY

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Introduction

Bibliometrics, which measures the productivity of scientific publications through citation counts. According to Belter (2018), bibliometric focuses on four key themes: productivity, collaboration, research topics, and citation impact. It's become an essential tool for researchers to stay ahead in today's competitive academic landscape. It's important to recognize the significance of Bibliometrics, which involves applying mathematics and statistical methods to evaluate thesis books and other forms of communication. In the field of Library and Information Science, bibliometric studies are incredibly useful for studying literature and determining trends. It accurately identifies user requirements and has established itself as a prominent component of information research.

Statement of the problem

University libraries need to allocate significant funds annually for acquiring information sources, and it's essential that these resources are utilized effectively to equip users with the necessary information. The process of regular research studies are necessary to assess relevancy and utilization of the resources and it should be assertive in the approach and ensure that the resources are optimized to meet the needs of the user community. To choose information sources across different subject disciplines, one can employ the 80:20 rule. This rule states that 80% of the total usage comes from just 20% of the entire collection. By identifying this 20% of heavily utilized materials, librarians can effectively meet 80% of the user's needs.

Implication of Research

Bibliometric analyses have been conducted on doctoral theses and dissertations across different disciplines. However, limited research of the nature has been carried out in Andhra Pradesh, as indicated by local literature. The implementation of a bibliometric study would prove to be a valuable asset for an academic library in multiple ways. The study says utilizing doctoral theses, is crucial for determining the bibliometric characteristics within a specific subject field. It aids in the identification of core journals,

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which are defined as the journals publishing the highest number of papers in any given area (Mattal & Singh, 2006), as well as other extensively utilized information sources. Additionally, it provides insights into the format and age of these information sources. By following such a procedure, libraries can effectively and efficiently manage their collections.

Review of Literature

The field of bibliometric is experiencing rapid growth and advancement in citation analysis. Many review articles and books have been published on the evolution of bibliometric. Bibliometric analysis has been increasingly used to evaluate the research performance of the scientists and the growth of different disciplines of science.

Fairthorne (1969) authored the initial examination of bibliometric empirical laws. The second important one was Hjerppe (1980), published a significant review encompassing over 200 items on bibliometric. The most extensive historical analysis was conducted by Hertzel (1987) and published in the 'Encyclopedia of Library and Information Science'. The review of bibliometric literature by Sen and Kumar (1986) showed that the first contribution to bibliometric from India emanated from INSDOC with the publication of an article on the study of citation practices in 200 India and foreign science and technology journal.

Subbarayudu and Surendra Babu (2014) have studied 7,444 citations of 43 PhD theses in philosophy of the University of Hyderabad during 1986-2012. This study reveals that 80.62% were book citations, 53.16% were geographical distribution, 92.60% is language wise distribution. Based on the data collection and analysis, it is drawn that most of research scholars in the department of philosophy have used books for their research studies than other sources.

Singh and Kumar (2016) analyzed total of 44 Ph.D. thesis in sociology which were published between 2000 and 2006. The authorship pattern revealed that these theses involved a total of 1842 authors. Among them, 1617 were single authors, 210 were joint authors, and 15 had more than two authors contributing to the 44 sociology Ph.D. theses.

In 2015, Garg and Saini conducted a bibliometric evaluation of 1763 postgraduate and Ph.D. Dissertations that were approved by Indira Gandhi Agricultural University, located in Raipur (Chhattisgarh). Garg and Pal (2019) examined 476 Ph.D. dissertations approved by the Indian Agricultural Research Institute (IARI) across various fields of Agricultural science and technology from 2011 to 2016.

Bansal and Garg (2021) analyzed 5703 theses accepted by 54 Indian state agricultural universities in the year 2018.

Objectives of the Study

The study was conducted to analyze the bibliometric characteristics of PhD dissertations in the Chemical Engineering discipline.

1. To analyze the thesis according to the University wise.
2. To examine the chronological growth of theses accepted by the universities in Andhra Pradesh during the period of 1942-2023 in block of ten years each.
3. To examine the thesis of male and female scholars during the period 1942-2023 in black of ten years each.
4. To identify the gender of the supervisors and to identify most prolific male and female supervisors.

Methodology

The methodology employed in the current study is derived from the 307 Ph.D. theses submitted under various universities like Sri Venkateswara University, Tirupati. Andhra University, Visakhapatnam. JNTUA, Ananthapuramu and JNTUK, Kakinada in Andhra Pradesh during 1942-2023. The data was gathered and organized using MS-Excel, and it has been analyzed in the form of tables and graphs

Analysis of Data and Interpretation

Distribution of thesis according to University wise:

Table 1. Indicate that majority of theses accepted 253 (82.41%) Andhra University. 27(8.79%) theses accepted by the JNTU Ananthapuramu. 16(5.21%) theses accepted by the Sri Venkateswara University, Tirupati.11 (3.58%) theses accepted by the JNTU Kakinada.

Table 1: University wise list of theses

S.No.	Name of the University	No.of. Theses	%
1	AU	253	82.41
2	JNTUA	27	8.79
3	SVU	16	5.21
4	JNTUK	11	3.58
	Total	307	100

Distribution of these according to Single Guide and Double Guide:

Table 2 denotes that total 307 these, 249 (81.10%) these were submitted under the guidance of single supervisor. 58 (18.90%) theses were submitted under the guidance of two mentors.

Table 2: Distribution of these according to Single Guide and Double Guide

S.No	Guide	No. of Theses	%
1	Single Guide	249	81.10
2	Double Guide	58	18.90
	Total	307	100

Chronological Distribution of Theses

Table-3 depicts the chronological distribution of theses accepted by Andhra Pradesh Universities during 1942-2023 in 9 blocks of ten years each by male and female scholars. During the study period 307 Ph.D. Theses were accepted in Chemical Engineering. Majority of theses accepted 127 (41.36%) in 2012-2021 block. Less number of theses accepted 3 (0.97%) in 1942-51 block.

Table3. Chronological order of dissertation of Theses

Theses disserted for every ten years

S.No	Year	Male	Female	Total
1	1942-51	3	0	3
2	1952-61	6	0	6
3	1962-71	19	1	20
4	1972-81	35	1	36
5	1982-91	15	5	20
6	1992-01	16	5	21
7	2002-11	51	11	62
8	2012-21	79	48	127
9	2021-23	8	4	12
	Total	232	75	307

Productivity of Male and Female Scholars

Table 4 indicates that the total 307 theses, 232(75.57%) accepted were submitted by male scholars and the remaining 75 (24.43%) were submitted by female scholars.

Table 4: Productivity of Male and Female Scholars

S.No	GENDER	SCHOLARS	%	GUIDES	%
1	MALE	232	75.57	286	93.2
2	FEMALE	75	24.43	21	6.8
	Total	307	100	307	100

Distribution of Supervisors

Table 5 Defines during the period of study 307 theses were accepted under the supervision of of 163 supervisors. of these 150 were male supervisors and 13 were female supervisors. The results (table 5) indicates that of the 307 theses 286 (93.15%) these were supervised male supervisors and remaining 21 (6.85%) thesis submissions were made under the guidance of female supervisors.

Table 5: Distribution of Supervisors

S.No	Year	Thesis under the Male & Female Supervisors						Total
		Male supervisors	Student Guided	%	Female Supervisors	student Guided	%	
1	1942-51	2	3	1.5	0	0	0	3
2	1952-61	5	6	1.2	0	0	0	6
3	1962-71	11	20	1.8	0	0	0	20
4	1972-81	19	36	1.9	0	0	0	36
5	1982-91	16	20	1.3	0	0	0	20
6	1992-01	15	21	1.4	0	0	0	21
7	2002-11	32	60	1.9	2	2	1	62
8	2012-21	41	111	2.7	8	16	2	127
9	2021-23	9	9	1	3	3	1	12
Total		150	286		13	21		307

Distribution of supervisors by number of students guided

As per the table 5, 163 supervisors guided 307 research scholars. Table 6 indicate that 59 (20%) supervisors guided only one scholars and remaining 104 (80%) supervised two or more scholars.

Table 6: Students guided by the supervisors

S.No	No. of Students guided by the Supervisors	No.of Supervisors	Total
1	One student	59*1	59
2	Two student	17*2	34
3	Three student	12*3	36
4	Four student	6*4	24
5	Five student	8*5	40
6	Six student	5*6	30
7	Seven student	2*7	14
8	Eight student	0*8	0
9	Nine student	2*9	18
10	Ten student	2*10	20
11	Eleven student above	2	32
	Total		307

Most Prolific supervisors

Table 7 indicates that 8 supervisors who guided 7 more scholars in the different areas in Chemical Engineering. The maximum number of scholars (20) by Prof. King Pulipati. This is followed by Prof. Rajendra Prasad P. supervising 12 scholars.

Table 7: Most Prolific supervisors

S.No	Name of Guide	No.of Students Guided	Gender
1	King, Pulipati	20	M
2	Rajendra Prasad, P.	12	M
3	Raju C H A I	10	M
4	Ramachandra Murthy C H V	10	M

Findings

- The present study analyzed 307 Ph.D. theses of Chemical Engineering awarded by the universities in Andhra Pradesh. The majority of theses 253 were submitted under the Andhra University. Less number of theses 11 were submitted under the JNTU Kakinada.
- Of the total 307 theses accepted, 249 theses were supervised by the single supervisor and 58 theses were supervised by two supervisors.
- Out of the 307 theses that were approved, 232 were from male scholars while 75 were from female scholars.
- Out of the 163 supervisors overseeing 307 scholars, 150 were male while 13 were female. This suggests that the majority of the theses were supervised by male supervisors.

Conclusion

A major orientation hole with male scholars overwhelming their female scholars has been accounted for in every one of the examinations referred to under survey of writing as well as in the current review. According to the survey conducted on academic writing, it was found that there was a higher number of male scholars compared to their female Scholars. The discoveries of the review might move female researchers at various Chemical Engineering to seek after their PhD and the faculty ought to likewise energize an ever increasing number of female researchers to do PhD.

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HALF A CENTURY OF MACHINE LEARNING: A SCIENTOMETRIC ANALYSIS (1972-2022)

A.Muthuraj[1] & N. Bakkiyaraj[2]

Introduction

Machine learning is a subfield of artificial intelligence, which is broadly defined as the capability of a machine to imitate intelligent human behavior. Machine learning is a buzzword for today's technology, and it is growing very rapidly day by day. Google Maps, Google Assistant, Alexa, and other systems use machine learning in our daily lives without our knowledge. We use artificial intelligence systems to perform complex

tasks in a manner akin to human problem-solving. Machine learning is one way to use AI. AI pioneer Arthur Samuel defined machine learning as the field of study that enables computers to learn without explicit programming in the 1950s.[1] Arthur Samuel used two methods that utilized learning, creating one of the first competent AI programs: rote learning and learning by generalization. [2]

Metrics are an important part of library and information science, including library metrics, informatics, bibliometrics, scientometrics, webometrics, cybermetrics, and altmetrics. Scientometrics has become a leading tool for measuring the value of research activities. Scientometrics can offer several indicators for assessing the publication performance of research teams or institutes. Nalimov and Mulchenko (1969) coined the term "scientometrics" by translating the Russian term "naukometriya" (measurement of science). Often referred to as the "science of science," scientometrics is a branch of science. It consists of quantitative studies of scientific activities, particularly publications, which overlap with bibliometrics to some extent. Pritchard, Nalimov, and Mulchenko introduced the terms bibliometrics and scientometrics almost simultaneously in 1969. Pritchard described the term bibliometrics as "the application of mathematical and statistical methods to books and other media of communication." Nalimov and Mulchenko (1989) define scientometrics as "the application of those quantitative methods that deal with the analysis of science as an information process." [3]

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Review of literature

S. No	Title	Year	Database and Coverage of study	Study focus
1	Identifying the landscape of machine learning- aided architectural design a term clustering and scientometrics study[4]	2019	Scopus (1970-2019)	Co-occurrence, scientific collaborations, geographic distribution, and co-citation analysis.
2	Exploring machine learning: a scientometrics approach using bibliometrix and VOSviewer[5]	2021	Dimensions (2010-2020)	co-authorship network of countries, and sources coupling in publications on machine learning techniques
3	Artificial Intelligence, Machine Learning, and Deep Learning in Structural Engineering: A Scientometrics Review of Trends and Best Practices[6]	2022	Dimensions (2011-2020)	Keyword frequency occurrences, Frequently publishing journals, Number of articles published per year, Map of highly publishing journals, Publications as per institution and country of origin
4	Data Mining in Scientometrics: Usage Analysis for Academic Publications[7]	2018	Scopus and Web of Science	Relative cumulative distributions of ages of downloaded papers, Density of downloads per paper (ρ) versus papers' ages, Cumulative downloads vs. cumulative citations.
5	Big data and social media: A scientometrics analysis[8]	2019	Scopus (2012-2019)	Science mapping technic with Bibliometrix R-package and analyzed co-citation, coupling, scientific collaboration analysis and co-word analysis
6	Knowledge discovery from a more than a decade of studies on healthcare Big Data systems: a scientometrics study[9]	2019	20 Databases (2008-2018)	The number of published papers in various years, Number of authors of papers, Papers subject categories, Data mining techniques used in papers, The number of published papers in each journal, Conceptual map of the keywords vs frequency chart.
7	Nipah Virus: An exploratory sciento metrics analysis, 1999-2018[10]	2019	Web of Science (1998-2018)	Quantification by the type of publications, year, citations, geographical productivity, keywords, most preferred journals, leading publications, mapping of authors, priority research areas and productive institutes.

Research Methodology

In the study, data were taken from the Scopus database.[11] The Scopus database is the largest abstract and citation database of peer-reviewed literature, including scientific journals, books, and conference proceedings. Scopus delivers a comprehensive overview of the world's research output in the fields of science, technology, medicine,

social sciences, and the arts and humanities. It features smart tools to track, analyze, and visualize research. [12] Scopus has 23,452 peer-reviewed journals (including 5,500 full open-access journals), 294 trade publications, 852 book series, and 9.8 million conference papers from over 120,000 worldwide events. Scopus has 77.8 million records and 44 million patent records from five patent offices. [13] The present study focuses only on research publications related to machine learning from 1972 to 2022. The author selected "Article Title" with "machine learning" as the search term and filtered the years 1972 to 2022. We analyze the search results based on year-wise publications, author-wise publications, country-wise publications, various types of documents, journal-wise publications, funding-wise publications, language-wise publications, highly cited research papers, and the top 25 institutes and universities in the field of machine learning. The study found that 101276 papers with 1441399 citations published research work in machine learning. This study employs MS Excel as a tool for data analysis.

Objectives of the study

The major objectives of the study are:

1. To find out the year-wise research productivity of machine learning publications.
2. To identify the list of leading authors in the field of machine learning.
3. To identify the country-wise publications.
4. To know the various types of documents.
5. To measure journal-wise publications.
6. To identify the top 25 institutes and universities.
7. To find out about funding and language-based publications.
8. To measure the highly cited research publications in the field of machine learning.

Data Analysis and Interpretation

Year-wise Machine Learning Publications

Table.1 Year-wise Machine Learning publications

S. No	Year	Nos.	%	Citation
1	2022	27860	27.52	37582
2	2021	23624	23.34	151205
3	2020	16483	16.28	191668
4	2019	12195	12.05	199779
5	2018	6414	6.34	304118
6	2017	3398	3.36	104341
7	2016	2147	2.12	81430
8	2015	1513	1.49	54709
9	2014	1160	1.15	34465
10	2013	891	0.88	26673
11	2012	768	0.76	30835
12	2011	701	0.69	60820

13	2010	616	0.61	24894
14	2009	541	0.53	18419
15	2008	417	0.41	12979
16	2007	393	0.39	11757
17	2006	364	0.36	15596
18	2005	316	0.31	8711
19	2004	200	0.20	7329
20	2003	133	0.13	6234
21	2002	122	0.12	11273
22	2001	112	0.11	6896
23	2000	85	0.08	8229
24	1999	76	0.08	2485
25	1998	82	0.08	7340
26	1997	104	0.10	9579
27	1996	76	0.08	1662
28	1995	72	0.07	2007
29	1994	77	0.08	1585
30	1993	57	0.06	740
31	1992	59	0.06	1141
32	1991	35	0.03	248
33	1990	22	0.02	274
34	1989	29	0.03	232
35	1988	35	0.03	2614
36	1987	14	0.01	181
37	1986	15	0.01	1329
38	1985	5	0.00	23
39	1984	5	0.00	14
40	1979	1	0.00	3
41	1975	1	0.00	0
42	1974	1	0.00	0
43	1973	1	0.00	0
44	1972	1	0.00	0
	Total	101221	100	

Table 1 lists the machine-learning publications by year. The study reveals that between 1972 and 2022, there were 10,1221 machine learning-related research publications published. The year 2022 saw the highest number of publications (27860, 27.52%) and citations (37582), while the year 2021 saw the next highest number of publications (23624, 23.34%) and the highest number of citations (151205). However, in 2018, we received the most citations at 304118. From 2014 onwards, the growth of publications shows a sudden spike. It was also discovered that, from 1972 to 1979, publications related to machine learning were the fewest.

List of leading Authors in the field of Machine learning

Table.2 List of leading Authors in the field of Machine learning

S. No	Author	Pub.	Citations	h-index
1	Mosavi, A.	72	3280	31
2	Muller, K.R.	53	7350	34
3	Pradhan, B.	53	2381	23
4	Ekins, S.	46	1196	18
5	Pourghasemi, H.R.	44	2355	22
6	Christofides, P.D.	40	464	13
7	Wu, Z.	40	435	12
8	Zibar, D.	39	840	10
9	Im, J.	37	1338	17
10	Karhade, A.V.	36	1004	18
11	Pham, Q.B.	36	763	14
12	Holzinger, A.	35	1548	17
13	Moni, M.A.	35	787	13
14	Ramprasad, R.	35	3680	23
15	Von Lilienfeld, O.A.	35	5122	25
16	Carena, A.	34	120	5
17	Khan, M.A.	34	385	11
18	Schwab, J.H.	34	734	17
19	Suri, J.S.	34	1036	17
20	Das, R.	33	939	12
21	Bui, D.T.	32	2304	26
22	Fuentes, S.	32	511	11
23	Pham, B.T.	32	1497	15
24	Xu, X.	32	699	16
25	Zhang, Y.	32	699	16

Table 2 displays the list of top machine learning authors. Mosavi, A. holds the highest number of publications (72 publications) and citations (3280 citations with a 31 h-index), trailed by Muller, K.R., and Pradhan, B., each with 53 publications. Muller, K.R., has the most citations of 7350 with a 34 h-index, and Pradhan, B., has the next most citations of 2381 with a 23 h-index. It is also further found that Bui, D.T., Fuentes, S., Pham, B.T., Xu, X., and Zhang, Y., published 32 publications, and Xu, X., and Zhang, Y., have 699 citations with a 16-h-index.

Leading Countries

Table.3 Leading Countries

S. No	Country	Nos.	%
1	United States	24217	23.92
2	China	15876	15.68
3	India	14976	14.80
4	United Kingdom	6470	6.39
5	Germany	5375	5.31
6	Canada	3999	3.95
7	Italy	3657	3.61
8	South Korea	3384	3.34
9	Japan	3104	3.07
10	Australia	3055	3.02
11	Spain	2771	2.74
12	France	2674	2.64
13	Saudi Arabia	2107	2.08
14	Brazil	1938	1.91
15	Turkey	1774	1.75
16	Russian Federation	1715	1.69
17	Iran	1698	1.68
18	Netherlands	1613	1.59
19	Malaysia	1601	1.58
20	Taiwan	1583	1.56
21	Switzerland	1544	1.53
22	Pakistan	1374	1.36
23	Bangladesh	1210	1.20
24	Sweden	1088	1.07
25	Singapore	1085	1.07

Table 3 displays country-specific publications. 160 countries contributed their research publications on machine learning. With 24217 (23.92%) publications, the United States holds the top position, followed by China with 15876 (15.68%) publications. It is also found that India has contributed 14976 (14.80%) publications and Singapore has contributed 1085 (1.07%) articles and is placed in the twenty-fifth position.

Various Types of Documents

Table.4 Various types of Documents

S. No	Document	Nos.	%
1	Article	53715	53.07
2	Conference Paper	37305	36.86
3	Review	3630	3.59
4	Book Chapter	2976	2.94
5	Editorial	1050	1.04
6	Conference Review	660	0.65
7	Erratum	564	0.56

8	Note	548	0.54
9	Letter	333	0.33
10	Book	215	0.21
11	Short Survey	104	0.10
12	Retracted	57	0.06
13	Data Paper	56	0.06
14	Report	2	0.00
15	Other	6	0.01
	Total	101221	100

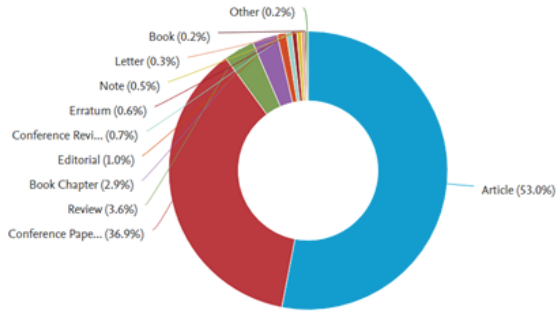


Fig.1 Various Types of Documents

Table 4 and Figure 1 show that various types of documents have published machine learning studies. There are 15 types of documents that publish machine learning-related content. Articles make up the majority (53715, 53.07%) of publications, while conference proceedings account for 37305 (36.86%). However, it is further found that only two publications are published in report form.

Journal-wise publications

Table.5 Journal wise Publications

S. No	Source	Nos.
1	Lecture Notes in Computer Science Including Subseries Lecture Notes In Artificial Intelligence and Lecture Notes In Bioinformatics	2346
2	ACM International Conference Proceeding Series	1153
3	Scientific Reports	1088
4	IEEE Access	1036
5	Advances In Intelligent Systems and Computing	919
6	Lecture Notes In Networks and Systems	902
7	Communications In Computer and Information Science	763
8	PLOS One	724
9	Remote Sensing	714
10	Journal of Physics Conference Series	709

11	Applied Sciences Switzerland	696
12	CEUR Workshop Proceedings	677
13	Proceedings of SPIE The International Society for Optical Engineering	666
14	Lecture Notes in Electrical Engineering	615
15	Sensors	493
16	Lecture Notes on Data Engineering and Communications Technologies	396
17	Procedia Computer Science	349
18	Energies	324
19	Sustainability Switzerland	316
20	Sensors Switzerland	314
21	Optics Infobase Conference Papers	279
22	International Journal of Advanced Computer Science and Applications	274
23	AIP Conference Proceedings	263
24	Expert Systems with Applications	259
25	Electronics Switzerland	255

Table 5 displays journal-based publications. The 177 journals are machine learning publications. The table displays only the top 25 journals. "Lecture Notes in Computer Science, Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics" published the most machine learning papers (2,346), followed by "ACM International Conference Proceeding Series," which published 1153 papers. Further investigation reveals that the journal "Scientific Reports" published 1088 publications. The journal "Electronics Switzerland" has published 255 research papers.

Top 25 Institutes and universities in the field of machine learning

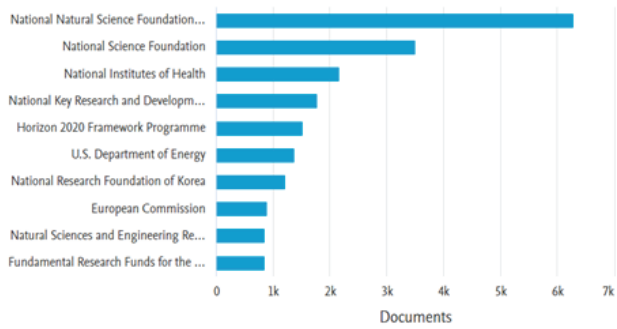
Table.6 Top 25 Institutes and universities in the field of machine learning

S. No	Affiliation	Nos.
1	Chinese Academy of Sciences	1304
2	Ministry of Education China	1038
3	CNRS Centre National de la Recherche Scientifique	751
4	Massachusetts Institute of Technology	658
5	Stanford University	613
6	University of Chinese Academy of Sciences	599
7	Tsinghua University	589
8	Harvard Medical School	560
9	University of Toronto	526
10	Georgia Institute of Technology	485
11	Zhejiang University	466
12	Vellore Institute of Technology	460
13	Imperial College London	452

14	University College London	444
15	National University of Singapore	443
16	University of California, Berkeley	443
17	University of Cambridge	441
18	University of California, Los Angeles	439
19	Shanghai Jiao Tong University	437
20	University of Oxford	434
21	Carnegie Mellon University	420
22	University of Illinois Urbana-Champaign	417
23	University of Michigan, Ann Arbor	401
24	Nanyang Technological University	387
25	University of Washington	381

Table 6 shows the top 25 institutes and universities in terms of the number of publications. The "Chinese Academy of Sciences" contributed the highest number of 1304 publications in the field of machine learning, with the "Ministry of Education China" following closely with 1038 publications. The National University of Singapore and the University of California, Berkeley have contributed a significant number of 443 research publications. In Tamil Nadu, Vellore Institute of Technology has contributed 460 research publications in the machine learning field. The "University of Washington" has also contributed 381 publications.

Funding wise publications



Funding-wise publications

Figure 2 depicts the funding distribution of machine learning publications (research work). The figure shows only the top ten funding agencies. The National Natural Science Foundation of China sponsors 6243 research publications, followed by the National Science Foundation with 3469 research publications. The National Institutes of Health has funded 2149 publications (research work). The National Key Research and Development Program of China, the Horizon 2020 Framework Programme, the U.S. Department of Energy, and the National Research Foundation of Korea have sponsored

1000–2000 research publications (research work). Further investigation reveals that the Fundamental Research Funds for the Central Universities have sponsored 836 research papers.

Language-wise publications



Fig.3 Language-wise publications

Figure 3 shows the language-wise publications. The majority of publications (99493 papers) were written in English, while 810 research publications were written in Chinese. Researchers also discovered that the languages of Croatian, Estonian, Indonesian, Norwegian, Slovak, and Catalan had the fewest machine-learning publications.

Highly Cited Machine Learning Publications

Table.7: Highly Cited Machine Learning Publications

S. No	Title	Authors	Source title	Year	Citation
1	Scikit-learn: Machine learning in Python	Pedregosa F, et.al	Journal of Machine Learning Research	2011	39665
2	TensorFlow: A system for large-scale machine learning	Abadi M., et.al	Proceedings of the 12th USENIX Symposium on Operating Systems Design and Implementation, OSDI 2016	2016	11118
3	Machine Learning in Automated Text Categorization	Sebastiani F.	ACM Computing Surveys	2002	5663
4	Text categorization with support vector machines: Learning with many relevant features	Joachims T.	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	1998	4517
5	Ensemble methods in machine learning	Dietterich T.G.	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	2000	4354

6	The use of the area under the ROC curve in the evaluation of machine learning algorithms	Bradley A.P.	Pattern Recognition	1997	4247
7	Data Mining: Practical Machine Learning Tools and Techniques	Witten I.H., et.al	Data Mining: Practical Machine Learning Tools and Techniques	2016	4190
8	Convolutional LSTM network: A machine learning approach for precipitation nowcasting	Shi X., et.al	Advances in Neural Information Processing Systems	2015	3834
9	Data Mining: Practical Machine Learning Tools and Techniques, Third Edition	Witten I.H., et.al	Data Mining: Practical Machine Learning Tools and Techniques, Third Edition	2011	3592
10	Practical Bayesian optimization of machine learning algorithms	Snoek J., et.al	Advances in Neural Information Processing Systems	2012	3554

Table 7 indicates highly cited publications. The Scopus database shows that the article "Scikit-learn: Machine Learning in Python" has received the most citations (39665), followed by "TensorFlow: A System for Large-Scale Machine Learning," which has received 11118 citations. It is also discovered that the article "Practical Bayesian Optimization of Machine Learning Algorithms" has 3554 citations.

Conclusion

Machine learning has become the latest buzzword, sweeping and trending across the global business landscape. In different industries, machine learning has paved the way for technological accomplishments and tools that would have been impossible a few years ago. The study shows that the machine learning field is continuously evolving, and along with evolution comes a rise in demand and importance. Research entails the development and testing of new algorithms, and researchers frequently work on a wide range of problems, including improving the performance of existing machine learning systems and their ethical and societal implications. Therefore, this study suggests that research plays a crucial role in the field of machine learning, which is expected to continue evolving in the coming years.

This paper's study reveals that machine learning research started in 1969, initially at a slow pace, gradually increasing, and then suddenly experiencing a significant surge. Scopus and the Web of Science index a greater number of journals related to this evolving field of research. Hence, this study helps machine learning scientists identify the scope and suitability of journals for their research publications. The study also shows that India is in third place with 14976 research publications. According to the study, the Vellore Institute of Technology in Tamil Nadu has published 460 research publications on machine learning. This study also gives an insight into the institutes that are conducting effective machine learning research all over the world. However, in Tamil Nadu, the Vellore Institute of Technology has produced larger machine learning publications. As

a result, machine learning researchers in this region can easily approach and collaborate with the Vellore Institute of Technology for their research work. The foreign funding agencies provide research grants for machine learning research, and the study helps and guides Indian scientists to easily identify the funding providers for their research. This study also brings out and provides machine learning researchers with the ability to quickly identify scientists and countries with which to collaborate on their research.

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SCHOLARLY IMPACT OF UNIVERSITY FACULTY PUBLICATIONS ON ACADEMIC SOCIAL NETWORKING SITES: A SPECIAL REFERENCE TO RESEARCHGATE

Mahalakshmi K R[1] & Dr. Rajendra Babu.H[2]

Introduction

The pursuit of knowledge in the growing field of academic study is driven by both individual curiosity and the collaborative efforts of scholars worldwide (Ovadia, 2014). ResearchGate continues to lead the way in this digital a revolution, providing an exciting platform for academics, scientists, and researchers from many sectors to collaborate, exchange ideas, and advance their work (Nicholas et al., 2016). At its essence, ResearchGate is an online social network designed exclusively for the academic community. Researchers can establish profiles that emphasize their expertise, publications, and contributions to their fields (Shettar & Mallikarjun, 2019). They can use this platform to interact with peers, participate in debates, and build collaborations that transcend regional borders.

A key feature that differentiates ResearchGate is its emphasis on open access to research. By offering a centralized repository for papers, preprints, and datasets, ResearchGate enables researchers to openly share their findings with the global scientific community (Bhardwaj, 2017). This spirit of openness and collaboration not just promotes discovery but also fosters imagination and multidisciplinary dialogue. Furthermore, ResearchGate provides a set of tools and services aimed at streamlining the research process. ResearchGate provides researchers with the tools they need to successfully negotiate the complexities of academia and optimize the effect of their work, from metrics analysis and citation tracking to Q&A forums and project collaboration. In an era of overload of information and shattered communication channels, ResearchGate stands as a light of connectivity and knowledge sharing (Yan & Zhang, 2018) . ResearchGate strives to push the boundaries of academic collaboration and advance scientific progress by cultivating a lively community of scholars united by a shared love for discovery.

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Research Gate (About Us | ResearchGate, n.d.) (https://www.researchgate.net/)

ResearchGate Launched by Drs. Ijad Madisch, Sören Hofmayer, and Horst Fickenscher in 2008, ResearchGate rapidly evolved into a crucial platform for scholarly collaboration as well as interaction. ResearchGate, which seeks to bring together researchers and make research accessible to everybody, has completely altered how researchers communicate with other researchers and share their findings (About Us | ResearchGate, n.d.).

- Services offered by ResearchGate
- Distributing their publications with ease.
- forming relationships with colleagues and associates.
- looking for potential joint research projects.
- gaining access to comprehensive analytics and statistics about how submitted articles are being used.
- posing queries to international scholars with comparable interests.
- supporting recruitment or job-seeking efforts.
- creating personal profiles that highlight their experience and output.
- demonstrating support by approving and following the work of other researchers.
- approving other researchers' abilities in the field.
- making use of bookmarking tools to quickly access information that you love.
- Adding to conversations by making remarks and offering criticism.
- distributing updates and news items quickly and effectively.

3. Objectives of the Study

1. To identify the status of Karnataka State Universities LIS faculty members participation on ResearchGate.
2. To identify the most engaged LIS department on ASNS in Karnataka, with a specific focus on ResearchGate
3. To examine the utilization of ResearchGate by LIS faculty members.
4. To identify the most engaged LIS department in ResearchGate in Publications and Views.
5. To identify the universities with Highest Citation on ResearchGate.

Method and Material

A qualitative approach was employed to collect data manually by visiting the faculty profile pages of all Faculty members, who have accounts on ResearchGate during the Month of March 2024. A total of 42 faculty members were identified, and data was gathered from their profile pages, including information on publications, reads, profile views, citations, and RGScore.

The study focuses on the faculty members working in the Karnataka state Universities from the discipline of library and information science. The universities

teaching LIS included are University of Mysore, Karnataka State Karnataka State Akkamahadevi Women's University, Vijayapura, Vijayapura, Vijayapura, Bangalore University, Gulbarga University, Karnatak University, Dharwad, Kuvempu University, Shivamogga, Mangalore University, Mangalore, Rani Channamma University, Siyasanga, Karnataka State Open University, University of Mysore, Tumkur University, Tumakuru, the collected data were represented for frequency and percentages.

Data Analysis and Interpretation: Utilization of ResearchGate by Karnataka State Universities faculty members

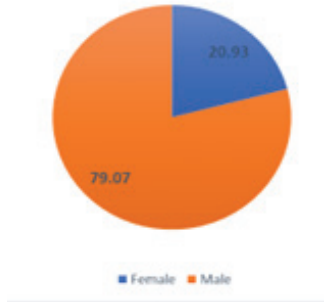


Figure: 1- Demographic Information

The data in Figure-1 shows that among faculty members in Library and Information Science (LIS) in Karnataka, 20.93% were female, and 79.07% were male faculty members.

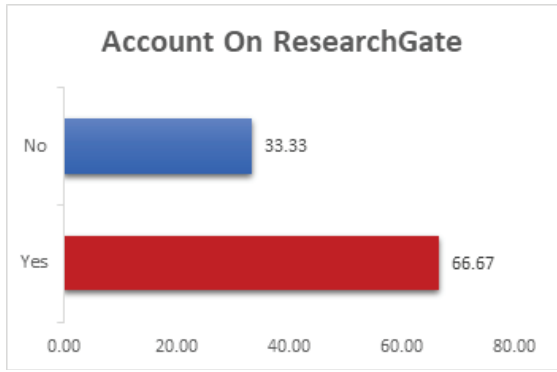


Figure-2: LIS Faculty in ASNS: Profile and their Engagement with ResearchGate

Figure 2 Shows the academic social networking Presences of faculty members in Library and Information Science (LIS) in Karnataka, Approximately 33.33% maintain ResearchGate accounts, while 66.67% do not.

TABLE-1: FACULTY MEMBERS WITH MEMBERSHIPS

Sl. No	Name of the University	Total Number of Faculty members	Research Gate	Percentage
1	Bangalore University, Bengaluru	6	2	33.3
2	Gulbarga University, Gulbarga	5	3	60.0
3	Karnatak University, Dharwad	5	5	100.0
4	Karnataka State Open University, Mysuru	1	0	0.0
5	Kuvempu University, Shimoga	4	2	50.0
6	Karnataka State Akkamahadevi Women's University, Vijayapura.	3	3	100.0
7	Mangalore University Mangalore	5	2	40.0
8	University of Mysore, Mysuru	4	2	50.0
9	Rani Channamma University, Vidyasangama	4	3	75.0
10	Tumkur University, Tumakuru	5	3	60.0
	TOTAL	42	25	59.5

Table-1, displays that Faculty members with Memberships, Karnatak University, Dharwad, 5 out of 5 faculty members having a ResearchGate Profile, Gulbarga University, Gulbarga with 3 out of 3 faculty members having a ResearchGate Profile, and Bangalore University, with 2 out of 6 faculty members having a ResearchGate Profile, indicate comparable performance and resource utilization.

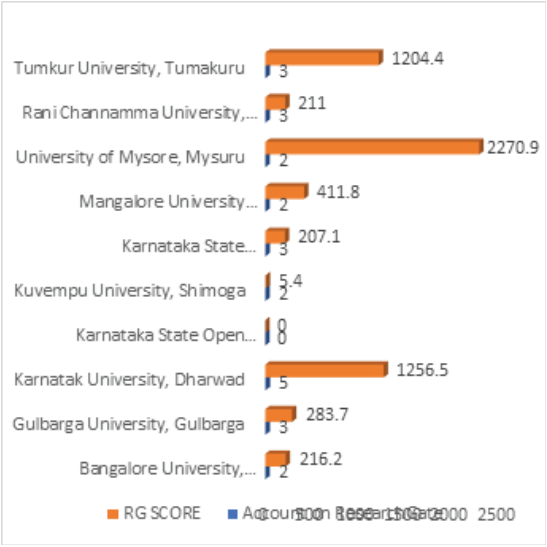


Figure- 3: Faculty Participation and ResearchGate Scores

Figure -3: Shows that University of Mysore, Mysuru, 2 faculty members have account on ResearchGate and got high RG score of 2270.9, Karnatak University, Dharwad with 5 faculty members active on ResearchGate, and Its RG score of 1256.5. Tumkur University,

Tumakuru has 3 faculty members on ResearchGate, indicating active engagement with research dissemination with RG score of 1204.4.

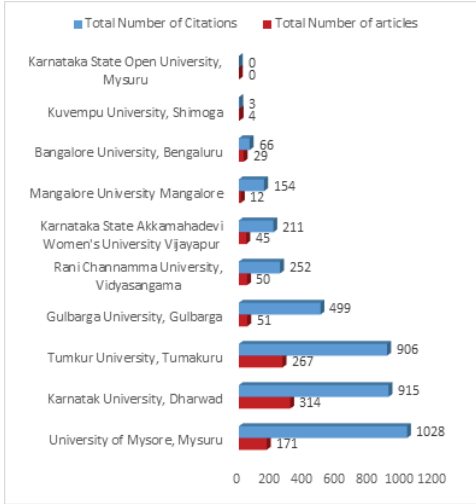


Figure- 4: Research Engagement Comparison among Karnataka State Universities

Data in the figure-4, Shows that University of Mysore, Mysuru has 171 articles and 1028 citations on ResearchGate. Followed by Karnatak University, Dharwad uploaded more research articles with 314, with 915 citations. Tumkur University, Tumakuru Presents 267 articles with 906 citations, indicating a substantial research output and impact.

Table-2: ResearchGate: Research output V/s Citations

Sl. No	Name of the University	Total Number of articles	Total Number of Citations
1	University of Mysore, Mysuru	171	1028
2	Karnatak University, Dharwad	314	915
3	Tumkur University, Tumakuru	267	906
4	Gulbarga University, Gulbarga	51	499
5	Rani Channamma University, Vidyasangama	50	252
6	Karnataka State Akkamahadevi Women's University Vijayapura	45	211
7	Mangalore University Mangalore	12	154
8	Bangalore University, Bengaluru	29	66
9	Kuvempu University, Shimoga	4	3
10	Karnataka State Open University, Mysuru	0	0
	Total	943	4034

Data in the table-2, Shows that University of Mysore, Mysuru has uploaded 171 articles and received 1028 citations on ResearchGate. Karnatak University, Dharwad, Produces more research productivity with 314 articles, with citations 915. Tumkur University, Tumakuru Presents 267 articles with 906 citations, indicating a substantial research output and impact.

Table-3: ResearchGate: Research Output V/S Reads

Sl. No	Name of the University	Total Number of articles	Reads
1	Bangalore University, Bengaluru	29	85289
2	Gulbarga University, Gulbarga	51	7958
3	Karnatak University, Dharwad	314	159549
4	Karnataka State Open University, Mysuru	0	0
5	Kuvempu University, Shimoga	4	406
6	Karnataka State Akkamahadevi Women's University, Vijayapur	45	19176
7	Mangalore University Mangalore	12	150815
8	University of Mysore, Mysuru	171	164775
9	Rani Channamma University, Vidyasangama	50	11476
10	Tumkur University, Tumakuru	267	109209
	TOTAL	943	708653

Data in the table-3, Shows that Bangalore University, Bengaluru has contributed 29 articles have uploaded on ResearchGate, and recieved 85,289 reads. followed by Gulbarga University, Gulbarga With 51 articles, has received 7,958 reads on ResearchGate. Karnatak University, Dharwad Shows a significant research output with 314 articles, accumulating a total of 159,549 reads.

Salient Findings

1. Among faculty members in Library and Information Science (LIS) in Karnataka, 20.93% were female respondents, while 79.07% were male
2. Approximately 33.33% of faculty members in Library and Information Science (LIS) in Karnataka maintain ResearchGate accounts, while 66.67% do not.
3. The Study found that Karnatak University, Dharwad, 5 out of 5 faculty members having a ResearchGate Profile, Gulbarga University, Gulbarga with 3 out of 3 faculty members having a ResearchGate Profile.
4. University of Mysore, Mysuru, leads in both research output and impact, with a high number of articles 171 and citations 1028 on ResearchGate. Karnatak University, Dharwad, exhibits a high research output with 314 articles, though with slightly fewer citations 915 compared to the University of Mysore.
5. Study Shows that Bangalore University, Bengaluru has contributed 29 articles have uploaded on ResearchGate, and recieved 85,289 reads. followed by Gulbarga University, Gulbarga With 51 articles, has received 7,958 reads on ResearchGate. Karnatak University, Dharwad Shows a significant research output with 314 articles, accumulating a total of 159,549 reads.

Conclusion

To Sumup, the study reveals a significant gender disparity, with 79.07% male faculty members compared to 20.93% female faculty members. It is noteworthy that

only about 33.33% of these faculty members have ResearchGate accounts, indicating the need for greater engagement. Notably, Karnatak University, Gulbarga University, and Bangalore University demonstrate active participation in research dissemination on ResearchGate, reflecting their commitment to impactful research. University of Mysore, Mysuru, stands out as a leader in both research output and impact, with 171 articles and 1028 citations on ResearchGate. Karnatak University, Dharwad, also exhibits a strong research output with 314 articles, albeit with slightly fewer citations (915) compared to the University of Mysore. These findings underscore the need for greater collaboration and support to enhance the engagement and impact of LIS faculty members in Karnataka.

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BIG DATA IN LIBRARIES ITS RESEARCH TRENDS BETWEEN 2001-2020: A BIBLIOMETRICS ANALYSIS

Jitu Mani Das[1] & Amrita Devi[2]

Introduction

Big data is the term used to describe extraordinarily vast and varied sets of semi-structured, unstructured, and organised data that keep growing rapidly over time. Conventional data management systems are unable to store, process, and analyse these datasets because to their enormous size and complexity in volume, velocity, and variety. The use of artificial intelligence (AI), connectivity, mobility, and the Internet of Things (IoT) are some of the digital technological innovations that are driving the rapid growth of data availability and volume. As data keeps growing and multiplying, new big data technologies are appearing to assist businesses in gathering, processing, and analysing data as quickly as possible to maximise its value. Big data refers to vast, heterogeneous datasets with enormous volumes that expand quickly over time. Machine learning, predictive modelling, and other advanced analytics employ big data to solve business issues and make defensible judgements. There are two types of big data: unstructured and structured. Data that is already organised and maintained by the company in spreadsheets and databases is called structured data, and it is often numerical in nature. Information that is disorganised and does not fit into a predefined model or format is referred to as unstructured data.

Finding methods to take advantage of it and give their customers better services is the true challenge for organisations. Numerous and intricate types of data are produced at academic and non-academic establishments. As libraries try to figure out how to handle big data internally and leverage it to create new services, they are up against new obstacles. As a result, libraries in many organisations lack the expertise to develop new services on their own. Additionally, libraries have always handled information and adopted new technologies, thus big data technologies will undoubtedly change their environment.

Many information workers are thinking about the library's use of big data right now. What role does the library play in terms of data and information? The solution is straightforward: find and pick important resources; arrange, characterise, and protect them; and lastly grant users access. Librarians are expected to become involved early

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in the information cycle while working with Big Data, whereas in the past they were primarily responsible for processing the research outputs that were published after being filtered. The phrase "big data" has been appearing more frequently in media headlines, trade magazines, and scholarly journals across a wide range of fields since 2012. Large-scale data is useful in many fields; it can provide unexpected insights and has a wide range of capabilities and applications.

Literature Reviews

Patil, Kumar & Nikam, Khaiser (2014) state that librarians can benefit from using open-source big data analytic tools for various operations and studies within the library environment. These tools are essential for handling the characteristics of big data, such as high volume, velocity, and variety. Traditional database solutions are not sufficient for managing the large amounts of data generated by digital technologies. Librarians can utilize these tools for user studies, research activities, bibliometric studies, and information retrieval tasks like searching.

AlBarashdi and Al-Karousi (2018) conducted a literature review on the analysis of Big Data in academic libraries over the past seven years. Despite the significant amount of research on this topic, only a few studies have discussed the implications of Big Data in academic libraries. The review aimed to explore techniques and tools for Big Data analysis in academic libraries, as well as the benefits of utilizing Big Data in these institutions. The study also aimed to identify gaps in research on Big Data in academic libraries and highlighted the need for further research to enhance understanding of the advantages and implications of Big Data in these settings.

Garoufallou and Gaitanou (2021) conducted a systematic literature review on the opportunities and challenges of Big Data in libraries, focusing on papers published between 2012 and 2018 in English. The study categorized the collected literature based on the types of libraries discussed, revealing new and evolving roles within various library settings. The researchers utilized specific keywords related to libraries and Big Data to search databases like Scopus, Google Scholar, and LISTA from August 2018 to October 2019. This approach identified relevant literature and highlighted the growing importance of Big Data in shaping the future of libraries through insights and information management.

Simović, Aleksandar (2018) discusses the implementation of a Big Data smart library recommender system in educational institutions, which aims to enhance user satisfaction and engagement through personalized content recommendations. By utilizing the Hadoop ecosystem to manage large differential data from multiple sources, the system offers unique features for library management, improving data handling and processing efficiency. The integration of recommender systems into smart libraries encourages librarians to modernize their infrastructure for data collection, analysis, and visualization to adapt to the demands of the Big Data environment. This modernization enables libraries to engage in new business processes and interactions with users effectively,

ultimately leading to improved user service and increased motivation in the continuous learning process.

Ball, Rafael (2019) In "Big Data and Their Impact on Libraries," the author discusses the potential benefits and challenges of utilizing large amounts of data in library settings. With the rapid increase in data production driven by technological advances, such as faster internet speeds and more powerful computers, the volume of data is projected to grow exponentially in the coming years. Big data is seen as the "oil of the 21st century" for its potential in data analysis and customer understanding. Libraries and information systems are increasingly recognizing the importance of big data, with the topic being included in conference programs in recent years. This growing interest among librarians and information professionals indicates a rising awareness of the relevance of big data in the field.

Objectives of the study

The following are the main objectives of my study:

1. To analyse the annual scientific research out put on Big Data in Libraries indexing in Web of Science (woS).
2. To find the trends of research in Big Data in Libraries in the studied period.
3. To investigate the most relevant sources of the research output on Big Data in Libraries.
4. To find the nation with maximum number of research output and India's position in it.

Scope and limitation of the stud

The study aims to assess big data research output in libraries and related sector trends. Research output is indexed by the Web of Science, and only the years 2001–2020 are considered in the studies.

Methodology of the study

For the present study, we have used the statistical method. Here we will consider Web of Science database indexing publications on big data in Libraries from 2001 to 2020. Data will be collecting by using extract and filtering from the Web of Science database sources in the form of BibTex. Statistical operational tool R Software Biliometrix (Biblioshiny) shall be use for analysing and interpretations of the data.

Big Data

Big data is an enormous volume of digital information that is gathered by several businesses, government agencies, for-profit businesses, social media platforms, and other websites. Every day, we employ a broad range of big data applications. Frequently without ever considering them to be big data applications. Several apps, including Facebook, Google, LinkedIn, and Twitter, use a lot of data to provide us with entertainment and insights.

"Big data technologies describe a new generation of technologies and architecture designed to economically extract value from very large volumes of a wide variety of data enabling high-velocity capture, discovery and/or analysis," said International Data Corporation (IDC). “Big data can be as high volume, high velocity and high variety of information assets which demands cost effective innovative forms of information processing for enhanced insight and decision making.”

The Big data is defined with 5 Vs and are as follows:

Velocity is the speed at which the data is created and how fast it moves.

Volume is the amount of data qualifying as big data.

Value is the value the data provides.

Variety is the diversity that exists in the types of data.

Veracity is the data's quality and accuracy.

Big Data in Libraries

Information management, including collection acquisition, organisation, and accessibility, has historically been the responsibility of libraries. The primary issue with traditional libraries is their inability to locate lost or removed items from shelves, efficiently manage a vast volume of book records, and handle late delivery (Tarique & Rani, 2017). Consequently, due to their daily workload, traditional libraries are no longer able to provide their usual services.

In order to effectively and efficiently provide relevant services to their users, libraries and librarians are being driven by recent technological breakthroughs to integrate information and communication technologies into their daily operations. Preater (2014) claims that since the introduction of information and communication technology (ICT), the information industry has grown extremely competitive to the point where information is now sold as a commodity. Various actors outside of libraries, such as mega-bookstores, online book sellers, publishers, and aggregators, and even the internet, are vying for the attention of library users. At the request of people or organisations, they are responsible for offering clients a private channel for information (both tangible and intangible information goods).

Bibliometrics analysis

Bibliometric analysis has become a vital research tool, offering insightful information about authors', institutions', and countries' publication output. Researchers can use it to map study areas, spot trends, and monitor the influence of their articles. The goal of this course is to give you the practical skills required to perform your own analysis in addition to a thorough understanding of bibliometric analysis.

An introduction to bibliometric analysis is covered in the first section of the course, along with its objectives, advantages, and differences from other research methods

including systematic literature reviews and meta-analyses. You'll also gain additional knowledge about the typical research issues that bibliometric analysis can help with. the use of statistical techniques to analyse bibliographic data. How many publishing scientists have even rudimentary knowledge of bibliometrics, citation networks, or even information retrieval? (Wright, Donald A., 1974)

In bibliometrics, numbers and patterns related to bibliographic data and use-that is, the quantity of papers published, the expansion of the body of literature, and patterns of library and database usage-are studied. Webometrics is the quantitative study of web phenomena, such as search engines, link analysis, and web citation analysis. These words refer to subfields within the study of discipline dynamics as they are expressed in the literature produced within such disciplines (Chellappandi, P.,2018)

The study or measurement of textual, documental, book, and information format features is known as bibliometrics. Pritchard used the word "bibliometrics" in 1969 to refer to the application of statistical and mathematical techniques to books and other communication mediums. It included the relationship between the development in the quantity of papers in the literature and the utilisation habits of library databases. A fair sample of publication activity in the realm of knowledge can be found in bibliographic databases. The realm of library and information science is where bibliometrics approaches are most frequently applied; they are employed by many study fields to investigate the influence of their respective fields. Since 1958, bibliometrics has completely evolved.

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There are several bibliometric analysis approaches, such as performance analysis, science mapping, citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, co-authorship analysis, network metrics, clustering, and visualisation. To conduct bibliometric analysis, which includes establishing the purpose and scope of your study, selecting relevant techniques, collecting data, performing the analysis, and reporting results. To visualise and analyse citation data with common bibliometric analysis tools such as VOSviewer, CiteSpace, and SciMAT. By the way, bibliometric analysis, as well as the knowledge and abilities required to conduct your own analysis.

Data Analysis and Interpretation

For this study we have considered the period between 2001 to 2020 research productivities indexing in Web of Science database only around the globe. In this period, we have found total 840 numbers of research productivities occurred in around the world. The following diagram shows the annual productivities in the period.

Annual Research Productivities

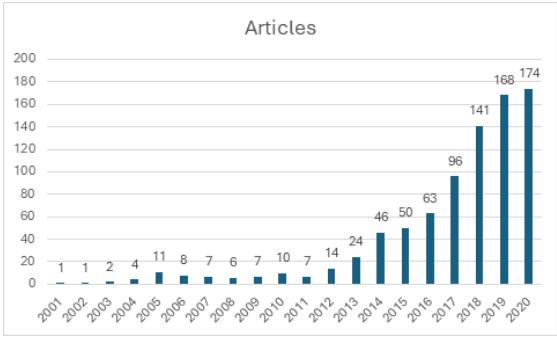


Diagram-01: Annual Research Productivities

From the above diagram it is very much clear that annual productivities on Big Data in libraries content had grows in a steady level from 2001 to 2011 after that the growth has change its nature and grows in a very speedy rate. In the initial eleven-years growth productivity rate is only 7.61% were as in the next 9 years it was 92.39%.

Basic information of the study on Big Data in Libraries in the considered period.

Table-01: Basic Information about the study period.

Timespan	2001-2020
Sources (Journals, Books, etc)	478
Documents	840
Annual Growth Rate %	31.2
Document Average Age	7.11
Average citations per doc	35.46

From the above basic information table this has been seen that timespan for study is considered between 2001 to 2020 indexing research productivity only in Web of Science (WoS). Total 840 numbers of documents were indexed in total 478 numbers of sources. Annual growth rate was 31.2%, average document age is 7.11 and the average citation per document is 35.45.

Table-02: Authorship Details

AUTHORSHIP DETAILS	
Authors	3861
Authors of single-authored docs	78
AUTHORS COLLABORATION	
Single-authored docs	78
Co-Authors per Doc	5.51
International co-authorships %	29.4

The above-mentioned table shows that total 3861 numbers of f authors were involved in the publication of 840 numbers of research production in the timespan of 20 years. Out of 840 numbers of documents 78 documents are with single authorship and rest 762 documents with multiple authorship. 5.51 s the co-author per document and 29.4% in the international co-authorship in the mentioned publications.

Table-03: Types of documents

DOCUMENT TYPES	
article	680
article; data paper	1
article; proceedings paper	22
book review	1
correction	1
editorial material	9
meeting abstract	2
review	122
review; book chapter	2

From the table-03 this has been displays that out of 840 research output, 680 are research articles i.e.80.95 %. In second the review article was there with 122 numbers, i.e. 14.52%. in next conference proceeding 22 numbers i.e. 2.62% and others in unit digit numbers. That means mostly research rely on publications as research articles.

The following diagram has graphically explained that major sources of production over time, PLOS has initially has very less numbers of production from 2012 onwards take a massive growth in the productivity. IEEE also has changed its momentum after 2015. But Cochrane Database of Systematic Review has the almost the same momentum over the time span from 2004 with a steady growth rate of its productivities.

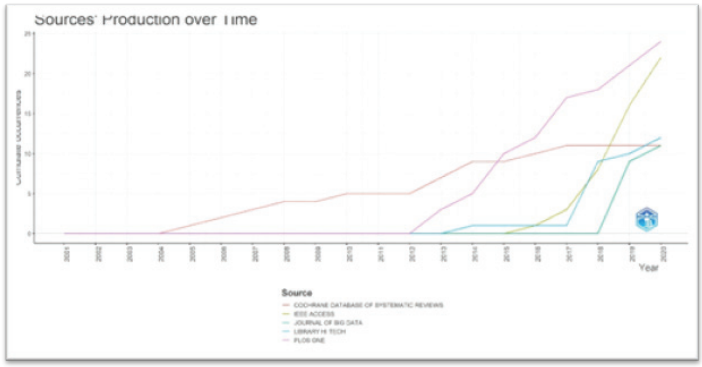


Diagram-02: Major Sources of publications over time.

The following table has been retrieved the top 20 sources of productivity on big data in libraries.

Table-04: Top 20 Sources of publications

Sl.No.	Sources	Articles
1	Plos One	24
2	Ieee Access	22
3	Library Hi Tech	12
4	Cochrane Database of Systematic Reviews	11
5	Journal of Big Data	11
6	Computer Physics Communications	10
7	Journal of Documentation	9
8	Bmc Bioinformatics	8
9	Bmj Open	8
10	Journal of Chemical Information and Modeling	8
11	Journal of Cheminformatics	8
12	Scientific Reports	8
13	Electronic Library	7
14	Agro Food Industry Hi-Tech	6
15	Bmc Genomics	6
16	Frontiers In Pharmacology	6
17	Future Generation Computer Systems-The International Journal of Escience	6
18	Gigascience	6
19	Isprs International Journal of Geo-Information	6
20	Journal of Academic Librarianship	6

From the table-04 this has shows us the top 20 sources pr production of research on Big Data in Libraries over the timespan considered for study. PLOS ONE has the highest

numbers with 24 followed by IEEE with 22 numbers. Library Hi-Tech has the 3rd highest numbers with 12 numbers. Out of 20 top sources of productivities only 4 numbers of proper Library Sciences sources.

Table -05: Top 10 Contributing Institutions

Sl.No.	Affiliation	Articles
1	UNIV MIAMI	48
2	TAIPEI MED UNIV	46
3	UNIV OXFORD	38
4	WUHAN UNIV	32
5	SICHUAN UNIV	28
6	UNIV CALIF BERKELEY	28
7	PEKING UNIV	26
8	INDIANA UNIV	19
9	UNIV CHINESE ACAD SCI	19
10	CHINESE ACAD SCI	18

Table 05 has shown us the top 10 institutions involved in maximum numbers of research productivity on Big Data in Libraries. Out of 10 major institution 8 institutions are from Republic of China and 2 institutions are from USA.

Table -06: Top 10 Contributing Authors

Authors	Articles	Articles Fractionalized
LI L	15	2.75
WANG J	15	2.14
LI Y	14	2.04
LI J	13	1.70
ZHANG Y	12	1.48
WANG X	11	2.79
ZHANG Z	11	0.86
CHEN Y	10	2.33
LI W	10	1.32
WANG Y	10	1.49

The table 6 shows us the top 10 authors who contributes maximum research output on big data in Libraries. The author Li L and Wang J has the highest numbers of publications in Big Data in libraries with 15 numbers of research articles. It has been seen that all the top 10 contributors are from Republic of China having more the 10 research output on the mention areas.

Table-07: Top 20 Ranked Nations on Scientific Production on Bid data in Libraries

Sl. No.	Nations	Frequency
1	CHINA	1036
2	USA	1020
3	UK	255
4	GERMANY	155
5	JAPAN	117
6	CANADA	111
7	SPAIN	110
8	SOUTH KOREA	93
9	FRANCE	77
10	ITALY	75
11	NETHERLANDS	72
12	AUSTRALIA	70
13	BELGIUM	60
14	INDIA	58
15	SWITZERLAND	56
16	BRAZIL	39
17	FINLAND	35
18	SWEDEN	33
19	RUSSIA	32
20	GREECE	28

From the above table this has been seen that Republic of China was in the top ranked with 1036 numbers of frequency on big bata in libraries follows by USA with 1020. Only two nations have the more than 1000 frequencies of productions. On the other hand, UK, Germany, Japan, Canada, and Spain has in 3-digit frequencies on production of big data in Library areas. India has only 58 numbers of within the considered timespan in 14th Ranked.

From the table 8 we can find here the major areas of trends where the Big Data is applied for conducting research. From the table this has been seen that Big Data theory heist research production has taken place in the considered time span i.e. 53 times, followed by big data in management with 37 times. Median year of maximum research taken place was 2018. On big data model 36 times has studies taken up in 2017 as the median year. Big data study in Library and libraries has 32 and 15 frequencies in the ranked 5th and 8th positions.

Table-08: Top 20 Trends on Bid data in Libraries

Trends of area	Freq	Year_Q1	Year Med	Year_Q3
Big Data	53	2018	2018	2019
Management	37	2017	2019	2020
Model	36	2017	2018	2019
Identification	35	2016	2019	2020
Library	32	2017	2018	2019
Impact	21	2018	2019	2020
Algorithm	18	2015	2017	2018
Libraries	15	2016	2017	2018
Services	14	2016	2017	2019
Internet	14	2019	2020	2020
Optimization	12	2015	2016	2018
Visualization	12	2015	2016	2018
Search	10	2014	2016	2018
Network	10	2018	2020	2020
Risk	10	2017	2020	2020
Sequence	8	2014	2015	2018
DNA	7	2012	2013	2016
Web	7	2014	2014	2017
Resources	7	2012	2015	2018
Sequences	6	2013	2014	2018

Table-09: Yearwise mean of Citation per article and mean of total citation per year.

Year	Mean TC per Art	Numbers	Mean TC per Year	Citable Years
2001	26	1.00	1.08	24
2002	10	1.00	0.43	23
2003	8.5	2.00	0.39	22
2004	16.25	4.00	0.77	21
2005	21.45	11.00	1.07	20
2006	32.88	8.00	1.73	19
2007	59.57	7.00	3.31	18
2008	70.17	6.00	4.13	17
2009	19.71	7.00	1.23	16
2010	29.9	10.00	1.99	15
2011	91.14	7.00	6.51	14

2012	46.64	14.00	3.59	13
2013	66.92	24.00	5.58	12
2014	70.61	46.00	6.42	11
2015	54.42	50.00	5.44	10
2016	41.41	63.00	4.60	9
2017	34.82	96.00	4.35	8
2018	24.99	141.00	3.57	7
2019	32.01	168.00	5.34	6
2020	24.01	174.00	4.80	5

From the table 9 we analyse the mean of total citation of per articles per year. This is observed that 91.14 and year 2011 has the highest the mean of total citation per articles i.e. 91.14 and in 2003 the lowest mean of total citation i.e. 8.5.

Conclusions

The study provides a bibliometric analysis of research output on "Big Data in Libraries" from 2001 to 2020, analyzing 840 research documents from 478 sources. The annual growth rate was 31.2% with an average citation per document of 35.46. China and the USA were the top contributing countries, with trends showing a focus on "Big Data", "Management", and "Model" research areas. While big data technologies are prevalent in academic and medical libraries, public and research libraries are still developing their strategies. Librarians are urged to systematize retrieval techniques and provide information visualization technologies for accessible and usable large datasets. The top research areas were "Big Data", "Management", and "Model", with research productivity steadily increasing until 2011 and accelerating from 2011-2020. PLOS ONE, IEEE Access, and Library Hi Tech were the top publishing sources, predominantly from China. Chinese institutions and authors were top contributors, with China leading in research output followed by the USA. The most popular research topics were Big Data, Management, Model, Identification, and Library, presenting opportunities and challenges for libraries to adapt their services.

Librarians must stay informed about data-driven research to support knowledge generation, as academic and medical libraries have adopted big data technologies while public and research libraries are still developing their strategies. Librarians must play a role in organizing retrieval techniques and providing data visualization tools for accessible large datasets.

The concept of "Big Data" has become a prominent and transformative force, impacting various aspects of society. It has led to changes in how we work, live, and think, sparking innovation internationally. Libraries are also affected by big data, with opportunities arising for information workers and librarians to create new roles and enhance retrieval techniques and data visualization. While academic and medical libraries have adopted big data technologies, public and research libraries are still developing

their strategies. Librarians must stay informed about data-driven research to support knowledge generation within their communities. It is essential for libraries to integrate information and communication technologies into their operations to effectively serve users amidst technological advancements. By developing big data strategies and utilizing big data technologies, libraries can adapt to the evolving environment and improve their services. The evolving role of librarians in managing and leveraging big data is crucial for enhancing library services and supporting research in the digital age.

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MAPPING GROWTH TRENDS AND THE GLOBAL LANDSCAPE OF MILLETS RESEARCH: A PUBLICATION ANALYSIS (2000-2023)

Anandraj K.C[1] & Dr. S Aravind[2]

Introduction

Millets, a group of small-seeded grasses cultivated as cereal crops, have garnered increasing attention in recent years due to their nutritional value, climate resilience, and potential contribution to food security. (Wrigley et al., 2016).As the interest in millets increases, there is a parallel growth in scientific research focused on exploring various aspects of these crops. As these small-seeded grains gain prominence globally, understanding the landscape of millets research becomes crucial for shaping future agricultural applications, nutritional strategies, and sustainable farming practices. This scientometric assessment aims to comprehensively explore and analyze the global research patterns surrounding millets across various scientific disciplines and geographical regions. By applying scientometric methods, which involve quantitative analysis of publication data, citation patterns, collaboration networks, and the global activity index, this study seeks to uncover trends, identify key research themes, and assess the impact of millet-related research over time.

Review of Literature

Jeena et al., (2024) conducted a scientometric study on bibliotherapy research, examining its evolution, trends, and major contributions. Bibliotherapy academic literature was analyzed using Biblioshiny and VOS viewer and citation and co-citation methodologies. Scopus was used to find 1,703 papers published between 1942 and 2023 for extensive data analysis, showing bibliotherapy research's scope. In "Scientometric Analysis and Knowledge Mapping of Cybersecurity," Alqurashi and Ahmad (2024) examined malware detection and cybersecurity research trends and new technologies. They identified six co-citation clusters in 9,967 publications from 2019 to 2023 using Citespace, explored the research areas of malware categorization, dodging classifiers, android malware detection, IoT network security, CNN, and ransomware families. This analysis is essential for understanding current and future directions in cybersecurity

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research. Recent and emerging COPD with sarcopenia research was examined by Jingfeng Zou and Wen Peng (2024) focused on recent research and emerging areas in COPD with sarcopenia. They retrieved articles from the Web of Science Core Collections from 2003 to 2022 and analysed them using scientometric and keyword analyses with VOS viewer and Cite Space. The findings indicate that COPD with sarcopenia is frequently associated with other diseases, highlighting the complexity and the need for comprehensive treatment approaches. The study emphasizes the importance of Mechanistic and diagnostic aspects, especially computed tomography, are stressed in this research. Wang etal., (2024) carried out a scientometric analysis of Cerebral Amyloid Angiopathy (CAA) research over the previous 25 years. CAA research publishing patterns, countries/regions, institutions, authors, journals, cited references, and keywords were examined using VOS viewer and CiteSpace. This study intends to inform future CAA research and scientific decision-making by revealing CAA research trends. Khosravi et.al, (2024) used 27,213 Web of Science papers to conduct a scientometric study on the Otitis media research knowledge domain. This paper emphasizes the prevalence and public health consequences of Otitis media, highlighting research prioritization. Scientometric software like Biblioshiny and CiteSpace used to discover research trends and important areas for future study. Hosamani and Krishnamurthi (2023) analyzed cloud computing literature from 2009 to 2018 using Web of Science International Database data, examining both quantitative and qualitative aspects of cloud computing publication output to provide a complete picture of the field's progress. Anand and Aravind (2023) conducted a complete scientometric analysis of Indian millets research from 1989 to 2022 using the Web of Science database and 3,373 Indian research outputs analysed. This study offers significant insights into the research trends and collaborative networks and the results shed light on millets research trends and collaborations. Lafuente-Lechuga et al. (2021) reviewed global research up to mid-2021 on sustainability, big data, and the math techniques used for analysis. They analyzed where the research was done and which Sustainable Development Goals were focused on, and the growing interest in using big data for sustainable cities and Industry 4.0 and found a rise in published articles, with China, the US, and India leading.

Background of the study

Millets are gaining prominence for their nutritional benefits and resilience to environmental challenges, making them crucial for sustainable agriculture and food security. Despite increasing research interest across various disciplines, there is a lack of comprehensive scientometric analysis on global millet research trends. The aim is to provide a holistic view of the millets research landscape, guiding future studies and is crucial for understanding the evolution and impact of research in this field and promoting sustainable agricultural practices. This enhanced background highlights the significance of millets, emphasizes the need for scientometric analysis, and underscores the potential impacts on millets research and agricultural practices.

Objective of the study

- To identify the growth pattern of publications in the field of Millets Research
- To trace out the Annual ratio of Growth (ARoG), Doubling time (Dt) and Relative Growth rate (RGR)
- To find out the research performance of most productive countries with Activity Index
- To evaluating global research impact through the Performance Efficiency Index
- To analyze the publication performance of journals with impact factor, CSR and SJR
- To Investigate Identify the most productive authors with h index,

Materials and Methods

The type of research carried out in this work is exploratory, descriptive and quantitative based on the techniques and tools of bibliometric analysis of the documents stored in the Scopus bibliographic database. This is one of the world's most important databases of bibliographic references and citations of periodical publications. The data was downloaded on 10/05/2023 for time span of 24 years (2000-2023). The data was tabulated in Ms Excel and tested by the scientometric tool to achieve objectives. The search string was TITLE-ABS-KEY (Millets) and PUBYEAR > 1999 and PUBYEAR < 2024.Records downloaded were 14140, all these downloaded bibliographic details were transferred to spreadsheet application and data was analysed as per objective of the study.

Analysis and Discussion

Global growth pattern of Millets Research

The global growth pattern of millets research over the years reveals a steady increase in the number of research literature published annually, reflecting a growing interest and emphasis on this field of study. From 2000 to 2023, the cumulative publications steadily rose from 224 to 14,140, with a corresponding increase in the cumulative percentage from 10.1% to 100%. The highest growth rates were observed in 2006, 2015, and 2023, indicating significant spikes in research activity during those years. This growth is evident in the increasing number of publications each year, with some years experiencing higher growth rates than others. Overall, the data underscores the increasing global attention and importance attributed to millets research over the past two decades.

Table 1 Annual Ratio of Growth (ARoG) and Compound Annual Growth rate (CAGR)

Year	No. of Article	Percentage	Cumulative Publications	Cumulative Percentage	ARoG	CAGR
2000	224	1.6	224	10.1	1.02	
2001	179	1.3	403	20.0	1.21	0.099
2002	216	1.5	619	28.6	1.06	0.027
2003	228	1.6	847	36.1	1.07	0.034

2004	244	1.7	1091	42.7	1.11	0.056
2005	272	1.9	1363	48.2	1.05	0.025
2006	286	2.0	1649	53.3	1.26	0.120
2007	359	2.5	2008	58.4	1.02	0.011
2008	367	2.6	2375	62.5	1.06	0.028
2009	388	2.7	2763	66.3	1.13	0.065
2010	440	3.1	3203	70.1	1.19	0.090
2011	523	3.7	3726	73.6	0.95	-0.026
2012	496	3.5	4222	77.3	1.09	0.046
2013	543	3.8	4765	80.5	0.99	-0.006
2014	536	3.8	5301	83.2	1.09	0.045
2015	585	4.1	5886	85.8	1.22	0.106
2016	715	5.1	6601	88.3	1.01	0.003
2017	719	5.1	7320	90.4	1.10	0.047
2018	788	5.6	8108	92.3	1.19	0.089
2019	934	6.6	9042	94.0	1.12	0.059
2020	1048	7.4	10090	95.6	1.16	0.079
2021	1219	8.6	11309	97.1	1.15	0.071
2022	1397	9.9	12706	98.4	1.03	0.013
2023	1434	10.1	14140	100.0	1.11	2.140
Total	14140	100.0				

Annual Rate of Growth (ARoG)

The Annual Rate of Growth (ARoG) of publications is a metric used to quantify the percentage increase in the number of publications over a specified period. From 2000 to 2010, the Annual Rate of Growth in millets research steadily increased, ranging from 1.02% to 1.19%. This period witnessed substantial expansion, reflecting heightened interest and investment in the field. However, from 2011 to 2015, the growth rate slowed, dropping to as low as 0.95%. In the subsequent years (2016-2023), ARoG fluctuated between 1.01% and 1.22%. 2023 marked a notable increase in research output, with 1,434 articles published, contributing to the field's highest cumulative percentage of publications reaching 100% by the end of 2023.

Compound Annual Growth Rate (CAGR)

The Compound Annual Growth Rate (CAGR) provides a standardized measure to assess annualized publication growth, smoothing volatility into a single representative rate. The global millet research from 2000 to 2023 exhibited varied CAGRs, with notable fluctuations. Early 2000s showed moderate growth (e.g., 2001: 0.099, 2002: 0.027), while spikes occurred in 2006 (0.12) and 2015 (0.106). Some years, like 2011 (-0.026) and 2013 (-0.006), saw slight declines. Positive CAGRs in the late 2010s and early 2020s (e.g., 2018: 0.089, 2019: 0.059) culminated in a significant surge in 2023 (2.14 CAGR), reflecting increased global focus on sustainable agriculture.

Table 2 Relative Growth rate and Doubling Time

Year	No.of Article	Cumulative Publn.	Cumulative %	Log W1	Log W2	Rt	Mean Rt	DT	Mean Dt
2000	224	224	1.6		5.412	0			
2001	179	403	2.9	5.412	5.187	-0.23		3.1	
2002	216	619	4.4	5.187	5.375	0.19		3.7	
2003	228	847	6.0	5.375	5.429	0.05	0.03	12.8	6.0
2004	244	1091	7.7	5.429	5.497	0.07		10.2	
2005	272	1363	9.6	5.497	5.606	0.11		6.4	
2006	286	1649	11.7	5.606	5.656	0.05		13.9	
2007	359	2008	14.2	5.656	5.883	0.23		3.1	
2008	367	2375	16.8	5.883	5.905	0.02	0.11	31.5	12
2009	388	2763	19.5	5.905	5.961	0.06		12.4	
2010	440	3203	22.7	5.961	6.087	0.13		5.5	
2011	523	3726	26.4	6.087	6.26	0.17		4.0	
2012	496	4222	29.9	6.26	6.207	-0.05		13.1	
2013	543	4765	33.7	6.207	6.297	0.09		7.7	
2014	536	5301	37.5	6.297	6.284	-0.01	0.05	53.3	11.4
2015	585	5886	41.6	6.284	6.372	0.09		7.9	
2016	715	6601	46.7	6.372	6.572	0.20		3.5	
2017	719	7320	51.8	6.572	6.578	0.01		115.5	
2018	788	8108	57.3	6.578	6.67	0.09		7.5	
2019	934	9042	63.9	6.67	6.84	0.17		4.1	
2020	1048	10090	71.4	6.84	6.955	0.12	0.12	6.0	9.0
2021	1219	11309	80.0	6.955	7.109	0.15		4.5	
2022	1397	12706	89.9	7.109	7.242	0.13		5.2	
2023	1434	14140	100.0	7.242	7.268	0.03		26.7	
Total	14140								

CAGR = (Cumulative Publication at the end of the period/ Cumulative Publications at the beginning of the period) ^1/n -1. Where n = number of Period.)

Relative Growth (Rt) and Doubling Time (Dt)

The global publication landscape in millets research from 2000 to 2023 exhibits significant growth and varying relative growth rates (Rt) and doubling times (DT) (Kumar & Mahajan, 2019) the table 2 shows the number of articles increased from 224 in 2000 to 1,434 in 2023, with a cumulative total of 14,140 publications. The early 2000s saw moderate growth, with Rt values fluctuating, such as -0.23 in 2001 and 0.19 in 2002. Notable growth spikes are seen in 2007 (0.23) and 2016 (0.20). The overall mean relative growth rate (Rt) is calculated to be 0.09.

Doubling times (DT) (De Solla Price, 1975) varied significantly, with a mean DT of 9.0 years. Early in the study period, DT values were lower, indicating faster growth. For instance, 2001 had a DT of 3.1 years, while 2018 had a DT of 7.5 years, reflecting a slower but steady increase in publications. Peaks in doubling times are seen in 2008 (31.5 years) and 2017 (115.5 years), suggesting periods of slower growth. The research in millets has shown a steady upward trend in publication volume, with periodic fluctuations in growth rates and doubling times, reflecting changes in research focus, funding, and global interest in millets as a sustainable crop.

Relative Growth and Doubling Time in 5 Year Block period

Table 3 Relative Growth and Doubling Time in 5 Year Block period

5-Year Block	Mean Rt	Description	Mean DT (Years)	Description
2000-2004	0.062	Slow growth	15.02	Millets research doubles approximately every 15.02 years, indicating a slow pace of expansion during this period.
2005-2009	0.093	Moderate growth	7.62	Millets research doubles approximately every 7.62 years, indicating a moderate increase in research activity.
2010-2014	0.120	Significant growth	5.81	Millets research doubles approximately every 5.81 years, reflecting a notable increase in research output during this period.
2015-2019	0.130	Significant growth	5.32	Millets research doubles approximately every 5.32 years, indicating continued growth at a notable pace.
2020-2023	0.106	Moderate growth	7.46	Millets research doubles approximately every 7.46 years, indicating a moderate pace of expansion in the most recent years.

Analysis of millets research output over distinct 5-year periods shows varying growth patterns. From 2000 to 2004, there was slow progress (Rt = 0.062). Moderate growth was observed from 2005 to 2009 (Rt = 0.093). A significant surge occurred from 2010 to 2014 (Rt = 0.120), followed by sustained growth from 2015 to 2019 (Rt = 0.130). However, growth moderated from 2020 to 2023 (Rt = 0.106). These fluctuations highlight the dynamic nature of millets research.

Publication performance of Journals

Table 4 Global publication performance of journals

Sl No	Name of The Journals	Publications	TGCS	H - index	Total Cite Score	Cite Score Rank	IF	SJR
1	Journal Of Food Science And Technology	188	3745	105	7.6	61	3.9	0.666
2	Frontiers In Plant Science	178	4036	216	7.3	56	5.6	1.231
3	Electronic Journal Of Plant Breeding	153	355	15	1.1	283	0.71	0.249
4	Plos One	150	5321	435	6.1	17	3.7	0.885
5	Indian Journal OfAgricultural Sciences	131	529	34	0.09	290	0.4	0.177
6	Food Chemistry	125	8799	324	16.3	10	8.8	1.624
7	Agronomy	94	660	145	6.2	76	2.1	0.663
8	Scientific Reports	92	2414	315	7.5	11	4.6	0.973
9	Lwt	82	2703	158	11.8	34	6	1.173
10	Pesquisa Agropecuaria Brasileira	78	2059	59	1.2	252	0.8	0.237
11	Agronomy Journal	77	1953	152	4.7	76	2.1	0.663
12	Journal Of Cereal Science	73	3244	139	7.8	56	3.8	0.736
13	Field Crops Research	72	2784	190	9.6	26	5.8	1.396
14	Journal Of The Chinese Cereals And Oils Association	72	157	10	0.9	306	0.56	0.146
15	Revista Brasileira De Ciencia Do Solo	71	1272	59	3	218	0.97	0.414

Millets research is scattered over a total of 161 journals, reflecting the diverse landscape of scholarly dissemination in this area. The publication performance of journals in millet research on a global scale varies widely and is dynamic, with prominent journals playing a significant role in disseminating and advancing knowledge in this field. Journals such as the Journals like “Journal of Food Science and Technology” and “Frontiers in Plant Science” lead in millet research with significant contributions: "Journal of Food Science and Technology" and "Frontiers in Plant Science" have published 188 and 178

articles respectively, with high TGCS of 3745 and 4036, and impressive H-indices of 105 and 216. "PLOS ONE" excels with an exceptional H-index of 435 and TGCS of 5321, demonstrating widespread recognition. These journals collectively elevate the visibility, impact, and advancement of global millet research, offering crucial platforms for sharing findings and fostering progress in the field.

Research Performance by Authors

The collective endeavors of authors in global millets research are significant, with a total of 42868 contributors worldwide. The most prolific authors in millets research highlight individuals from leading institutions in China and India. X. Diao from the Chinese Academy of Agricultural Sciences leads with 81 records, an h-index of 30, and 2552 total Google Scholar citations (TGCS). Close behind, B. Feng of Northwest A&F University in China has 79 records, an h-index of 27, and also 2552 TGCS. From India, A. Kumar at the Central University of Haryana has contributed 73 records, achieving an h-index of 27 and 1761 TGCS. M. Prasad from the National Institute for Plant Genome Research in India stands out with a high h-index of 59 from 71 records and 3391 TGCS. These results revealed that the significant contributions these authors have made to agricultural science, particularly within their respective institutions in China and India.

Table 5 Research Performance by Authors

Sl No	Authors	Institution and Country	No. of Rec's	h -index	TGCS
1	Diao, X.	Chinese Academy of Agricultural Sciences,China	81	30	2552
2	Feng, B.	Northwest A&F University,China	79	27	2552
3	Kumar, A.	Central University of Haryana,India	73	27	1761
4	Prasad, M.	National Institute for Plant Genome Research India	71	59	3391
5	Shetty, H.S.	Department of Biotechnology, Mysore	71	37	1015
6	Hash, C.T.	International Crops Research Institute for the Semi-Arid Tropics,India	66	46	2909
7	Shen, Q.	China Agricultural University,China	60	37	2465
8	Upadhyaya, H.D.	International Crops Research Institute for the Semi-Arid Tropics,India	59	63	1874
9	Govindaraj, M.	International Crops Research Institute for the Semi-Arid Tropics,India	54	20	798
10	Rai, K.N.	International Crops Research Institute for the Semi-Arid Tropics,India	52	22	1197

Country wise contribution (Top 10 Only)

The landscape of millets research encompasses contributions from 274 countries. From 2000 to 2023, millets research has seen substantial contributions from various countries on a global scale. India emerges as a prominent leader in this field, with a total of 4435 publications, demonstrating a consistent commitment to advancing knowledge and understanding in millets research. Following closely behind, China has also made significant strides, contributing 2649 publications, highlighting its active engagement and substantial research output in this area. The United States maintains a strong presence in millets research with 1988 publications, indicative of its active involvement and contribution to the global research landscape. Brazil shows notable involvement with 966 publications, underscoring its significant contribution to advancing research in millets. Additionally, the United Kingdom, Germany, France, Nigeria, Japan, and

Canada actively contribute to millets research with 606, 522, 488, 256, 390, and 347 publications, respectively. These collective efforts represent a global commitment to advancing knowledge and addressing challenges related to millets, reflecting the collaborative nature of scientific research on a global scale.

Table 6 Country wise (Top 10) contribution and Activity Index of Millets research

Year	Publications	India Publn/AI	China Publn/AI	USA Publn/AI	Brazil Publn/AI	UK Publn/AI	Germany Publn/AI	France Publn/AI	Nigeria Publn/AI	Japan Publn/AI	Canada Publn/AI
2000	224	61 (86.76)	4 (2.31)	50 (2.36)	6 (0.63)	15 (2.48)	274 (5.17)	7 (1.34)	8 (3.12)	14 (3.58)	6 (1.38)
2001	179	65 (69.64)	5 (2.45)	34 (1.44)	5 (0.52)	7 (1.44)	17 (2.8)	3 (0.63)	7 (2.66)	8 (2.05)	4 (0.92)
2002	216	66 (84.58)	9 (2.49)	36 (1.58)	16 (1.01)	14 (2.12)	14 (2.31)	6 (1.07)	9 (3.14)	11 (2.82)	5 (1.03)
2003	228	74 (89.81)	6 (2.79)	48 (2.42)	12 (0.76)	13 (2)	11 (1.82)	11 (2.11)	4 (1.28)	14 (3.54)	2 (0.52)
2004	244	77 (96.29)	10 (2.9)	52 (2.63)	24 (1.78)	16 (2.28)	12 (1.94)	13 (2.49)	2 (0.64)	10 (2.26)	7 (1.05)
2005	272	79 (107.18)	17 (2.97)	56 (2.77)	18 (1.37)	17 (2.42)	7 (1.24)	14 (2.82)	6 (1.92)	19 (5.37)	6 (1.38)
2006	286	79 (112.98)	13 (2.97)	60 (2.97)	38 (3.07)	11 (1.61)	14 (2.56)	11 (2.15)	5 (1.6)	14 (3.54)	11 (2.76)
2007	359	94 (141.7)	27 (3.52)	69 (3.87)	23 (1.89)	19 (2.780	19 (3.14)	12 (2.76)	3 (0.96)	13 (3.23)	13 (3.74)
2008	367	99 (145.54)	32 (3.88)	54 (2.72)	39 (3.84)	13 (1.89)	10 (1.93)	17 (3.26)	6 (1.280	14 (3.54)	10 (2.88
2009	388	109 (153.98)	41 (4.32)	69 (3.87)	37 (3.68)	15 (2.020	15 (2.67)	22 (4.21)	7 (1.6)	12 (3.08)	6 (1.38)
2010	440	119 (174.51)	44 (4.9)	72 (4.02)	50 (5.23)	16 (2.07)	13 (2.38)	11 (2.49)	4 (0.64)	18 (4.62)	11 (2.76)
2011	523	125 (207.11)	51 (5.03)	88 (4.79)	58 (6.52)	19 (2.78)	13 (2.56)	28 (5.47)	16 (6.28)	23(5.9)	14 (4.03)
2012	496	157 (196.08)	54 (7.29)	66 (3.49)	65 (7.51)	29 (5.47)	11 (1.81)	16 (3.07)	4 (0.64)	9 (2.3)	17 (4.9)
2013	543	160 (214.49)	70 (7.46)	79 (3.94)	63 (7.08)	23 (3.97)	20 (3.31)	24 (4.58)	7 (1.28)	23 (5.9)	11 (3.16)
2014	536	187 (211.23)	92 (8.21)	87 (4.380	48 (4.36)	28 (5.47)	23 (3.8)	23 (4.41)	16 (6.41)	9 (2.07)	19 (5.47)
2015	585	186 (230.42)	89 (8.16)	99 (4.960	42 (3.48)	23 (3.97)	28 (4.94)	17 (3.25)	23 (6.41)	8 (1.86)	23 (6.63)
2016	715	254 (281.62)	124 (9.58)	109 (5.62)	49 (4.46)	50 (7.92)	35 (6.17)	28 (5.35)	16 (4.29)	24 (6.32)	31 (8.53)
2017	719	226 (283.96)	143 (8.06)	94 (4.54)	47 (4.32)	33 (5.260	22 (4.09)	32 (4.21)	11 (2.45)	15 (3.85)	22 (6.34)
2018	788	233 (311.51)	166 (8.31)	124 (6.26)	56 (6.25)	33 (5.26)	23 (3.8)	36 (4.41)	19 (4.17)	17 (4.36)	17 (4.89)
2019	934	254 (368.6)	243 (9.58)	120 (7.28)	44 (4.02)	41 (6.57)	33 (4.94)	28 (5.35)	20 (4.73)	17 (4.36)	24 (6.91)
2020	1048	340 (414.11)	268	124 (6.97)	47 (4.52)	42 (6.57)	35 (6.44)	26 (5.02)	20 (4.73)	20 (4.92)	21 (5.62)
2021	1219	411 (483.85)	329	128 (7.01)	66 (7.57)	47 (7.33)	43 (7.65)	33 (6.31)	19 (4.17)	22 (5.38)	22 (6.34)
2022	1397	439 (556.86)	436	127 (6.98)	57 (5.87)	42 (7.33)	49 (8.75)	39 (7.47)	15 (3.5)	37 (9.46)	17 (4)
2023	1434	541 (11.84)	376 (8.35)	143	56 (2.690)	40 (2.47)	28 (1.77)	31 (2.43)	9 (0.76)	19 (4.63)	28(6.11)
Total	**14140**	**4435 (5034.65)**	**2649 (157.34)**	**1988 (167.5)**	**966 (92.43)**	**606 (93.48)**	**522 (87.99)**	**488 (86.66)**	**256 (68.66)**	**390 (98.94)**	**347 (92.73)**

Activity Index (AI)=Country's PublicationsTotal Global Publications×100Activity Ind ex (AI)=Total Global Publications Country's Publications×100

Activity Index of top Ten Countries:

The Activity Index (Bornmann & Leidesdorff, 2014) provides insights into the relative contribution and engagement of different countries in millets research over the years. From 2000 to 2023, India maintained a consistently high level of activity in millets research, with a total activity index of 5034.7, indicating a strong and sustained focus on millets research throughout the period. The United States follows with a total of 167.5, showing a notable increase particularly in recent years, peaking in 2023. China's activity index, totalling 157.3, also demonstrates significant growth, particularly in the latter half of the period. Brazil, with a total of 92.4, and the United Kingdom, with 93.5, exhibit moderate but consistent research activity in millets. Germany's research activity totals 88.0, reflecting a steady involvement. France (86.7) and Japan (98.9) show similar levels

of activity, while Nigeria (68.7) and Canada (92.7) have lower but consistent research engagement over the years.

Performance Efficiency Index (PEI) of Top Ten Countries

The Publication Efficiency Index (Kumar & Madhusudhan, 2019) assesses research impact by comparing citations per publication against global averages. India leads with a strong research impact, achieving a PEI of approximately 0.102 based on 4435 publications and 71756 citations. China follows with a PEI of about 0.023 from 2649 publications and 49981 citations, while the USA shows a robust PEI of 0.039 with 1988 publications and 70771 citations. The UK, Brazil, Germany, and France have PEIs ranging from 0.004 to 0.007, indicating varying levels of citation impact. Nigeria, Japan, and Canada exhibit lower PEIs around 0.001 to 0.002, reflecting comparatively modest citation impacts globally. These PEI values highlight each country's research productivity and influence relative to global publication and citation metrics.

Table 7 Performance Efficiency Index (PEI) of Top Ten Countries

Country	Total publications (TNPi)	Total No. of citations (TNCi)	Average Citaion	Total publications worldwide (TNPt)	Total Citation worldwide (TNCt)	$PEI = \frac{TNC_i/TNC_t}{TNP_i/TNP_t}$
INDIA	4435	71756	16.8	14140	252194	0.102
CHINA	2649	49981	18.87			0.023
USA	1988	70771	35.6			0.039
UK	606	22336	36.86			0.006
BRAZIL	966	13081	13.54			0.007
GERMANY	522	14465	27.21			0.004
FRANCE	488	14384	29.48			0.004
NIGERIA	256	7383	28.84			0.001
JAPAN	390	7630	19.56			0.002
CANADA	347	12030	34.67			0.002

Findings of the Study

The global growth pattern of millets research from 2000 to 2023 exhibits notable fluctuations in Compound Annual Growth Rate (CAGR) significant spikes occurred in 2006 (0.12) and 2015 (0.106), reflecting increased interest. In 2023, there was a remarkable surge, possibly driven by heightened global attention to the sustainable millets agriculture, with a CAGR of 2.14, indicating significant expansion in research activities in this field. The examination of the Annual Rate of Growth (ARoG) revealed consistent growth in millets research output from 2000 to 2010, with ARoG ranging from 1.02% to 1.19%, indicating significant interest and support in the field. Despite this, between 2011 and 2015, growth slowed to a minimum of 0.95%. From 2016 to 2023, the growth rate varied, with ARoG ranging from 1.01% to 1.22%. In 2023, research output surged notably, with 1,434 publications, highlighting substantial growth in the area. These findings underscore the dynamic nature of millets research and the diverse factors influencing its development over time. The global publication landscape in millets research from 2000 to 2023 exhibits substantial growth, with varying Relative Growth rates (Rt) and Doubling Times (DT). The number of articles increased from 224 in 2000

to 1,434 in 2023, reaching a cumulative total of 14,140 publications. Notable spikes occurred in 2007 and 2016, with an average Rt of 0.09. Doubling times fluctuated from 3.1 years in 2001 to 7.5 years in 2018, indicating a steady, albeit slower, and increase. Peaks in doubling times in 2008 and 2017 suggest periods of slower growth, indicating shifts in research focus, funding, and global interest in millets as a sustainable crop.

The wide dispersion of millets research across 161 journals underscores the breadth of scholarly engagement in this field. Journals such as "Journal of Food Science and Technology" and "Frontiers in Plant Science" boast high publication volumes and notable Total Global Citations Scores (TGCS). Additionally, "PLOS ONE" stands out with exceptional impact metrics. Despite smaller publication volumes, journals like "Electronic Journal of Plant Breeding" and "Indian Journal of Agricultural Sciences" play crucial roles in specific contexts, contributing significantly to global visibility and advancement in millet research. The combined efforts of authors in global millet research are substantial, with a total of 42868 contributors worldwide. Notable authors such as X. Diao from the Chinese Academy of Agricultural Sciences, who has 81 records, a 30 h-index, and 2552 TGCS, B. Feng from Northwest A&F University in China, with 79 records, a 27 h-index, and 2552 TGCS, and A. Kumar from the Central University of Haryana in India, with 73 records, a 27 h-index, and 1761 TGCS, have made significant contributions. These authors' efforts underscore the impactful nature of millets research on a global scale, particularly within their respective academic institutions in China and India.

Research on millets has received contributions from 274 countries. Notably, from 2000 to 2023, India emerged as the leading contributor with 4435 publications, closely followed by China with 2649 publications, demonstrating both countries' significant involvement and substantial output in this field. The United States also played a significant role, maintaining a robust presence with 1988 publications, indicating ongoing contributions to the field. The Activity Index from 2000 to 2023 highlights India's sustained high engagement in millet research, with a total index of 5034.7. The United States and China show significant growth, with totals of 167.5 and 157.3 respectively, peaking in 2023. The United Kingdom (93.5) and Brazil (92.4) demonstrate moderate but consistent activity. Assessing the research impact using the Publication Efficiency Index, India leads with a PEI of 0.102 and an average of 16.8 citations per publication. China follows with a PEI of 0.023 and an average of 18.87 citations. The USA shows robust impact with a PEI of 0.039 and an average of 35.6 citations per publication. This result focuses on the PEI values (indicating research impact relative to global averages) and the average number of citations per publication for each country, providing a brief overview of their research influence.

In addition to the above findings Millets research covers a wide range of disciplines, extending across 27 global fields with Agricultural and Biological Sciences leading with 9207 publications, followed by Biochemistry, Genetics, and Molecular Biology with 2657 publications, and Environmental Science follows with 1824

publications, highlighting sustainability concerns and showcasing interdisciplinary collaboration. Moreover, there are 161 research organizations collaborating on millet research, underscoring the collective effort in advancing knowledge and innovation in this field. Leading this collaboration is the International Crops Research Institute for the Semi-Arid Tropics, India with 458 articles and 3235 citations, emphasizing its significant role. Noteworthy contributions also come from the Chinese Academy of Agricultural Sciences in Beijing, and the Indian Council of Agricultural Research, demonstrating their dedication to advancing millet research globally.

Suggestions

In order to assure comprehensive coverage and compare global millet research trends, future research could benefit from the use of alternative databases such as Web of Science and Google Scholar. Employing extensive scientometric tools for network and citation analysis, the period of the study can be adjusted to concentrate on evaluating millet research.

Conclusion

Mapping Growth Trends and the Global Landscape of Millets Research analysis reveals a consistent increase in published research outputs, punctuated by bursts of activity, signifies a growing global focus on unlocking the potential of these grains. Collaboration emerges as a major driver of progress, with a vast network of institutions working together. Additionally, the presence of distinct research clusters suggests a targeted approach to addressing specific challenges and opportunities related to millets. The data and findings presented in this study provide an in-depth overview of the current state of research in millet studies. These findings not only demonstrate the historical development of the subject but also establish a strong basis for future progress. The ongoing development and significance of millet research in explaining agricultural and nutritional innovation are emphasized by the collaborative, global, and institutional dynamics. Hence, this study serves as a valuable resource for academics, Research institutions, and professionals interested in the ongoing advancement of Millets research.

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TOPIC MODELLING AND BIBLIOMETRIC APPROACH OF STRATEGIC MANAGEMENT IN ACADEMIC LIBRARIES RESEARCH

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Introduction

Academic libraries support the institution's mission by providing access to resources, fostering information literacy, and facilitating scholarly communication (Brophy, 2005). As higher education evolves with technological advancements and changing user needs, strategic management within academic libraries has become increasingly crucial (Adams Becker et al., 2017; Bharti & Verma, 2021). It encompasses the planning, executing, and evaluating an organization's long-term goals and activities, ensuring alignment with broader institutional objectives while adapting to external and internal shifts (Germano & Stretch-Stephenson, 2012).

Despite the critical importance of strategic management in academic libraries, there remains a limited understanding of its development and the prevailing research trends within this field. To address this gap, it is essential to systematically examine the existing body of literature, identifying key themes, influential works, and emerging areas of interest. Bibliometric analysis (Donthu et al., 2021) and topic modelling techniques provide a robust methodological approach to achieve this. By analysing patterns in publication data, such as citation networks and co-authorship, and uncovering latent thematic structures within the literature, these methods provide comprehensive insights into the intellectual landscape of strategic management in academic libraries.

Bibliometric analysis involves the quantitative examination of publications and their metadata, allowing researchers to map the structure and dynamics of academic fields (Öztürk et al., 2024). This method identifies prolific authors, seminal works, and collaboration patterns, providing a macroscopic view of research activities and trends. Topic modelling uses algorithms to detect underlying themes in a corpus of texts while researchers can further delve into the content of the literature (Kherwa & Bansal, 2020; Murakami et al., 2017). Topic modelling algorithms, such as Latent Dirichlet Allocation

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(LDA), categorize documents into topics based on word co-occurrence patterns, offering a nuanced understanding of the primary subjects and their evolution over time (Chauhan & Shah, 2022; Lamba & Madhusudhan, 2021).

The significance of strategic management in academic libraries cannot be overstated. As academic institutions navigate unprecedented challenges (Kalebar et al., 2024), including technological disruptions, budgetary constraints, and evolving user expectations, strategic foresight and effective decision-making within library settings become increasingly paramount (Sahu, 2015). Strategic management frameworks offer a systematic approach to address these challenges, enabling libraries to optimize their operations, enhance user experiences, and contribute meaningfully to the academic mission of their parent institutions (Peter Brophy, 2007).

The findings of this study will provide valuable insights for both researchers and practitioners. For researchers, understanding the historical and current trends in strategic management within academic libraries can guide future investigations and foster interdisciplinary collaboration. For practitioners, identifying best practices and emerging strategies can inform decision-making processes, helping libraries align their initiatives with institutional goals and effectively respond to challenges. In the following sections, we present our methodology, findings, and discussions, offering a comprehensive synthesis of the scholarly discourse on strategic management in academic libraries and charting a course for future inquiry and action in this dynamic and vital domain.

Literature Review

The previous studies provide a comprehensive overview of recent scholarly endeavors in strategic management, highlighting key studies contributing to researchers' understanding of various facets within this domain. Adiatma et al., 2023 analyse the landscape of strategic management research within an inclusive economy and business innovation context. The bibliometric analysis of 784 articles from ScienceDirect revealed three primary thematic clusters, shedding light on key topics and prolific authors. Similarly, Koseoglu et al., 2015 focused on strategic management in healthcare by analysing 97 articles from academic health management journals. It encompassed multiple database and provided insights into publication trends, authorship, and research methodologies, thus paving the way for future investigations in this domain. Al-Sharaa et al., 2024 conducted a study on bibliometric analysis of strategic information systems, uncovering significant publication trends, key authors, and research gaps. This approach utilized various tools and Scopus databases for interdisciplinary research and further exploration of connections with fields like supply chain management. Rao & Shukla, 2023 address the intersection of long-term strategic planning and sustainability, termed Sustainable Strategic Management (SSM). It noted the limited systematic reviews on SSM over the past three decades. It aimed to fill this gap through a bibliometric analysis of 221 articles from Scopus and Web of Science. The study offers valuable insights for

researchers interested in SSM's current state and future directions. Latip et al., 2022 investigates the relationship between strategic management and leadership, emphasizing the need for effective and skilled leadership to achieve organizational goals. Through a bibliometric and visualization analysis using the Scopus Database and VOS Viewer, Latip examines 342 articles, narrowing down to 58 relevant publications.

Meanwhile, Marco-Lajara et al., 2021 conducted a comprehensive study on the dynamic capabilities view (DCV) within strategic management, employing bibliometric techniques to explore its intellectual structure. The study provided valuable insights into current research trends and identified major clusters of the most cited references by analysing a vast array of research articles and cited references. This study contributes significantly to understanding strategic management's evolving landscape, offering valuable insights for researchers and practitioners while highlighting avenues for future exploration and collaboration.

Objectives

The objectives of this study were as follows:

1. To assess publication patterns and citations from 1974 to 2023.
2. To identify productive and impactful authors, prominent institutions, and countries.
3. To identify the co-occurrences of keywords using bibliometric mapping and visualization software.
4. To identify major topics discussed in the literature through topic modelling using the Latent Dirichlet Allocation (LDA) techniques.
5. To examine the top words and growth patterns of research topics over time.
6. To identify prevalent topics within the literature.
7. To identify key documents associated with research topics in the domain.

Methodology

Bibliometric Method

Bibliometric data were retrieved from the Scopus database, covering 1974 to 2023. A total of 1,249 records were extracted based on the predefined search criteria. These records were selected to represent various scholarly works within the specified timeframe. The aim is to identify prolific authors, prominent institutions, countries, leading journals, highly cited papers (HCPs), and emerging keywords through co-occurrence analysis. The extracted bibliometric data were compiled into a structured format using a CSV file. A comprehensive examination of bibliometric indicators and performance metrics was performed using the bibliometrix package (Aria & Cuccurullo, 2017; Biblioshiny, 2023)within the R studio environment. VOSviewer software (van Eck & Waltman, 2010)generated visual representations of trending keywords based on co-occurrence analysis.

Topic Modelling Approach

Topic modelling, a widely utilized technique for uncovering latent thematic structures within textual data, was conducted using the LDAShiny package (Chang et al., 2022). This package offers robust functionality for implementing Latent Dirichlet Allocation (LDA) (De la Hoz-M et al., 2021; Verma & Yuvaraj, 2023), a probabilistic generative model commonly employed for topic modelling tasks. The Excel file (.csv) containing bibliographic data was uploaded to the LDAShiny software platform. Utilizing the LDA-based approach, the software automatically identified topic words, characterized the growth of research topics' prevalent themes and identified key documents associated with the research topic.

A comprehensive outline of the systematic data collection process is presented in Table 1, outlining the stages involved in retrieving, selecting, and analysing bibliometric analysis and topic modelling from the Scopus database.

Stage 1: Data Collection	Scope & Coverage	**Database**: Scopus **Time Span**: 1974-2023 **Document Type**: Article, Conference Papers, Review, Book Chapter, Book, Conference Review, Note, Short Survey, Editorial, Letter and Erratum **Search Field**: Title, Abstract and Keyword **Keyword Search**: “Strategic Management” OR “Strategic Change Management” OR “Strategic Planning” OR “SWOT analysis” OR “Strategic leadership” AND “Academic Libraries” OR “ Libraries” Total documents retrieved: 1247
Stage 2: Bibliometric Analysis	Performance Analysis	• **Software**: Bibliometrix (R Package) and Microsoft Excel • **Analysis**: Yearly output, Top productive authors, prominent institutions, and countries
	Science Mapping	• **Software**: VOS Viewer • **Analysis**: Co-occurrence analysis
Stage 3: Topic Modelling		• **Software**: LDAShiny (R package) • **Model**: Latent Dirichlet Allocation (LDA) • **Analysis**: Top words, Key topic, annual growth of the topic, prevalent topic, key documents

Results

Bibliometric Analysis

Annual Growth of Publications and Citation Trends

The annual growth of publications and the citation trends per year from 1974 to 2023 are displayed in Figure 1. Over this period, the data show fluctuations in both the number of publications and their citation counts. From 1974 to the early 1990s, the number of publications remained relatively low, with occasional peaks. During this time, the citation rates also fluctuated, with some years seeing minimal citations while others saw slightly higher rates. The total number of publications varies significantly across the years, with peaks observed in certain periods, such as 2018 (n=83), 2013 (n=76), and 2019 (n=63), indicating potentially significant periods of research activity or interest.

The 1990s witnessed a sudden increase in publication numbers and citation rates, indicating a period of prolific research output and increasing recognition within the academic community. This trend continues into the early 2000s, with a consistent rise in publications and citations, suggesting sustained growth and impact within the scholarly landscape.

From the mid-2000s onwards, while the number of publications continues to increase, citation rates appear to fluctuate. These could reflect changes in citation practices, shifts in research focus, or variations in the quality of publications during this period. Notably, there are peaks and troughs in both publication counts and citation rates throughout the timeline, indicating periods of heightened activity and possibly moments of exceptional impact within the field. For instance, 2009 (2.33 citations) and 2021 (1.05 citations) stand out with notably high citation rates compared to surrounding years, suggesting the emergence of particularly influential publications during those periods.

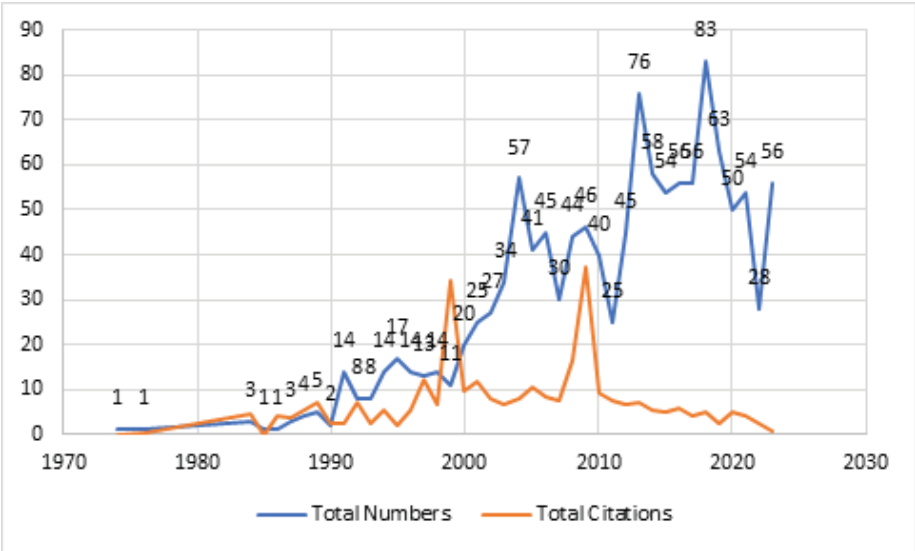


Figure 1. Annual Growth of Publications and Citation Trends

Leading Authors, Institutions, and Countries

Table 1 presents data on top authors, institutions, and countries based on total publications. Syed Zamberi Ahmad has the highest total publications (8) among the listed authors. However, his h-index and total citation are relatively low (1 and 7, respectively), indicating that while prolific, his work may not have had as significant an impact as some other authors. Followed by Holt Zaugg stands out with 7 publications and a higher h-index of 3, suggesting a more impactful body of work with 34 total citations. Antão Moura and Jacques Sauvé received the highest number of citations with 46, also having notable h-indices (4), suggesting a significant impact despite fewer total publications.

The institution with the highest total publication count is Abu Dhabi University, which has 16 publications. However, regarding citation impact, it ranks lower with only 21 citations, which is relatively low compared to some of the institutions on the list. Following it, The University of Texas at Austin stands out with 14 publications but significantly higher citations at 130, indicating that its research output is substantial and impactful, as evidenced by the citation count. This ranking suggests different institutions' research output and impact on scholarly work.

Analysing by country, the U.S. has the highest total publications (463) and total citations (4586). This indicates significant research output and impact from the U.S. Following the United States, the United Kingdom ranks second with 127 publications and 1503 citations, showcasing a strong presence in academic research. This ranking reflects different countries' research output and impact on the global academic landscape.

Table 1. Ranking of Top Authors, Institutions, and Countries based on Publications

Top Authors				Top Institutions			Top Countries		
Author	TP	H_Index	TC	Affiliation	TP	TC	Country	TP	TC
Syed Zamberi Ahmad	8	1	7	Abu Dhabi University	16	21	United States	463	4586
Holt Zaugg	7	3	34	The University of Texas at Austin	14	130	United Kingdom	127	1503
Monica Singhania	6	1	1	University Of Illinois Urbana-Champaign	11	68	India	89	186
Khairul Akmaliah Adham	5	1	3	Loughborough University	10	100	China	44	97
Virginia Bodolica	5	3	20	University Of Pretoria	10	44	Australia	43	449
Martin Spraggon	5	1	20	Brigham Young University	9	31	Canada	40	1057
Antão Moura	4	4	46	University Of Delhi	8	4	Germany	29	203
Gopalakrishnan Narayanamurthy	4	1	2	Indian Institute of Management Kozhikode	8	4	Iran	26	845
Jacques Sauvé	4	4	46	University Of Delhi	8	4	Spain	25	194
David Streatfield	4	3	34	The University of Sheffield	7	28	United Arab Emirates	22	42

TP= Total Publications, TC= Total Citations

Keyword Co-Occurrence Analysis

Keyword analysis is a powerful tool for identifying trends and topics of interest within a given field. Using VOSviewer, a bibliometric analysis software, analysed all keywords (titles, abstracts, or keyword lists) of relevant literature. This analysis generated 5,970 results, with a minimum co-occurrence threshold of three. Of these, 639 keywords met the threshold visually represented in Figure 2. Here, the keywords are grouped by color, indicating their thematic clustering. The size of each circle in the cluster corresponds to the proportion of citations for that keyword, with larger circles and map labels indicating higher relevance and significance.

The generated keywords network map divides the keywords into 9 clusters. The top ten most frequently occurring keywords were: strategic planning (548 occurrences, 3218 TLS, 1cluster), libraries (152 occurrences, 957 TLS, 1cluster), academic libraries (117 occurrences 371 TLS, 5 cluster), human (83 occurrences, 1134 TLS, 3 cluster), digital libraries (78 occurrences 528, TLS, 1cluster), article (70 occurrences, 951 TLS, 4 cluster), strategic management (62 occurrences, 181 TLS, 5 cluster), humans (55 occurrences, 843 TLS, 3 cluster), information services (55 occurrences, 498 TLS, 6 cluster), and societies and institutions (52 occurrences, 390 TLS, 6 cluster).

Each cluster's relevance and the interconnectedness of keywords within the clusters provide insights into prevalent research themes and emerging topics within the field.

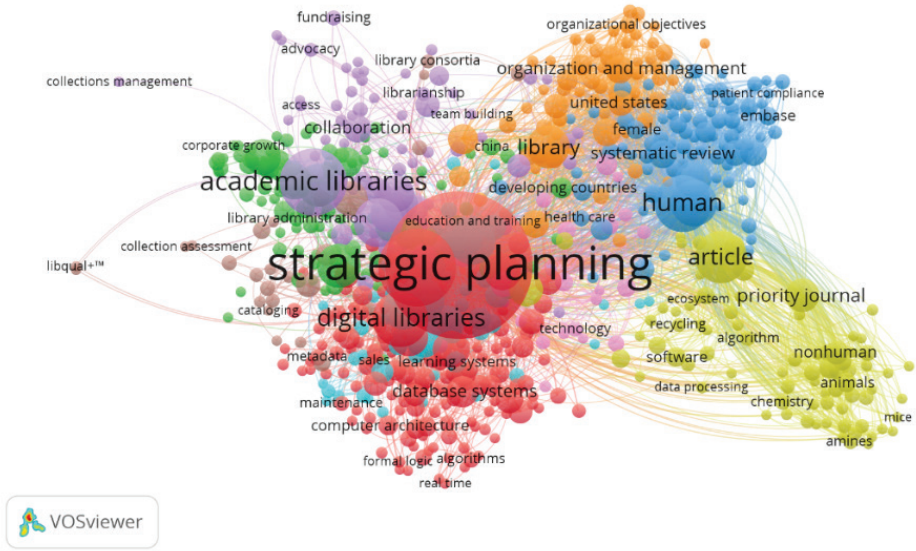


Figure 2. Co-occurrence network of keywords

Top Modelling

Number of Topics

In LDAShiny (R package) (Maestre et al., 2021), several methods are available to determine the optimal number of topics, including coherence, four metrics, perplexity, and harmonic mean. The graphical outputs of each metric are shown in Figure 3(a, b, c, d). In every scenario, the time taken to complete the inference is recorded.

The processing times for each metric were as follows: coherence (2540.56 seconds), four metrics (386.75 seconds), perplexity (7426.69 seconds), and harmonic mean (815.77 seconds). Regarding the optimal number of topics, the metrics Griffths2004

(Griffiths & Steyvers, 2004), CaoJuan2009 (Cao et al., 2009), Arun2010 (Arun et al., 2010), Deveaud2014 (Deveaud et al., 2014), Perplexity, and Harmonic Mean indicated that the suitable number of topics ranges between 35 and 50. However, the coherence indicated 14 topics. It selected 10 topics for the present study, with 10 being the optimal coherence score. However, it's important to note that there are considerations that must be addressed when using LDAShiny. No universally accepted method for selecting the number of topics in a topic model exists. Consequently, determining the appropriate number of topics can be quite complex.

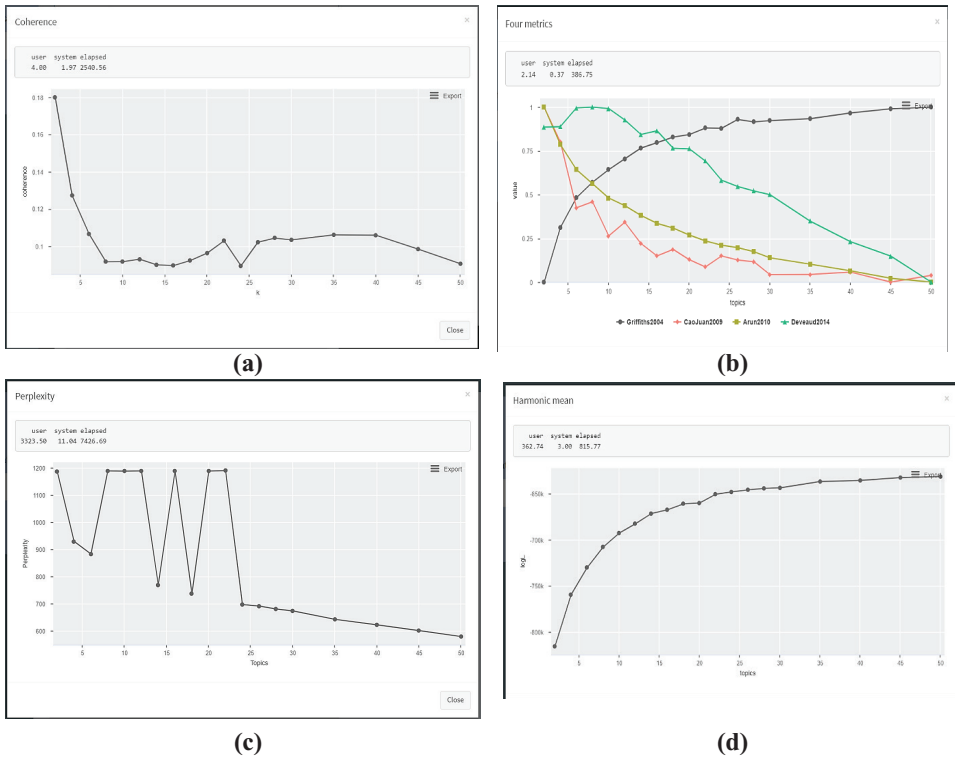


Figure 3. Number of topics. **(a)** Coherence method. **(b)** Comparison of four methods. **(c)** Perplexity. **(d)** Harmonic Mean.

Top Words in Literature Ranked by Term Frequency

The information presented in tabular form contains the words, their frequency of appearance (term_freq), and the number of documents in which these terms appear (doc_freq). Additionally, Inverse document frequency (IDF) (Stecanella, 2019) measures how much information the word provides, that is, whether the term is common or rare across all documents. It is calculated as:

$$= \text{Log}$$

Where N is the total number of documents, and df is the document frequency.

Table 2 displays the top terms in literature ranked by term frequency. The top word in the dataset is "library," with a term frequency (T.F.) of 2348, document frequency (D.F.) of 985, and IDF of 0.23. It is followed by the terms "strategic," with T.F. = 1574, DF = 782, IDF = 0.4; "libraries," with T.F. = 1361, DF = 542, IDF = 0.8; and "management," with T.F. = 1327, DF = 49, IDF = 0.91.

Table 2. Top words in the Strategic Management in Academic Libraries dataset

	term	term_freq	doc_freq	idf
2611	library	2348	985	0.235854305
2610	strategic	1574	782	0.466641205
2609	libraries	1361	542	0.833229944
2608	management	1327	497	0.91990592
2607	planning	1107	592	0.744989311
2606	information	963	441	1.03945107
2605	case	843	291	1.455172679
2604	study	775	446	1.028176994
2603	research	728	356	1.253565215
2602	development	712	410	1.112338786

Topic Trend

The annual growth of topics in Strategic Management literature is depicted in Figure 4 using a heatmap. The x-axis represents the years, while the y-axis indicates the probability of a particular topic being mentioned in a given year, as indicated by the pixel's color. The peak of growth for each topic is observed between 1974-2023.

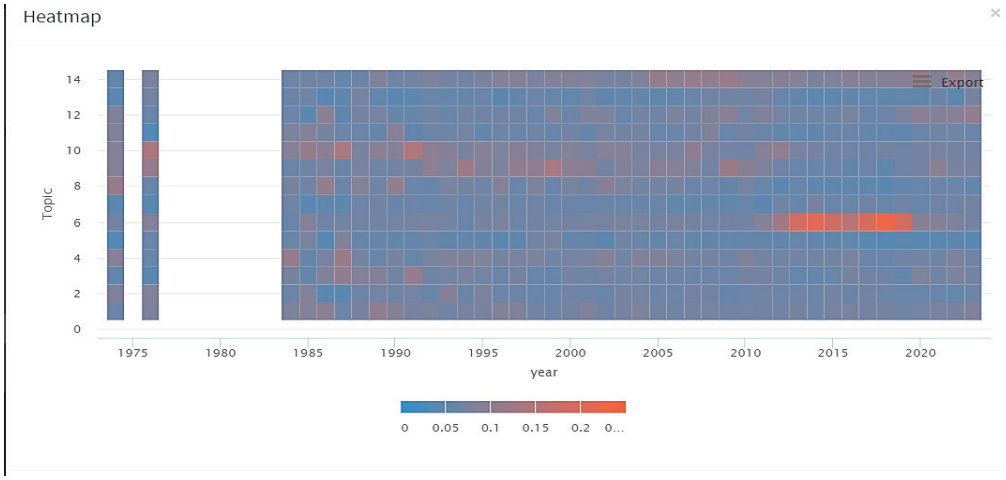


Figure 4. Graphical output of trend topic

Top Prevalent Topics

Table 3 presents the research topics derived from the LDA model, providing a summary that includes the label, coherence score, prevalence, and the top term for each topic. The results are ranked based on prevalence scores. Notably, there is a high prevalence of literature on these topics, and it is clear that Case (t_6) is the most dominant topic, reflecting a strong emphasis on practical business applications and education. Other significant topics include management (t_1), library services (t_4), and university-related themes (t_3). Topics such as investment (t_2), information science (t_8), development strategies (t_7), and marketing (t_5) also feature prominently but with varying degrees of prevalence. This prevalence distribution highlights the areas of focus and interest within the dataset.

In some instances, papers exhibit topic probability values that are closely clustered, suggesting potential overlap between two or more topics. However, these cases were not considered, and the topic with the highest probability was selected.

Table 3. Summary of top prevalent topics

topic	label_1	coherence	prevalence	top_terms
t_6	case	0.283	12.107	case, business, management, strategy, teaching, students, level, strategic, notes, learning
t_1	management	0.047	7.259	management, change, development, work, organizational, organization, leadership, performance, staff, implementation
t_4	library	0.071	7.114	library, services, public, libraries, service, new, needs, librarians, users, user
t_3	university	0.025	6.628	university, library, education, program, francis, taylor, article, students, published, learning
t_2	investment	0.048	6.365	one, first, new, long, many, years, world, two, term, time
t_8	information	0.073	6.028	information, knowledge, science, web, technology, based, role, lis, skills, internet
t_7	development	0.101	5.982	development, social, analysis, opportunities, swot, innovation, economic, strengths, threats, weaknesses
t_5	marketing	0.06	5.043	marketing, cost, part, customer, products, product, well, use, customers, target

Key documents

LDAShiny was utilized to identify key documents associated with each topic by analysing the topic-document distribution matrix theta (). In this matrix, each row represents the distribution of topics within individual documents, denoted as $P(topic_k / document_d)$ (Jones, 2023). Notably, Topic t_6, "FragraAroma – accord in business, concord in family," authored by Gupta, N. et al., has the highest Theta value of 0.68936, indicating a strong association with this topic. Conversely, topic t_3, "Lessons learned: A comparison of Ph.D. In technology management programs," authored by McKirahan, J. et al., has the lowest Theta value of 0.27669. Table 4 provides an overview of these key documents, serving as a valuable reference for researchers interested in the library and information science field and its intersections with other domains such as politics, economics, and technology management.

Table 4. Key documents associated with the themes

Author(S)	Document	Topic	Theta
Qiong, L. et al.	Standardized Management System for Reading Promotion under AIGC Technology Environment	t_1	0.44298
Kavyanirad, M. et al.	The impact of pacific-oriented approach of the United States on security of South West Asia; with emphasis on national security of Iran	t_2	0.43923
McKirahan, J. et al.	Lessons learned: A comparison of Ph.D. In technology management programs	t_3	0.27669
Zaugg, H. & Rackham, S.	Identification and development of patron personas for an academic library	t_4	0.37069
Owens, L.	Marketing in library and information science: A selected review of related literature	t_5	0.33051
Gupta, N. et al.	FragraAroma – accord in business, concord in family	t_6	0.68936
Zarnegar, Z. et al.	Strategic explanation of resistive economy in the passing of sanctions and economic constraints	t_7	0.33508
Harper, R.	Knowledge management through the lens of library and information science: A study of job advertisements	t_8	0.33683

Discussion

The bibliometric analysis provided valuable insights into the evolution and impact of research within the field of strategic management in academic libraries over nearly five decades. The annual growth in publications and citation trends from 1974 to 2023 reveals distinct phases of scholarly activity. Initially, the period from 1974 to the early 1990s shows relatively low publication numbers and variable citation rates, reflecting perhaps a nascent stage of research development in this domain. The significant increase in both publications and citations during the 1990s suggests a pivotal expansion in research interest and recognition, potentially driven by emerging theoretical frameworks and practical applications within the domain.

The growth in publications into the 2000s highlights these research areas' continued importance and relevance. However, the fluctuating citation rates from the mid-2000s onwards could indicate variations in research quality, shifts in scholarly focus, or changing citation practices. Notable peaks in citation rates in 2009 and 2021 highlight periods where particularly influential works were published, suggesting breakthroughs or significant advancements in the field.

The analysis of leading authors, institutions, and countries provides further insights into the dynamics of research contributions. Syed Zamberi Ahmad's high publication count contrasts with his relatively low citation impact, highlighting the distinction between quantity and influence in academic contributions. In contrast, authors like Holt Zaugg, Antão Moura, and Jacques Sauvé demonstrate a higher impact despite fewer publications, emphasizing the importance of citation metrics in assessing research significance. Institutions like Abu Dhabi University and The University of Texas at Austin demonstrate varying strengths, with the latter achieving a higher citation impact despite fewer publications. This variation emphasizes the importance of research quality and impact over mere publication quantity. The dominance of the U.S. and the U.K. in publications and citations reflects their strong research infrastructure and investment in academic scholarship, influencing global research trends.

The keyword co-occurrence analysis provides a detailed view of the thematic clusters within the field. Strategic planning, libraries, and academic libraries emerge as dominant themes, indicating their centrality to the field. Clustering keywords into thematic groups highlights interconnected research areas and potential collaboration opportunities. The visualization of these clusters aids in understanding the research landscape and identifying emerging trends and gaps. The topic modelling analysis presents a comprehensive overview of the prevalent topics in the literature. The varied metrics used to determine the optimal number of topics highlight the complexity of topic modelling. The selection of 10 topics based on coherence scores suggests a focused approach to understanding key research areas. This selection reflects the diverse and multifaceted nature of research in the field. The identification of key terms and their frequencies further elucidates the focus areas within the literature, with terms like "library," "strategic," and "management" being particularly prominent. The prevalent topics identified, such as case management, library, university, investment, information, development, and marketing, provide a snapshot of key research areas. The heatmap of topic trends over time reveals the evolution of these themes, with certain topics experiencing peaks of interest at different times, indicating shifts in research focus and emerging areas of importance. Identifying the documents associated with each topic offers a valuable resource for researchers. These documents, representing significant contributions to the field, serve as foundational readings for those seeking to delve deeper into specific topics, facilitating further research and scholarly discourse.

Conclusion

This bibliometric analysis offers a comprehensive overview of publication and citation trends, leading authors and institutions, and prevalent research themes in the field from 1974 to 2023. The data reveal a significant growth and impact, with fluctuations reflecting the evolving nature of research focus and practices. An analysis of leading contributors highlights the varying implications of prolific versus high-quality research outputs, emphasizing the importance of both quantity and quality in academic scholarship. The prominence of certain keywords and the thematic clustering revealed through keyword

co-occurrence analysis underscore the multidisciplinary and interconnected nature of the research. The topic modelling analysis provides valuable insights into prevalent and emerging topics, guiding future research directions. Strategic planning, libraries, and digital transformation are central focus areas, reflecting research's dynamic and evolving nature. This analysis offers researchers, practitioners, and policymakers valuable insights, guiding future research efforts and strategic planning. By understanding historical trends and the current landscape, stakeholders can better navigate the complexities of the field and contribute to its continued growth and development.

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GLOBAL RESEARCH ON HEALTH LITERACY: A BIBLIOMETRIC ANALYSIS

Rahul K.P[1] & Dr. Rekha R V[2]

Introduction

According to the Centers for Disease Control and Prevention, "Health literacy is the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions". As a vital component of life, health has a profound effect on all facets of our existence. Therefore, health-related research is essential. Studies on health are important for a number of reasons, such as bettering healthcare systems, public policy, health promotion, and understanding disease and prevention. There are many different fields of study in the field of health, and one of the most important ones is health literacy. The present study analyses the literature on health literacy in the last five years (2019-2023), to understand the collaboration trends in this research area.

Related studies

Huang (2024) conducted a bibliometric study on tsunami warning research and he analysed the literature visually and quantitatively using Web of Science and Vos Viewer. The study's findings indicate that after 2005, TW research attracted a lot of attention and continued to expand, emerging as an interdisciplinary topic of study mostly in the Earth Sciences. Paucar-Caceres et al. (2023) conducted a bibliometric review on 'Health Literacy Concepts, Themes, and Research Trends Globally and in Latin America and the Caribbean'. The study's findings indicate that academics' interest in health literacy is growing. Especially in the past five years, there has been a significant growth in the quantity of publications. The Global North is in charge of them. Hurstak et al. (2023) analyzed how health literacy affects people's confidence in receiving a COVID-19 vaccination. The study investigates the association between demographic characteristics, health literacy levels, and vaccine confidence among urban adults exposed to COVID-19 using a reliable measure of health literacy. Durmuş (2021) assessed the level of health literacy of adult patients who received healthcare services from public and private healthcare institutions in Turkey. Nutbeam (2008) explored the evolving concept of health literacy.

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Methodology

The SCOPUS database was searched to find out all article publications pertaining to health literacy that were released between 2019 and 2023. "Health literacy" which were present in the article title was the search phrase utilized to find the most similar publication. The document type was restricted to Article only. A total of 4474 papers were found as the data source throughout the search, which was carried out through May 2024. Year of publication, title, author, affiliation, keywords, abstract, and citation counts were among the details exported into CSV format for the publications that satisfied the requirements. Bibexcel is used to identify the authorship pattern and the Co-authorship and Co-occurrence were examined using VOSviewer (version 1.6.20). Also, MS Excel and Bibexcel is used to analyse data.

The main objective of the study is to understand the collaborative trends on health literacy literature. The specific objectives of the study are:

- To find out the year-wise and country-wise publication productivity in Health literacy for the last 5 years
- To study the authorship trends of health literacy literature for the past five years.
- To identify the author-wise co-authorship collaboration.
- To identify the country-wise and organizational-wise co-authorship collaboration
- To identify the co-occurrence collaboration of the author and Index keywords.

Data Analysis

Year-wise analysis

Table 1 shows the Year-wise analysis of health literacy literature for the past 5 years retrieved from SCOPUS.

Table 1: Year wise Analysis

Year	Productivity	Percentage
2019	609	13.60
2020	783	17.48
2021	905	20.20
2022	1065	23.78
2023	1117	24.94
Total	4479	100

The year-wise productivity analysis of the published articles during 2019-2023 on health literacy indicates that 2023 is the most productive period with 1117 items (24.94 percent) followed by 2022 with 1065 items (23.78 percent). The table also shows that 2019 is the least productive period with 609 items (13.60 percent) followed by 2020 with 783 items (17.48 percent). The average publication per year of these five years is 895.8.

Author-wise analysis

Table 2 shows the author-wise analysis of the health literacy literature retrieved from SCOPUS. The authors are classified according to their contribution. The total article contributions on health literacy covered in SCOPUS are calculated and that comes to4479 records over the period of study. The table shows that four authored publications are the maximum, sharing 17.28 percent of the total publications. It is followed by three authored publications (16.83 percent), five authored publications (14.38 percent) and six authored publications (12.37 percent). 4.91 percent of publications have more than ten authors. Also, Ten authored publications (2.25 percent) are the minimum among the health literacy article literature, followed by nine authored (2.95 percent). Also, there are 12 articles with no authors.

Table 2: Author wise Analysis

No. of Authors	No. of Publications	Percentage
Single author	206	4.60
Two authors	513	11.45
Three authors	754	16.83
Four authors	774	17.28
Five authors	644	14.38
Six authors	554	12.37
Seven authors	342	7.64
Eight authors	227	5.07
Nine authors	132	2.95
Ten authors	101	2.25
More than ten authors	220	4.91
No authors	12	0.27
Total	4479	100

Country-wise analysis

Table 3 shows the country-wise analysis of the health literacy literature retrieved from Scopus. There are 196 countries involved in health literacy literature over the time period of study. The table indicates that the United States is the country which has the most publications in the health literacy literature in the period of study with 990 publications. It is followed by China (466 publications), Australia (409 publications) and Iran (394 publications). Besides this, there are four countries with more than 150 publications.

Table 3: Country wise analysis

Country	No. of Publications
United States	990
China	466
Australia	409
Iran	394
Germany	300
United Kingdom	225
Turkey	200
Canada	151
Brazil	126

Co-Authorship analysis

Author-wise co-authorship

Table 4 shows the author-wise co-authorship linkage among the authors of the health literacy literature retrieved from Scopus during the past 5 years. Through the literature search, it was identified that within the dataset of 17163 authors 59 were displayed after meeting the criteria of a minimum publication count of at least 10 and a citation count of not less than 10.

The following table shows the top 10 authors and their collaboration linkage in the Health literacy domain, ranked by the number of documents. Among them, OrkanOkan has more number with 53 article publications with 1073 citations and a total link strength of 90. Kevin Dadaczynski has 41 article publications with 604 citations and a total link strength of 59. Out of the authors who met the criteria, four among them have a link strength of more than 50.

Table 4: Author wise co-authorship

Author	Documents	Citations	Total Link Strength
Orkan Okan	53	1073	90
Kevin Dadaczynski	41	604	59
Doris Schaeffer	27	474	55
Richard H Osborne	27	324	23
Julie ayre	19	239	55
Eva-maria Berens	19	428	41
Guglielmo Bonaccorsi	19	340	33
Chiara Lorini	19	382	33
Helle T Maindal	18	399	14
Saul M Paiva	17	123	34

Figure 1 shows the mapping of the Author wise co-authorship of collaborated authors among the top-ranked authors.

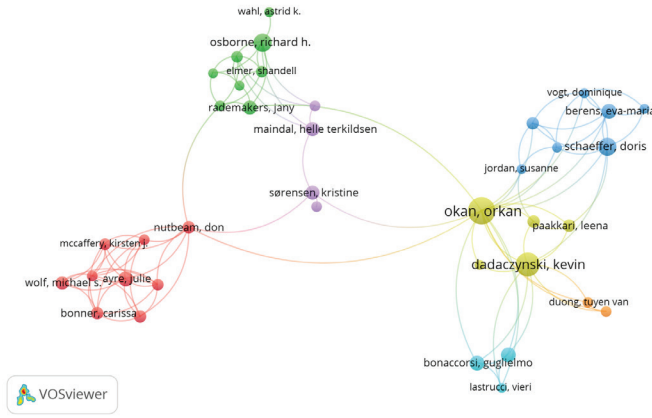


Figure 1 Mapping of Author wise co-authorship

Country-wise co-authorship

Table 5 shows the country wise co-authorship linkage of the Health literacy literature retrieved from Scopus during the past 5 years. Putting the threshold as the minimum number of documents of a country as 5 and the minimum number of citations as 10, the United States has the greatest total link strength with 399 followed by Australia (330), United Kingdom (265), and Germany (179). Out of the 196 countries, 71 countries meet the threshold. Out of the 71, some of the items are not connected to each other. By excluding the unconnected items, the largest set of connected items consists of 70 items.

Table 5: Country wise Co-Authorship linkage

Country	Number of Documents	Number of Citations	Total link strength
United States	990	8389	399
Australia	409	3939	330
United Kingdom	225	2376	265
Germany	300	2811	179
China	466	2626	137
India	87	379	137
Canada	151	1357	123
Netherlands	107	1164	118
Denmark	84	1447	108
Belgium	40	665	105

Figure 2 shows the mapping of the country wise co- authorship linkage among the collaborative countries of the Health literacy literature after meeting the threshold criteria.

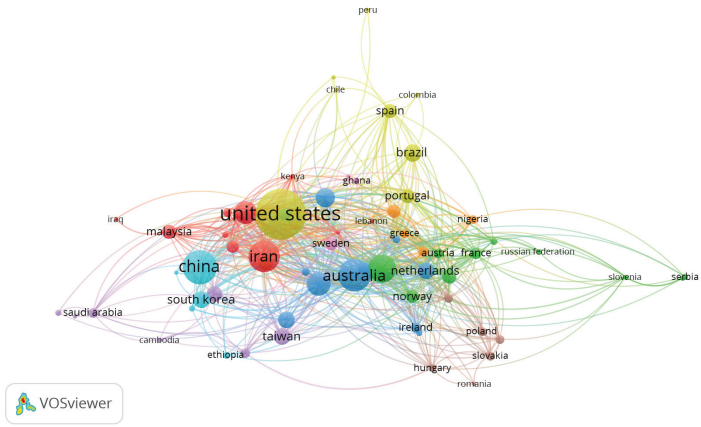


Figure 2 Mapping of country wise co- authorship

Organization-wise co-authorship

The following table and figure shows the organization wise co-authorship linkage of the Health literacy literature retrieved from Scopus. Through the literature search, it is identified that within the dataset of 13201 organizations, 209 of them were displayed after meeting the criteria of a minimum publication count of at least 3 and a citation count of not less than 10. Table 6 shows the top 10 organizations and their collaboration linkage in the Health literacy domain, ranked by the number of documents.

Figure 5 indicates that "Department of Health Education and Health Promotion, School of Health, Mashhad University of Medical Sciences, Iranis" comes first with 23 articles and 253 citations. Organizations like "School of Nutrition and Health Sciences, Taipei Medical University, Taiwan & Department of Health Education and Health Promotion, School of Health, Mashhad University of Medical Sciences, Iranare" having high link strength.

Table 6: Organization wise Co-Authorship Linkage

Organization	Documents	Citations	Total link strength
"Department of Health Education and Health Promotion, School of Health, Mashhad University of Medical Sciences, Iran"	23	253	29
"Social Determinants of Health Research Center, Mashhad University of Medical Sciences, Iran"	22	272	23
"School of Nutrition and Health Sciences, Taipei Medical University, Taiwan"	18	974	54
"Health Metrics Research Center, Iranian Institute For Health Sciences Research, Tehran, Iran"	11	98	9
Department of psychology, university of Houston, United States	10	105	9

Behavioral science research institute, Srinakharinwirot university, Bangkok, Thailand	10	34	2
Global health literacy academy, Risskov, Denmark	10	389	2
School of nursing and midwifery, Griffith university, Southport, Australia	8	14	0
Lovisenberg diaconal university college, Oslo, Norway	7	41	9
Department of health education and health promotion, school of medical sciences, Tarbiatmodares university, Iran	7	44	8

Figure 3 shows the map of the organization wise co- authorship of the collaborative organizations meeting the threshold criteria.

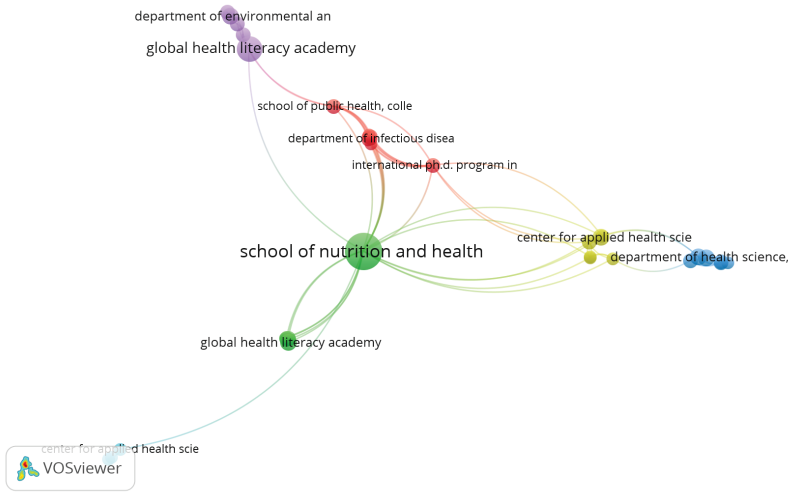


Figure 3 Mapping of organization wise co- authorship

Co-occurrence analysis

The Table 7 shows the co-occurrence of all keywords in the Health literacy literature retrieved from scopus. The keywords that appeared most were “Health literacy” with occurrence of 3763 and a total link strength of 65153 followed by “Human” with a total link strength of 65621 which had a strong link to “Female” and “Article”. Beside “Health literacy”, “Human”, “Female” and “Article”, “Male” and “Adult” are the other keywords having a total link strength more than 45000.

Table 7: Co-occurrence analysis of all keywords

Keyword	Occurrences	Total Link Strength
Health literacy	3763	65153
Human	3120	65621
Article	2172	53559
Female	2060	51514

Male	1860	47144
Adult	1841	45147
Questionnaire	1338	32741
Cross-sectional study	1180	28420
Major clinical study	1026	27765
Controlled study	991	26248

Figure 4 shows the mapping of co-occurrence analysis of author keywords of the Health literacy literature retrieved from scopus. Keywords with minimum occurrences of 5 have been included in the study. The keywords that appeared most were "Health literacy" with a total link strength of 5438 and "Covid-19" with a total link strength of 679 which had a strong link to "Mental health literacy" and "Health promotion".

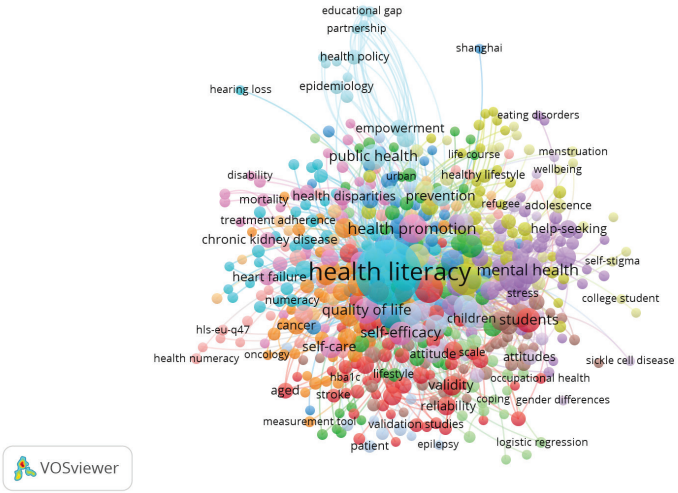


Figure 4 Mapping of the author keywords co-occurrence analysis

Figure 5 shows the mapping of co-occurrence analysis of index keywords of the LGBT health literacy literature retrieved from scopus. Keywords with minimum occurrences of 5 have been included in the study. The keywords that appeared most were "Human" with occurrence of 3120 and a total link strength of 60752 and "Health literacy" with a total link strength of 58381 which had a strong link to "Female" and "Article". Beside "Human", "Health literacy", "Female" and "Article", "Male" and "Adult" are the other keywords which have a total link strength more than 40000.

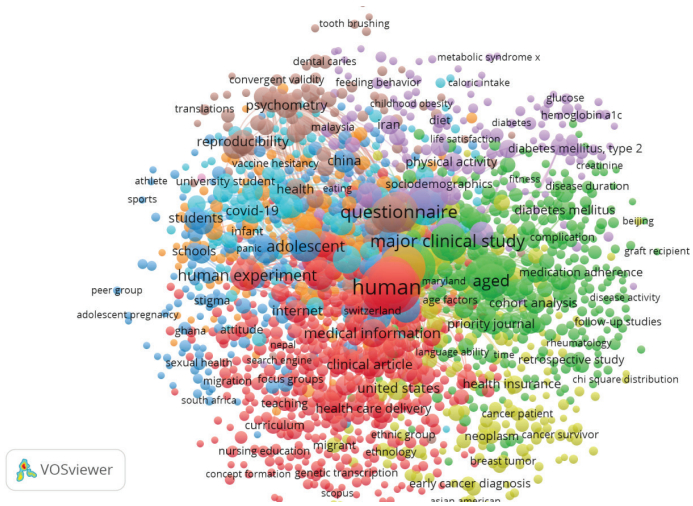


Figure 5: Mapping of the Index keywords co-occurrence analysis

Findings and Conclusion

The bibliometric analysis of the Health literacy literature retrieved from Scopus has revealed that 2023 is the most productive period with 1117 articles (24.94 percent) on Health literacy for the past 5 years. Out of the 4479 articles, four authored publications are the maximum, sharing 17.28 percent of the total publications followed by three authored publications (16.83 percent). The United States has more publications in the Health literacy literature with 990 publications followed by China (466 publications). Only four countries have more than 150 publication articles on this topic. The country-wise co-authorship shows that the United States has the greatest collaboration with other countries with a total link strength of 399 followed by the Australia (330). The organization wise co-authorship shows that only 10 organizations have a link strength of more than 15 and "Department of health education and health promotion, school of health, Mashhad university of medical sciences, Iran" is one of the leading organizations among those involved in Health literacy research globally, which having 23 articles and 253 citations. The author-wise co-authorship pattern shows that OrkanOkan has 53 published articles with 1073 citations and he has collaborated with 90 authors. Out of the authors who met the criteria, four among them have a link strength of more than 50. The co-occurrence analysis of all keywords shows that "Health literacy" is the most appeared keyword among the health literacy literature with an occurrence of 3763. The co-occurrence analysis of author keywords shows that "Health literacy" is the most appeared author keyword among the Health literacy literature with link strength of 5438. The co-occurrence analysis of index keywords shows that "Human" is the most appeared keyword with a total link strength of 60752.

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NIRF INDIA RANKINGS 2023: A STUDY WITH SPECIAL REFERENCE TO TAMIL NADU STATE UNIVERSITIES

Dr. P. Mohanathan[1] & Dr. S. Radhakrishnan[2]

Introduction

The National Institutional Ranking Framework (NIRF), a ranking system adopted by the Ministry of Education to evaluate higher education institutions in India, highlights a significant achievement in Tamil Nadu. Specifically, the 2023 NIRF ranking of the top universities and colleges in India showcases Tamil Nadu's consistent success in providing high-quality and inclusive higher education. This achievement aligns with Tamil Nadu's commitment to development with social justice and offers valuable insights for other states. Notably, central government-funded institutions like IIT Madras, NIT, Central University of Tamil Nadu in Tiruvarur, and IIITDM have outperformed many state universities in the rankings. Anna University, a prominent institution, is ranked 14th and Bharathiyar University is ranged 21st position among universities.

Review of Literature

Deka, P., & Sarmah (2021) observed that research publications played a vital role in ranking universities and higher educational institutions. They found that NIRF (National Institutional Ranking Framework) allocated 70% of its weightage to publications and the quality of those publications. The study disclosed that only eight universities from Northeast India achieved rankings in the NIRF assessment. Tezpur University emerged as the most prolific institution in the region, boasting the highest number of publications (3243), citations (48382), an average citation per paper of 14.92, and an impressive h-index of 77. The research also highlighted remarkable growth in research publications at Sikkim University, showing a 54% increase over the past ten years. Interestingly, following the NIRF rankings, there was a noticeable uptick in the number of publications, but this was accompanied by a decrease in the average citation rate. The same trend was observed in the h-index, signaling a significant impact on the overall quality of publications."

Balasubramani, J., & Thangavel, R. (2019). conducted an analysis of publications from Indian Institutes of Technology (IITs), which were accessible and indexed in databases such as ResearchGate, Web of Science, Scopus, and the Indian Citation Index. Data for the study were sourced from two websites: the National Institutional Ranking

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Framework (NIRF) and ResearchGate. A total of 47,380 publications were indexed in Web of Science, Scopus, and the Indian Citation Index, while 46,729 publications were available on ResearchGate. The study revealed that ResearchGate had a higher number of publications compared to other commercial databases, suggesting that open access is the optimal means to disseminate research. The study also recommended incorporating h-index evaluations for individuals, departments, and institutions within NIRF's assessment criteria.

Mandhirasalam, M. (2017) investigated that ranking higher education institutions (HEIs) globally had been an annual practice by renowned organizations like TIMES Higher Education World Rankings, The QS World University Rankings, The Academic Ranking of World Universities, The Best Global Universities Rankings, and the University Ranking by Academic Performance, alongside QS Asian University Rankings, among others. Unfortunately, at that time, no HEIs in India featured within the top 200 in many of these prestigious rankings. To motivate Indian HEIs to enhance their global competitiveness, the Ministry of Human Resource Development (MHRD), Government of India, had launched the 'National Institutional Ranking Framework (NIRF)' in 2015. The 2016 rankings of HEIs in India were released based on data provided by the institutions themselves. The researcher had emphasized that HEIs needed to focus on improving parameters such as teaching-learning processes, resources, research, professional practice, and collaboration to compete at the global level. This, in turn, would benefit the country, particularly in the higher education sector.

The study aims to achieve the following objectives:

- To examine and assess the rankings assigned to Tamil Nadu State Universities in India as per the National Institutional Ranking Framework (NIRF).
- To investigate and understand the various parameters and criteria used by NIRF for evaluating and ranking these universities.

In order to accomplish these objectives, a specific methodology was employed:

Information regarding the top universities in India, as per the NIRF rankings for the year 2023, was collected and organized in a spreadsheet. This data was collected from the official NIRF website (https://www.nirfindia.org) for further analysis. The study focused on gathering data related to several key factors for an in-depth analysis. These factors included:

The total number of faculty members holding Ph.D. degrees. The count of scholars who have successfully completed their Ph.D. degrees, both on a full-time and part-time basis. The number of undergraduate (UG) students enrolled in these universities. The number of postgraduate (PG) students enrolled in these universities. The study then narrowed its scope to concentrate on seven specific institutions in Tamil Nadu, which are among the top-ranked State Universities in the NIRF rankings. These universities are:

- Bharathiar University
- Alagappa University

- Bharathidasan University
- University of Madras
- Madurai Kamaraj University
- Periyar University
- Manonmaniam Sundaranar University

This research methodology was designed to provide a comprehensive understanding of how NIRF ranks Tamil Nadu State Universities and the specific criteria it employs for assessment.

Results and Discussions

Table 1 – NIRF Score and Rank of Tamil Nadu State Universities

Sl. No	Name of the Universities	NIRF Score	NIRF Rank
1	Bharathiar University	57.82	21
2	Alagappa University	53.53	30
3	Bharathidasan University	51.48	41
4	University of Madras	49.5	50
5	Madurai Kamaraj University	48.95	53
6	Periyar University	48.3	59
7	Manonmaniam Sundaranar University	44.85	83

The table 1 describes that the NIRF scores and ranks for several universities in India. Among them, Bharathiar University stands out with a notable NIRF score of 57.82, securing the 21st position in the ranking. Following closely is Alagappa University with a respectable score of 53.53, placing it at the 30th position. Bharathidasan University also performed well, achieving a score of 51.48 and ranking 41st. University of Madras secured the 50th position with a score of 49.5, while Madurai Kamaraj University closely follows at 53rd place with a score of 48.95. Periyar University, with a score of 48.3, secured the 59th rank. Lastly, Manonmaniam Sundaranar University, although lower in ranking at 83rd place, still obtained a score of 44.85. These rankings and scores provide valuable insights into the relative performance of these universities in the context of the NIRF evaluation

Table 2 –Sanctioned (Approved) Intake of UG & PG Students

Sl. No	Name of the Universities	2021-22	2020-21	Total
1	Bharathiar University	1647	1585	3232
2	Alagappa University	1758	1643	3401
3	Bharathidasan University	1150	1200	2350
4	University of Madras	2092	2034	4126
5	Madurai Kamaraj University	890	846	1736
6	Periyar University	1056	1020	2076

7	Manonmaniam Sundaranar University	1138	1138	2276
Total		9731	9466	19197

The table 2 shows illustrates the approved intake of undergraduate (UG) and postgraduate (PG) students for two consecutive academic years, 2021-22 and 2020-21, across seven universities. Notable trends include Bharathiar University and Alagappa University experiencing growth in sanctioned seats, with Bharathiar University increasing from 1585 to 1647 and Alagappa University from 1643 to 1758. Conversely, Bharathidasan University saw a slight reduction from 1200 to 1150. University of Madras expanded its intake from 2034 to 2092. Both Madurai Kamaraj University and Periyar University saw increases, with Madurai Kamaraj University going from 846 to 890 and Periyar University from 1020 to 1056. Manonmaniam Sundaranar University maintained its intake at 1138. In total, all universities combined had 9731 sanctioned seats in 2021-22, showing growth from 9466 in 2020-21. These figures reveal fluctuations in student intake and potential shifts in educational preferences.

Table 3 –Total Actual Student Strength of Universities.

Sl. No	Name of the Universities	Male	Female	Total	%
1	Bharathiar University	1253	1926	3179	16.13
2	Alagappa University	1417	2442	3859	19.58
3	Bharathidasan University	1202	1575	2777	14.09
4	University of Madras	1333	2132	3465	17.59
5	Madurai Kamaraj University	932	887	1819	9.23
6	Periyar University	720	1266	1986	10.08
7	Manonmaniam Sundaranar University	922	1697	2619	13.29
	Total	7779	11925	19704	100

The table 3 reveals the gender distribution of students in seven universities. Bharathiar University and Alagappa University have the highest total enrollments, with 3179 and 3859 students, respectively. Notably, female students outnumber males in these institutions, indicating a shift towards greater gender inclusivity. Bharathidasan University and the University of Madras also exhibit substantial female enrollment, with 1575 and 2132 female students, respectively, out of their total enrollments. Conversely, Madurai Kamaraj University and Periyar University have slightly more male students, suggesting some gender variation. Manonmaniam Sundaranar University shows a relatively balanced gender distribution, with 922 male and 1697 female students. These trends highlight the evolving landscape of gender diversity in higher education across these universities.

Table 4 – Placement & Higher Studies for previous 3 years for PG Programs

Sl. No	Name of the Universities	2019-20	2020-21	2021-22	Total	%
1	Bharathiar University	720	753	798	2271	36.8
2	Alagappa University	68	80	176	324	5.2
3	Bharathidasan University	216	184	235	635	10.3
4	University of Madras	264	100	440	804	13.0
5	Madurai Kamaraj University	108	150	215	473	7.7
6	Periyar University	169	139	153	461	7.5
7	Manonmaniam Sundaranar University	332	424	450	1206	19.5
	Total	1877	1830	2467	6174	100

The table 4 presents data on the placement and higher studies outcomes for postgraduate (PG) programs in seven universities over the past three years. Bharathiar University consistently stands out, with 798 students finding placements or pursuing further studies in 2021-22, showing steady growth since 2019-20. Alagappa University has made substantial progress, with placements/higher studies increasing from 68 to 176. Bharathidasan University also improved, with 235 students in 2021-22, up from 216 in 2019-20. University of Madras showed fluctuations but reached 440 placements/higher studies in 2021-22. Madurai Kamaraj University, Periyar University, and Manonmaniam Sundaranar University also contributed significantly. These figures indicate the universities' efforts in enhancing students' career prospects and educational pursuits.

Table 5 – No. of Ph.D (Full time and Part time) students graduated

Sl. No	Name of the Universities	2019-20	2020-21	2021-22	Total	%
1	Bharathiar University	587	522	526	1635	31.4
2	Alagappa University	143	156	257	556	10.7
3	Bharathidasan University	121	134	919	1174	22.6
4	University of Madras	136	153	188	477	9.2
5	Madurai Kamaraj University	104	296	237	637	12.2
6	Periyar University	229	119	143	491	9.4
7	Manonmaniam Sundaranar University	59	63	110	232	4.5
	Total	1379	1443	2380	5202	100

The table 5 describes that presents data on Ph.D. graduates, both full-time and part-time, across seven universities for the past three years. Bharathiar University consistently produced a significant number of Ph.D. graduates, with 526 in 2021-22, totaling 1635 over the three years. Alagappa University displayed steady growth, with 257 graduates in 2021-22. Remarkably, Bharathidasan University saw a remarkable increase in 2021-22, with 919 Ph.D. graduates, significantly contributing to the total of 1174. University of Madras, Madurai Kamaraj University, Periyar University, and

Manonmaniam Sundaranar University also contributed to these achievements. This data underscores the universities' commitment to research and academic excellence.

Table 6 – Cumulative Grade Point Average & Strength of Faculties

Sl. No	Name of the Universities	CGPA	Faculties
1	Bharathiar University	3.63	315
2	Alagappa University	3.64	378
3	Bharathidasan University	3.32	285
4	University of Madras	3.32	372
5	Madurai Kamaraj University	3.54	211
6	Periyar University	3.61	157
7	Manonmaniam Sundaranar University	3.13	221

This table 6 provides insights into the Cumulative Grade Point Averages (CGPA) and faculty strengths across seven universities. Notably, Alagappa University boasts the highest CGPA at 3.64, closely followed by Bharathiar University with a CGPA of 3.63, indicating their strong academic performance. Conversely, Manonmaniam Sundaranar University has a comparatively lower CGPA of 3.13. When it comes to faculty strength, Alagappa University leads with 378 faculties, while Bharathiar University follows closely with 315. These numbers signify a robust academic workforce in these institutions, suggesting a favorable faculty-to-student ratio. However, the balance between CGPA and faculty strength should be considered, as it reflects both academic quality and the resources available for students' education.

Study Overview

- In-depth analysis of seven Tamil Nadu universities.
- Focus areas: NIRF rankings, student intake, gender distribution, placements, Ph.D. graduates, and academic performance.

NIRF Rankings

- Bharathiar University leads with a score of 57.82 (21st rank).
- Alagappa University closely follows with 53.53 (30th rank).
- Bharathidasan University, University of Madras, Madurai Kamaraj University, Periyar University, and Manonmaniam Sundaranar University are also ranked.

Student Intake Trends

- Fluctuations in sanctioned seats across universities.
- Bharathiar and Alagappa Universities expanding.
- Bharathidasan University reducing seats.
- University of Madras, Madurai Kamaraj, and Periyar Universities increasing seats.
- Reflects changing educational preferences.

Gender Distribution

- Positive shift towards gender inclusivity.
- Bharathiar and Alagappa Universities have more female students.
- Bharathidasan University and University of Madras also show significant female enrollment.
- Slight gender variation in Madurai Kamaraj and Periyar Universities.
- Manonmaniam Sundaranar University demonstrates balanced gender distribution.

Placement Outcomes

- Bharathiar University excels with consistent growth in placements.
- Alagappa University shows substantial improvement.
- Other universities, including Bharathidasan, University of Madras, Madurai Kamaraj, Periyar, and Manonmaniam Sundaranar, also contribute significantly to students' career advancements.

Ph.D. Graduates

- Bharathiar University consistently produces a significant number of Ph.D. graduates.
- Alagappa University displays steady growth.
- Other universities also contribute to Ph.D. graduates, reflecting a commitment to research and academic excellence.

Academic Performance and Faculty Strength

- Alagappa University and Bharathiar University have high CGPAs, indicating strong academic foundations.
- Alagappa University leads in faculty strength, closely followed by Bharathiar University.
- This suggests favorable faculty-to-student ratios, but a balance between CGPA and faculty strength is crucial to assess academic quality and resource availability effectively.

Conclusion

This study unveils the multifaceted landscape of higher education in Tamil Nadu through an analysis of seven universities. The NIRF rankings highlight their academic standing, with notable institutions like Bharathiar and Alagappa Universities leading the way. Student intake trends suggest evolving preferences, while increasing gender inclusivity reflects positive societal changes. The universities' commitment to enhancing students' prospects is evident in placement outcomes and Ph.D. graduates. Academic performance, measured by CGPA, and faculty strength underscore the academic quality and resources available. Striking a balance between these factors is essential. This study provides valuable insights for stakeholders and policymakers, aiding informed decision-making in shaping the future of higher education in Tamil Nadu.

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DIGITAL INFORMATION SERVICES IN THE UNIVERSITIES IN KERALA: A WEBOMETRIC ANALYSIS

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Introduction

The website of every institution can be seen as the digital face of the parent institution on the internet. As the proliferation in information and communication and digital technologies influenced all areas of human lives, it is necessary for every institution and organization to optimum use the potential of ICT and digital technologies to thrive in the digital era. Design and maintenance of a responsive website have paramount importance in keeping the presence of the institution visible in the digital era.

Institutional websites can be considered as an important criterion for communicating the mission and vision of an institution and it also helps in understanding the campus climate (Hutchings & Morgan, 2024). The websites are rich sources of data that can help their student community as well as other information seekers and they also act as carriers of information that is essential for research and higher education (Luu Blanco & Metcalfe, 2020). An institutional website must provide valid information about it to the users. It should accommodate all relevant information a student or any other user wishes to know. It also should facilitate the teaching-learning activities of the universities.

Society is in a revolutionary phase of digital transformation. Higher education institutions in India are also on the path of alignment with digital information and service delivery. They are in a positive shift from traditional pedagogical approaches to adapt to new digital technology integrated pedagogical approaches (Jena & Das, 2024)with technology playing a transformative role in enhancing access, equity, and quality. This paper explores the opportunities and challenges associated with leveraging technology to advance higher education in India. It examines initiatives aimed at expanding access to education, promoting equity among diverse learner populations, and improving the quality of educational experiences through the integration of Information Technology (IT. The Government of India also has an ambitious plan for digital enablement in Indian

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educational system (Chaudhary & Sharma, 2021).The Government has introduced many digital initiatives for the purpose of integration of education and digital technologies. The Ministry of Education, Government of India has set up a scheme 'The National Mission on Education through Information and Communication Technology (NMEICT)' to use the potential of ICT in higher education for the benefit of all learners. It is essential for universities to adopt these initiatives to help the students in their learning process and now universities all over India started adopting these. Many studies (Gawande, 2020; Akhan, et. al., 2023; Datta & Mete, 2021; Aggarwal & Chimni, 2023; Boricha & Gohil, 2019; Umamageswari & Vijayakumar,2020) were previously done explaining the various digital initiatives in higher education in India. It is essential to study the extent to which the universities have implemented these initiatives.

This study aims at a qualitative content analysis of the websites of six major universities in Kerala to find out what are the different types of information they provide on their websites in favour of the student community as well as to identify what are the various digital initiatives of higher education reflected on the websites of these universities. The University of Kerala (UoK), Mahatma Gandhi University (MGU), Cochin University of Science and Technology (CUSAT), University of Calicut (CU), Central University of Kerala (CUK) and Kannur University (KU) are selected for the study. These are the top six universities in Kerala in the field of arts and science according to the NIRF India University Rankings 2023.

Related Studies

Aggarwal. and Chimni, (2023) conducted a webometric analysis of the use and status of digital initiatives in higher education in the state and central universities of Haryana. The researchers used the Alexa tool and a self-prepared checklist for data collection. They analysed various points related to the use of websites like web pages, links, view a day, time on site, rank, search traffic, bounce rate, and top keywords etc. The study found that the intention of the users of these institutional websites is to seek information on results, admissions, exams, etc., and not related to the use of digital initiatives. The study suggests that universities should provide more details about the digital initiatives of higher education and it will help in more usage of the websites. A content analysis of the websites of 29 ICSSR institutes in India was done by Verma and Pathak (2021). The data was collected by the observation and survey method. They collected data related to the general information of the institution provided, currency and authority of the site, website aids, site description, site language etc. The study explains that the majority of institutions (17) use the English language, 11 institutes use both English and Hindi as their interface language. They found only 4 institutes provide the date of update on the website and suggested it is important to provide the currency details of the websites. They also provided insights on the use of web 2.0 tools on the sites and the influence of ICT in designing the websites. Astani and Elhindi (2008) also conducted a study on the websites of top 50 universities based on the U.S. News & World Report's ratings. They used Tarafdar, and Zhang. (2005-2006) characteristics to

analyse the websites. The findings revealed that the universities provide a wide range of information and the download speed is also good. But the universities have to improve more in features like navigation, customization and security and the study suggests the universities to do so.

A webometric analysis of Indian Maritime University was done by Mishra & Mandalia (2024) to analyse the impact of the university website. The study revealed that the website is easy to navigate and provides informative content. The study suggested the website needs a user-centric approach and the efficiency can be improved more by regular content updates and use of more multimedia. Maharaj et al., (2021) also conducted a webometric study of IITs and IIMs. They analysed the websites regarding the domain and page authority, traffic, backlinks, referring domains etc. They have also done a link analysis in order to find the web impact factor as well as had a study of the research productivity of the institutes. Their study revealed that the users of the websites are more interested in the general information about the institution such as courses, admission, facilities etc. The study found IIT Bombay and IIT Kanpur with the highest domain authority score while IIT Bombay has the highest page authority. In the study, the IIT Kanpur topped in traffic, Alexa ranking and has the highest web page while IIT Delhi topped in simple web impact factor. The research suggests the use of advanced ICT tools and technologies will help the institutions positively in the global ranking process.

Gawande (2020) has conducted a study to find out various digital initiatives in higher education in India. In the study, he explained the Digital India movement and identified many digital initiatives like SWAYAM, SWAYAMPRABHA, National Academic Depository, National Digital Library, Virtual Labs, E-Shodhsindhu, E-Yantra etc. He also emphasised on the effect of digitalization and digital reforms on higher education. Datta and Mete (2021) also conducted a descriptive study of the digital initiatives of NEP 2020 on higher education in India. The study describes the National Education Policy 2020 and the digital strategies under NEP. This study enlists various digital initiatives launched by the MHRD. Many initiatives such as SWAYAM, SWAYAMPRABHA, National Digital Library, GIAN, SAKSHAT, Digilocker etc. were explained in the study.

Methodology

The study focuses on the web content analysis of five state universities and one central university in Kerala. These six universities are the main important channels of higher education in Kerala. Hence the study is to investigate how effectively they disseminate information through their institutional websites as well as what are the various digital initiatives of higher education and whether these institutes provide insights about the initiatives on their websites. A web content analysis method was used to collect primary data. A website evaluation checklist was prepared by the authors consulting the existing literature. A checklist for identifying digital initiatives was also prepared by the authors by consulting websites of the Ministry of Education, All India Council for Technical Education (AICTE), University Grants Commission (UGC) and other existing

literature. To check the accessibility features of the websites, appropriate criteria were adopted from Manzoor & Hussain (2012). Data were collected in the month of June 2024. The websites of the selected universities under study were analysed and data were tabulated. The objectives of the study are:

- To find out what are the different types of information the university websites provide for the student support
- To explore information on various digital initiatives of higher education on the websites of the universities under study
- To identify which university website disseminates information on more number of digital initiatives
- To check the accessibility features of the university websites under study
- To find out information on unique digital services provided by the universities to the students

Analysis and Discussion

Data collected from the websites were analysed and represented in the form of tables.

Basic Information

The Table 1 describes the basic information and domain structure of the selected universities under study. It is clear that, all six universities are using the same top-level domain '.ac.in' in their domain names. This domain is used mainly by academic institutions all over the world. This shows the authenticity of the websites of the institutions.

Table 1: Basic Information

University	URL	Established Year	NIRF 2023 Rank	Domain
University of Kerala (UoK)	https://www.keralauniversity.ac.in/home	1937	24	.ac.in
Mahatma Gandhi University (MGU)	https://www.mgu.ac.in/home/	1983	31	.ac.in
Cochin University of Science and Technology (CUSAT)	https://cusat.ac.in/	1971	37	.ac.in
University of Calicut (CU)	https://www.uoc.ac.in/	1968	70	.ac.in
Central University of Kerala (CUK)	https://www.cukerala.ac.in/	2009	Rank-band: 101-150	.ac.in
Kannur University (KU)	https://www.kannuruniversity.ac.in/en/	1996	Rank-band: 151-200	.ac.in

4.2 Contact Information

It is important for a university to provide valid contact details and addresses to its students and other users who are looking at the website for access. Table 2 analyses whether the universities provide such information including the Postal Address, Phone

Number, Fax, Email and How to Reach or map location.

Table 2: Contact Information

Contact Information	UoK	MGU	CUSAT	CU	CUK	KU
Postal Address	✓	✓	✓	✓	✓	✓
Phone Number	✓	✓	✓	✓	✓	✓
FAX	✓	✓	✓	--	--	✓
Email	✓	✓	✓	✓	✓	✓
How to Reach	✓	✓	✓	✓	✓	✓

The data in the Table 2 shows that, all universities provide their basic contact information on their websites. Out of six, three universities namely, UoK, CUSAT and KU provide all the contact information. The other three namely, MGU, CU and CUK failed to provide the university FAX contact.

4.3 Authority and Currency of Information

The authority details mentioning the copyright statements and ownership would make a website more reliable. The study found that, the copyright information of the universities has mentioned on the footer of the sites. The author also checked for information related to the designer of the site. All websites should contain current and latest information for the users. Hence information about the currency of the content was also checked with date and frequency of update. The findings are mentioned in the Table 3

Table 3: Authority and Currency of Information

Authority and Currency Information	UoK	MGU	CUSAT	CU	CUK	KU
Authority	✓	✓	✓	✓	✓	✓
Copyright Statement	✓	✓	✓	✓	✓	✓
Designer	--	--	--	--	--	--
Contact Details of Designer	--	--	--	--	--	--
Last Date of Update	--	--	--	--	--	--
Frequency of Update	--	--	--	--	--	--

It is visible from Table 3 that, all six universities have mentioned the details regarding the ownership and copyright details on the homepage of the websites themselves. None of them provided any information about the designer and the contact details of the designer. While considering the currency information, none of the universities again provided any details of the date of the last update of the website and the frequency of the updates.

4.4 Content Coverage

A well designed website of a university should contain information that is very important for their student community. The students and other users who need basic information about the university should be able to locate information related to the history, academics, administration, faculty, courses, admissions, budget, basic infrastructure, facilities, etc. The Table 4 contains the observations.

Table 4: Content Coverage

Content Coverage	UoK	MGU	CUSAT	CU	CUK	KU
Welcome Message	--	--	--	--	--	--
History/About	✓					
Academics	✓	✓	✓	✓	✓	✓
Administration	✓	✓	✓	✓	✓	✓
Faculty	✓	✓	✓	✓	✓	✓
Courses	✓	✓	✓	✓	✓	✓
Admission	✓	✓	✓	✓	✓	✓
Academic Calendar	✓	✓	✓	✓	✓	✓
Courseware	✓	✓	✓	✓	✓	✓
Budget	✓	✓	--	✓	✓	✓
Infrastructure / Facilities	✓	✓	✓	✓	✓	✓
Downloads / Prospectus	✓	✓	✓	✓	✓	✓
Publications	✓	✓	✓	✓	✓	✓
Web 2.0 Applications	✓	✓	✓	✓	✓	✓
Hostel	✓	✓	✓	✓	✓	✓
Transport Facility	✓	✓	--	✓	✓	✓
Bank	--	--	✓	--	✓	--
Canteen	--	✓	✓	--	✓	--

Table 4 shows that, all six universities have given importance to the basic information they have to disseminate to the students such as the History / About of the university, Academics, Administration, Faculty, Courses, Admission, Academic Calendar, Courseware, Infrastructure / Facilities, Downloads and Prospectus, Publications of the universities, Web 2.0 Applications as well as the Hostel facilities. All the university websites provide basic information about the university to the students on the home page itself, meanwhile, there was a lack of a Welcome message on the websites. None of the universities provided a welcome message on their home page. Except the CUSAT, all five universities' websites provided their Budget information for the users. Neither CU nor KU provides any information about the basic student facilities like the Transport Facility, Bank, and Canteen on their websites. The UoK website also does not provide information about the student facilities of the Bank and Canteen while the MGU site

lacks information about Bank only. The CUSAT website failed to provide information on both the Budget as well as the Transport Facility. The website of the CUK provides all the information under study, that are helpful for the student community.

4.5 Activities Information

It is necessary for an institution to project its day-to-day activities, recent happenings and updates within the university, various student activities, placements, etc. on its website. Including such information can help the students and other information seekers to know more about the university, its environment and workflow. The Table shows data about the activities of the selected universities.

Table 5: Activities Information

Activities Information	UoK	MGU	CUSAT	CU	CUK	KU
News	✓	✓	✓	✓	✓	✓
Placement Link	✓	✓	✓	✓	✓	--
Student Cell/ Associations	✓	✓	✓	✓	✓	✓
NCC/NSS	✓	✓	✓	✓	✓	✓
Sports	✓	✓	✓	--	✓	✓
Alumni	✓	✓	✓	✓	✓	✓

The observations show that, all the universities under study have given information about various news and activities on their websites. The KU website lacks important information on Placement on their website while the CU website lacks information on Sports activities. All the other information related to the activities of the universities under study was found on the websites of them.

4.6 Provision for User Support

All websites should be able to help and guide their users. The sites must have provisions for clearing user queries and confusion. The users should be able to find information for immediate help on the sites as well as they should be able to access the information without any language barriers. Observations on the information regarding user support are given in Table 6.

Table 6: Provision for User Support

Provision for user support	UoK	MGU	CUSAT	CU	CUK	KU
Online Payment	✓	✓	✓	✓	✓	✓
Results	✓	✓	✓	✓	✓	✓
Provision for Comments	--	--	--	--	--	--
Links Self Explanatory	✓	✓	✓	✓	✓	✓
Help Hyperlink	--	--	--	--	--	--
Feedback Facility	--	--	✓	--	--	--
Email Helpdesk	✓	✓	✓	✓	✓	✓

Telephone Helpline	✓	✓	✓	✓	✓	✓
Link to other Websites	✓	✓	✓	✓	✓	✓
FAQs	✓	✓	--	✓	--	--
Staff Directory		--		--	✓	✓
Language Options	✓	✓	✓	✓	✓	✓
Hit Counter	--	--	--	✓	✓	--

All six university websites have provided students with the provision of Online Payment, Results, Email and Telephone helpdesks. All of them also provided useful links to other websites and all they have options for language also. Except CUK, the rest of the five universities provide an option to read the website in 'Malayalam' language, while the CUK has an option for 'Hindi' Language interface. All of the websites' links were found self-explanatory, but none of the sites were made with a provision for comments and Help Hyperlink. It should be noted that, only the website of the CUAST provides the students with an option of Feedback Facility. The FAQs were only provided by UoK, MGU, and CU. The Staff Directory information was provided by the UoK, CUSAT, CUK, and KU while the website Hit Counter was only provided by the CU and CUK.

4.7 Navigation

A website should be made with ease of navigation which helps the users in using it. It should contain meaningful internal links to web pages and there should be aids to help the users to find whatever information they are seeking. The Table 7 explains the information collected on the navigation features of the selected university websites.

Table 7: Navigation

Navigation	UoK	MGU	CUSAT	CU	CUK	KU
Internal Links	✓	✓	✓	✓	✓	✓
Web Page Scroll Down	✓	✓	✓	✓	✓	✓
Site Map	✓	✓	--	--	--	--
Search Facility	✓	✓	✓	✓	--	✓
A – Z Index	✓	--	--	--	--	--

The observations show that, all the university websites have meaningful Internal Links and Web Page Scroll Down facility. The website of the UoK was made with all the features that makes the website easier to navigate. Only the UoK site has an option of A – Z Index. The MGU website only lacks the A – Z index while the CUSAT, CU and KU websites lack a Site Map and A – Z Index but they provide a Search Widget on the header of the home page itself. The website of the CUK does not have any features of search like Search Widget, Site Map and A – Index.

4.8 Accessibility Features of the websites

A major advantage of the web is the ability to reach a vast audience with different capabilities. With the developments in digital technologies that caused different educational approaches, the accessibility of web resources and digital information are also should be ensured for all users including people with disabilities (Kuppusamy & Balaji, 2023). The accessibility-related features on the websites of the universities under study are analysed in Table 8.

Table 8: Accessibility Features of the websites

Accessibility Features	UoK	MGU	CUSAT	CU	CUK	KU
Adequate text-to-background contrast	✓	✓	✓	✓	✓	✓
Font size/spacing is easy to read	✓	✓	✓	✓	✓	✓
Screen Reader Compliance Information	--	--	✓	--	✓	--
Text Enhancement Facility	--	✓	✓	--	✓	✓

The websites of CUSAT and CUK is equipped with the accessibility features checked, while the UoK and CU should improve their website accessibility by enabling screen reader compliance and text enhancement features. MGU and KU websites lack information on screen reader compliance of their websites. In the study, the MGU website was found with more features of accessibility like contrast change, Highlight Links, Text Spacing, Pause Animations, Hide Images, Dyslexia Friendly, Cursor, Tooltips, Line Height, Text Alignment and Saturation adjustments. No other websites were found with these features.

4.9 Information on Digital Initiatives in Higher Education

It is important for an institution to comply with the projects and initiatives of the government and enrich the students with knowledge. Hence, universities should adopt such initiatives and disseminate information on them in ways possible. A checklist of various digital initiatives of higher education in India was prepared by analysing different government websites and previous studies to find whether the universities provide information related to it. Insights are given in Table 9.

Table 9: Information on Digital Initiatives in Higher Education

Digital Initiatives	Description	UoK	MGU	CUSAT	CU	CUK	KU
Academic Bank of Credits (ABC)	Student's academic credit repository	✓	--	--	--	--	✓
DigiLocker	Digital wallet of personal documents	✓	--	--	--	--	--
e-KUMBH	Provide technical education books to students and faculty in different Indian languages	--	--	✓	--	--	--
e-PG Pathshala	Free course content	✓	✓	✓	✓	--	✓

e-Shodhsindhu	Provide access to full-text journals	--	--	--	--	--	✓
e-Yantra	Hands-on experience on embedded systems	--	--	--	--	--	✓
FOSSEE	Free/Libre and Open Source Software for Education	--	--	--	--	--	✓
GIAN	Global Initiative for Academic Networks	✓	✓	--	--	--	✓
IRINS	Indian Research Information Network System	--	--	--	--	--	--
National Academic Depository	Online storehouse of academic awards in digital formats	✓	✓	--	--	✓	✓
National Digital Library of India	Single window access to e-content and resources	--	--	--	--	✓	✓
National Educational Alliance for Technology	Best technological products in education under a single platform	--	--	--	--	--	--
National Internship Portal	Internship portal for students	--	--	--	--	✓	--
NATS	National Apprenticeship Training Scheme	--	✓	--	✓	✓	--
SAKSHAT	Education portal for lifelong learning	✓	✓	--	--	--	
Plagiarism Detection Software	Shodh Shudhhi, Turnitin, Urkund etc	✓	✓	✓	✓	✓	✓
Shodhganga	Repository of Indian theses		--	--	--	--	
Spoken Tutorial	Tutorial in IT applications	--	--		--	--	
STRIDE	Scheme for Trans-disciplinary Research for India's Developing Economy	--	✓	--	--	--	--
SWAYAM	Providing free online courses	✓	✓	--	✓	✓	✓
University Enterprise Resource Planning (SAMARTH)	Platform for service planning, management and delivery in universities	--	--	--	--	✓	--
VIDWAN	Expert Database and National Research Network	--	--	--	--	--	✓
Virtual Labs	Web-enabled virtual experiments	--	✓	--	--	--	✓

The data shows that the websites of the universities provide some of the digital initiatives while they miss information on many of them. The KU website provides information on 14 digital initiatives of higher education and is the highest followed by the MGU and UoK. The e-Shodhsindhu, e-Yantra, FOSSEE and VIDWAN were only mentioned on the website of Kannur University. No universities provide information on the National Educational Alliance for Technology initiative, IRINS and Shodh Shudhhi.

Information on the STRIDE initiative was only found on the MGU website while the e-KUMBH, an important initiative for technical education was found on the website of the CUSAT which is specialised in providing technical education. The information on the DigiLocker Initiative was only found on the website of UoK. E-PGPathshala and SWAYAM are the most common initiatives found on at least five of the six websites under study followed by the NAD initiative which was found on four websites other than the CUSAT and CU sites. Information on the National Internship Portal and SAMARTH was only found on the interface of the CUK which is the only central university in Kerala.

Conclusion

The website of any institution being its digital face has to be a channel for information dissemination to its users. It should accommodate all the relevant details related to the university and should support the students in information seeking and, in the teaching-learning process. The study found that all six universities under study use .ac.in domain and provide basic information about the university such as History, Academics, Administration, Faculty, Courses, Admission, Contact Information, Courseware, Downloadable forms, Publications, News, Extra-curricular activities, Results, Online payment etc. to the student community. All university sites except CUK have English and Malayalam language options while the CUK site has English and Hindi language options. All the sites lack direct Help hyperlinks and provision for comments. Also, the sites failed to provide currency information such as the date and frequency of updates. The UoK website was found with all the navigational features like Internal Links, Web Page Scroll Down, Site Map, Search Widget and A-Z Index. The CUSAT website includes all accessibility features under study while the MGU website is found to be providing more accessibility features other than those studied, but lacks Screen Reader Compliance Information. The UoK and CU should improve their website accessibility and ensure access to students with different abilities. The study of information on digital initiatives found that, the KU website accommodates information on more number of digital initiatives. 'Digital Garden', a unique service was found on the website of UoK through which they provide information on the floristic diversity of the university in digital format. The MGU website found using virtual reality to provide a 360^{o} virtual tour of the university which is a unique attempt. The universities need to provide information on more digital initiatives which help the students in the learning process using the advantage of digital information and technologies. A standardized framework can be adopted for the design and development of websites of higher educational institutions in India.

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VISUALIZATION OF KEYWORDS IN TEA RESEARCH (2016-2020): A STUDY BASED ON THE WEB OF SCIENCE DATABASE USING VOSVIEWER

Pranjal Deka[1] & Dr. Mukut Sarmah[2]

Introduction

Keywords are vital elements in scientific publications, significantly enhancing the discoverability and accessibility of scholarly contents. These brief phrases, which appear after the abstract, highlight the core ideas, concepts, and issues addressed in the study. They aid in the organization and categorization of articles within academic databases, facilitating easier retrieval in specific fields of study. Keywords help researchers find pertinent information during their searches and offer a quick summary of the article's main topics, allowing readers to measure its relevance to their interests.

Well-chosen keywords are crucial for improving the visibility, referencing, and impact of academic publications, highlighting their importance in effectively communicating research to the scholarly community.

Keywords Plus, a concept introduced by Thomson Reuters (now Clarivate Analytics), involves additional keywords derived from the titles of articles referenced within a publication. Unlike Author Keywords, which are specifically chosen by the authors, Keywords Plus are generated automatically. They identify terms or phrases frequently appearing in the titles of the sources cited in the article. This approach includes important concepts from the references that might not be explicitly mentioned in the article itself, thereby enhancing the discoverability and categorization of the publication (Garfield, 1990; Garfield & Sher, 1993; Zhang et al., 2016).

VOSviewer is a user-friendly software tool developed by researchers at Leiden University for visualizing and analysing complex networks or bibliometric maps. It helps users explore relationships among items such as scientific publications or keywords, using advanced algorithms to create visual maps. This makes it easier to identify clusters, trends, and connections within large datasets. Researchers across various fields use VOSviewer for insightful analysis and interpretation of complex data structures.

This study, rooted in the principles of scientometric analysis, seeks to track the prevalence of keywords in tea-related studies from 2016 to 2020. The primary goal of

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this study is to identify the distribution of keywords in tea research and an understanding of tea research across various domains.

Objectives of the Study

The main objectives of this study are to analyse the distribution of keywords in tea research, to highlight the keywords based on their clusters, and to identify areas in tea research.

Scope and Limitation of the Study

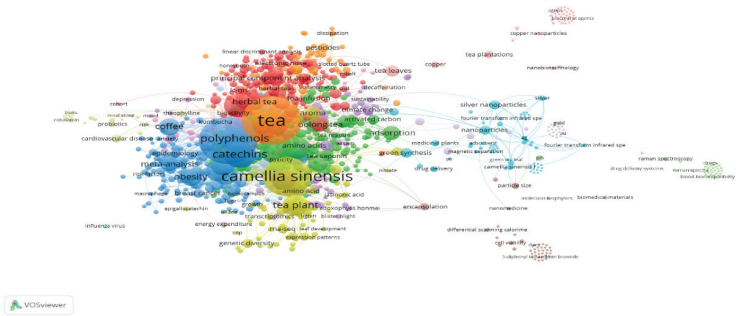
This study was conducted using the Web of Science Database during the period from 2016 to 2020. Only the tool VOSviewer was used; no other databases or software were utilized in this study.

Methodology

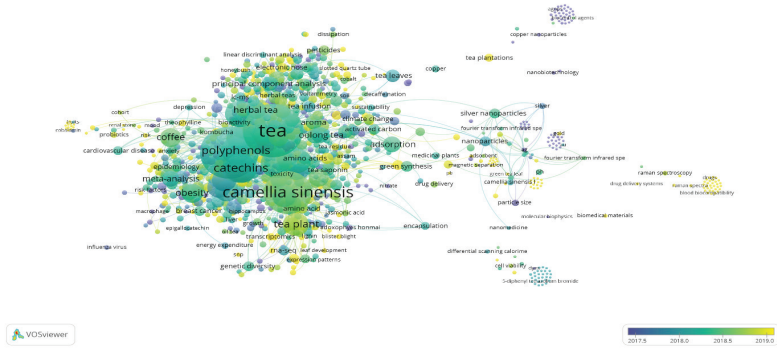
The required data were extracted from the web of Science Database using Title = Tea or Title = *Camelia sinensis*. Total 6987 no of data were extracted and collected data were analysed using the VOSviewer.

Visualization of Author Keywords

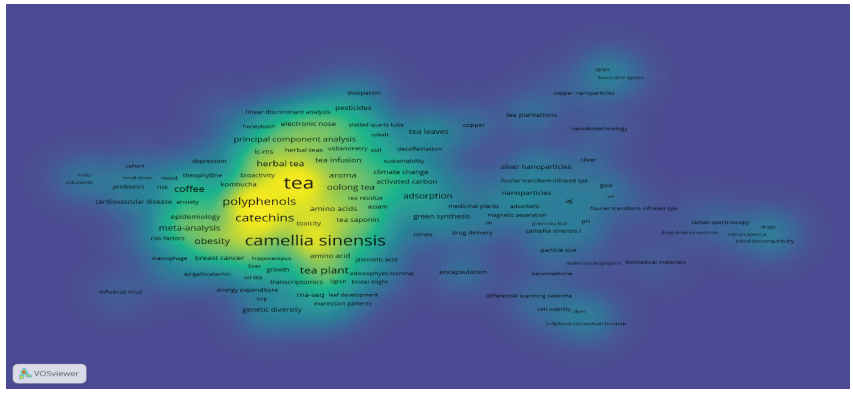
Figure-1 present the distribution of keywords used by the author across 17 clusters, with varying numbers of items in each cluster. Cluster 1 contains 170 items, Cluster 2 has 157 items, and Cluster 3 includes 152 items. Cluster 4 comprises 76 items, Cluster 5 has 68 items, Cluster 6 has 65 items, Cluster 7 includes 51 items, and Clusters 8 and 9 each contain 44 items. Cluster 10 consists of 42 items, Cluster 11 has 39 items, Cluster 12 includes 32 items, Cluster 13 contains 29 items, and Cluster 14 has 26 items. The smallest clusters, 15, 16, and 17, each contain only 1 item.



(a)



(b)



(c)

Fig-1: (a) Network visualization of Author Keywords, (b) Overlay visualization of Author Keywords, (c) Density visualization of Author Keywords,

Hundred Author Keywords with Highest Occurrence and Hundred Author Keywords with Lowest Occurrence:

Table -1 shows the 100 most frequently used keywords and the 100 least used keywords by the author in various scholarly content. The keyword “tea” tops the list with 604 occurrences and a total link strength of 1274, followed by “green tea” with 569 occurrences and 1153 total link strength. Other frequently used keywords include “camellia sinensis” (383 occurrences, 840 total link strength), “catechins” (177 occurrences, 480 total link strength), and “tea polyphenols” (164 occurrences, 218 total link strength).

Additionally, keywords such as “black tea,” “polyphenols,” “antioxidant activity,” “caffeine,” and “antioxidant” have significant occurrences ranging between 122 and 149, with corresponding link strengths. The list also includes keywords related to specific compounds, methods, and effects, like “green tea extract,” “catechin,” “EGCG,”

"oxidative stress," and "obesity." Lesser-used keywords include "alpha-amylase," "prostate cancer," "reactive oxygen species," "metabolites," and "cytotoxicity," each with occurrences between 18 and 19. The table provides insight into the distribution of author keywords and highlights emerging keywords in the field

The least occurred keywords also cover a broad range of topics and methodologies, reflecting the diverse scope of the research. Examples include specific terms like "drugs," "ecofriendly biocontrol agents," "economic importance," and "Eimeria species," each with a total link strength of 39 to 47.

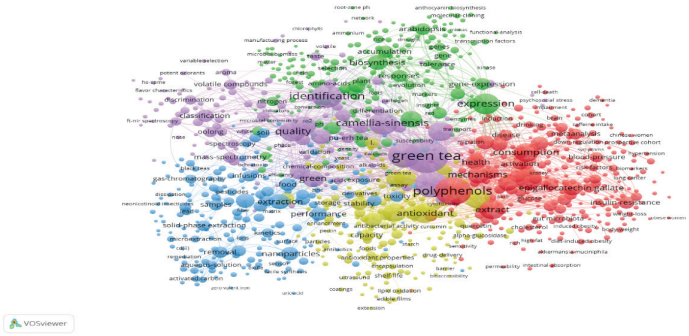
Keywords related to specific scientific techniques and analyses such as "electrokinetic effects," "energy dispersive x-ray analysis," "fourier transform infrared analysis," and "ultraviolet-visible spectroscopy" are also included. Additionally, some keywords focus on particular substances and their effects, such as "green tea flavonoids," "magnetic iron oxide-tea waste nanocomposite," "sulphated glycosaminoglycan biopolymer," and "osteoblasts."

Other distinguished keywords are associated with agricultural and biological studies, including "fruit shelf life," "green leaf yield," "intestinal damage," and "tea pathogenic fungus." This list illustrates the variety of less common keywords that contribute to the richness of the research landscape.

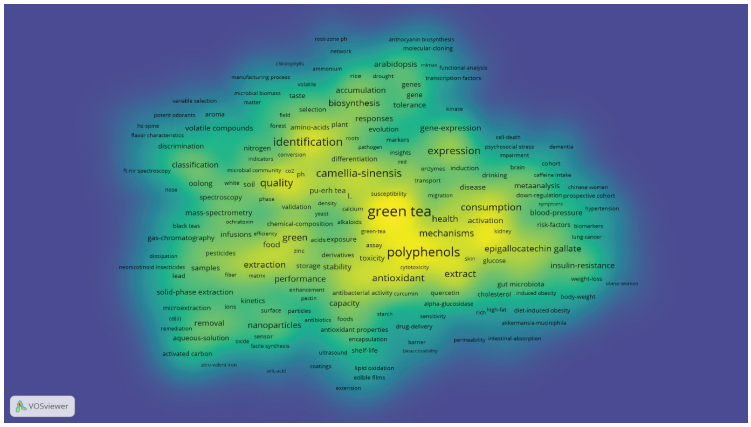
Table 1: 100 Author Keywords with Highest Occurrence and 100 Author Keywords with Lowest Occurrence

Visualization of Keywords Plus

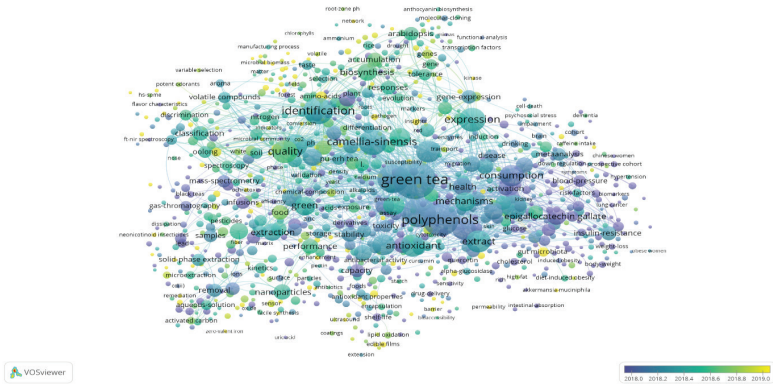
Figure -2 presents the distribution of Keywords Plus across7 clusters, with varying numbers of items in each cluster. Cluster 1 contains 264 items, Cluster 2 has 216 items, and Cluster 3 includes 199 items. Cluster 4 comprises 187 items, Cluster 5 has 130 items, Cluster 6 has 3 items, and Cluster 7 includes 1 item.



(a)



(b)



(c)

Fig-2: (a) Network visualization of Keywords Plus, (b) Overlay visualization of Keywords Plus, (c) Density visualization of Keywords Plus.

Hundred Keywords Plus with Highest Occurrence and Hundred Keywords Plus with Lowest Occurrence:

Highly occurred keywords plus in tea research are green tea (792 occurrences, 4604 total link strength), polyphenols (541 occurrences, 3228 total link strength), catechins (475 occurrences, 2828 total link strength), black tea (424 occurrences, 2680 total link strength), and Camellia sinensis (346 occurrences, 2005 total link strength). Epigallocatechin gallate (153 occurrences, 893 total link strength), antioxidant activity (264 occurrences, 1406 total link strength), oxidative stress (282 occurrences, 1600 total link strength), inflammation (93 occurrences, 551 total link strength), fermentation (90 occurrences, 485 total link strength), insulin resistance (105 occurrences, 673 total link strength), obesity (70 occurrences, 419 total link strength), disease prevention (79 occurrences, 413 total link strength), solid-phase extraction (80 occurrences, 434 total link strength), liquid chromatography (74 occurrences, 413 total link strength), tea leaves

(255 occurrences, 1372 total link strength), apoptosis (105 occurrences, 567 total link strength), gene expression (104 occurrences, 542 total link strength), protein activation (99 occurrences, 535 total link strength), and cancer (125 occurrences, 647 total link strength).

Among the least frequently occurring author keywords, the keyword "polymer" appears alongside "polymers," both occurring eight times with a total link strength of 42. Other terms such as "preservation," "product," and "radicals" also feature prominently, each with eight occurrences and varying link strengths. Notably, "rosemary" and "ultrasound-assisted extraction" show significant relevance, both with eight occurrences and link strengths of 51 and 53, respectively. Keywords like "bio accessibility," "cognitive impairment," and "fermented Camellia sinensis" each occur seven times. Environmental and health-related terms such as "climate," "drought tolerance," "heart disease," and "neuroprotection" also appear. Analytical techniques such as "cyclic voltammetry," "gc-olfactometry," and "lc-ms/ms" are highlighted.

Table 2: 100 Keywords Plus with Highest Occurrence and 100 Keywords Plus with Lowest Occurrence

S. No.	One Hundred Most Frequently Occurring Author Keywords.				One Hundred Least Frequently Occurring Author Keywords.		
	Keyword strength	Occur rences	total link		Keyword strength	Occur rences	total link
1	tea	604	1274		drugs	1	39
2	green tea	569	1153		ecofriendly biocontrol agents	1	42
3	camellia sinensis	383	840		economic importance	1	44
4	catechins	177	480		Eimeria species	1	39
5	tea polyphenols	164	218		electrokinetic effects	1	47
6	black tea	149	333		energy dispersive x-ray analysis	1	42
7	polyphenols	149	440		energy-dispersive x-ray spectroscopy	1	39
8	antioxidant activity	127	312		feo	1	25
9	caffeine	125	381		fish consumption	1	23
10	antioxidant	122	271		fluorescens	1	44
11	tea plant	112	141		fourier transform infrared analysis	1	42
12	green tea extract	101	179		fourier transform-infrared spectroscopy	1	25
13	catechin	96	295		fruit shelf life	1	24
14	egcg	95	211		functional biomolecules	1	42
15	oxidative stress	95	204		gastric ph	1	39
16	obesity	79	210		green leaf yield	1	44

17	coffee	72	219		green tea coated aluminium magnesium silicate beads	1	39
18	herbal tea	68	117		green tea flavonoids	1	47
19	metabolomics	68	165		green tea-ams hybrid complex	1	39
20	tea tree oil	65	88		greenhouse studies	1	44
21	adsorption	55	112		higuchi model	1	39
22	flavonoids	54	146		hydrodynamic diameters	1	35
23	meta-analysis	54	149		hydrodynamic size	1	35
24	oolong tea	54	144		hydrodynamics	1	35
25	epigallocatechin gallate	53	147		hydroxypropyl methylcellulose phthalate	1	39
26	theanine	53	156		in vitro evaluation	1	47
27	antioxidants	52	130		incubation time	1	24
28	inflammation	50	135		indigenous isolate	1	42
29	polyphenol	49	125		intestinal damage	1	39
30	antioxidant capacity	47	103		invitro antifungal study	1	42
31	response surface methodology	47	98		ionic gelation method	1	47
32	green tea polyphenols	45	63		iron compounds	1	25
33	tea polyphenol	45	49		iron oxide-tea waste surface	1	25
34	white tea	45	116		kc10	1	44
35	aroma	44	133		lead(ii) ions	1	25
36	principal component analysis	44	96		legumes	1	23
37	apoptosis	43	84		light scattering	1	24
38	gene expression	43	90		linking agent	1	39
39	chemometrics	41	81		loading efficiency	1	47
40	gc-ms	41	81		magnesium compounds	1	39
41	fermentation	38	104		magnetic iron oxide-tea waste nanocomposite	1	25
42	gut microbiota	37	89		magnetic tea waste	1	25
43	hplc	37	80		materials preparation	1	39
44	transcriptome	37	77		mc24	1	44
45	tea waste	36	63		mediterranean diet	1	23
46	tea leaves	35	102		metallic nanoparticles	1	42
47	tea consumption	34	59		molecular configurations	1	47
48	extraction	33	65		nanoformulation	1	44
49	green tea catechins	33	58		narrow size distribution	1	35
50	phenolic compounds	33	78		oral beads	1	39
51	phenolics	33	68		osteoblasts	1	47
52	pu-erh tea	33	64		particle shape	1	42
53	tea quality	32	60		ph-based dissolution	1	39

54	fluoride	31	70		pharmacokinetic studies	1	39
55	amino acids	30	100		phomopsis canker disease	1	42
56	epigallocatechin-3-gallate	30	48		phomopsis theae	1	42
57	risk assessment	30	55		plant diseases	1	44
58	diabetes	29	76		plant pathogenic microorganisms	1	42
59	tea infusion	28	46		polymer blends	1	47
60	bioavailability	27	75		precipitation (physical chemistry)	1	39
61	gallic acid	27	62		prophylactic treatment	1	39
62	tea plantation	27	33		rapid removal	1	25
63	volatile compounds	27	55		reaction temperature	1	24
64	cancer	26	101		reduction (chemical)	1	35
65	metabolism	25	59		reduction component	1	35
66	tea saponin	25	16		release efficiency	1	47
67	volatile	25	84		revenue loss	1	44
68	green synthesis	24	71		sannanensis	1	44
69	heavy metals	24	56		silver nitrate	1	24
70	activated carbon	23	32		silver nitrate concentrations	1	35
71	food analysis	23	87		site-specific codelivery	1	39
72	quality	23	60		size 176 nm	1	47
73	climate change	22	51		soil application	1	42
74	l-theanine	22	61		solution ph	1	35
75	antimicrobial	21	48		spherical colloidal ag nps	1	35
76	chitosan	21	38		stem disease	1	42
77	kinetics	21	50		sulphated glycosaminoglycan biopolymer	1	47
78	melaleuca alternifolia	21	35		surface morphology	1	47
79	metabolic syndrome	21	54		synthetic nanomaterials	1	44
80	nanoparticles	21	235		t	1	44
81	pesticides	21	37		tea leaf extracts	1	24
82	silver nanoparticles	21	170		tea pathogenic fungus	1	42
83	theaflavins	21	60		tea plant cultivating countries	1	44
84	amino acid	20	70		tea plant pathogens	1	44
85	biosynthesis	20	103		tea trade	1	44
86	breast cancer	20	45		tea-water ratio	1	24
87	dark tea	20	37		temperature 4	1	35
88	food composition	20	82		theae growth	1	42
89	genetic diversity	20	27		thermal behaviour	1	47
90	lc-ms	20	52		thermo-gravimetric analysis	1	24
91	rna-seq	20	41		time 10	1	25

92	stability	20	42		time 24 h	1	47
93	aging	19	58		ultraviolet-visible spectroscopy	1	42
94	china	19	27		uv-visible spectra	1	35
95	cytotoxicity	19	50		vascular cognitive impairment	1	23
96	epidemiology	19	51		vascular dementia	1	23
97	metabolites	19	41		vc38	1	44
98	prostate cancer	19	40		vegetables	1	23
99	reactive oxygen species	19	48		visible absorption spectroscopy	1	35
100	alpha-amylase	18	45		wine	1	23

Findings and Conclusion

This study highlights the major areas and underexplored research domains in tea research. From the visualization, we identified clusters of words in both author keywords and keywords plus, reflecting different dimensions of tea research. Highly occurring keywords indicate ongoing research areas, while the least occurring keywords suggest underexplored or discontinued areas in tea research. Both Table 1 and Table 2 provide a preliminary direction towards these research areas. For continued study in this field, it is essential to analyse all keywords, from the least to the most frequent, in the keyword network. Tea research is an ever-growing field, expanding into various dimensions daily. According to the Web of Science Database, the major research categories include Food Science Technology, Biochemistry Molecular Biology, Nutrition Dietetics, Pharmacology Pharmacy, Chemistry-Applied, Chemistry-Multidisciplinary, Chemistry-Analytical, Plant Sciences, Chemistry-Medicinal, Environmental Sciences, Oncology, Agriculture-Multidisciplinary, Biotechnology Applied Microbiology, Neurosciences, Chemistry-Physical, Toxicology, Materials Science-Multidisciplinary, Engineering-Chemical, Cell Biology, Multidisciplinary Sciences, Physiology, Integrative Complementary Medicine, Public Environmental Occupational Health, Medicine Research Experimental, Agronomy, Endocrinology Metabolism, Biochemical Research Methods, Microbiology, Medicine General Internal, Biology, Biophysics, Entomology, Genetics Heredity, Energy Fuels, Environmental Engineering, Surgery, Nanoscience Nanotechnology, Chemistry Organic, Electrochemistry, Dentistry Oral Surgery Medicine, Horticulture, Dermatology, Cardiac Cardiovascular Systems, Gastroenterology Hepatology, Immunology, and Soil Science. Thus, studying tea research is crucial for advancing knowledge and innovation in the field.

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MEDICAL NEGLIGENCE: BY MEANS OF SCIENTOMETRIC ANALYSIS WITH SPECIAL REFERENCE TO THE JUDGMENTS OF SCC ONLINE AND RESEARCH OUTPUT OF SCOPUS

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Introduction

Negligence

According to the Merriam-Webster Dictionary, "Negligence is an essential legal concept". Further, the Dictionary denotes that it is an act of failure to take care of a situation which has to be handled carefully.[1]

Indian Penal Code for Negligence

The IPC's Section 304A is titled "304A. Causing death by negligence."Any individual who kills another person by hasty or careless actions that do not constitute culpable murder faces a maximum two-year sentence in either type of jail, a fine, or both."[2]

Medical Negligence

The word "Medical Negligence" denotes the act of a Medical Practitioner or a medical supporting staff showing negligence in their medical role or responsibility in the process of treating a sick. Getting the wrong diagnosis from a medical professional can result in the patient's life becoming a catastrophe. Owing to negligence during surgery, the physician could leave some surgical instruments within the patient's body and finish the suturing process. Anesthesia overdose can even occasionally be fatal. Carelessness in administering a vaccination right away without first testing it with a pharmaceutical dose that could induce a heart attack. Prescribing a medication that makes the patient

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allergic. Long-term Negligent Treatment may also lead to disaster. Therefore, Medical Negligence is a great threat to the healthy and happy long life of every living being.[3]

Medical Negligence in India

Man is not flawless. Thus, it is possible for even highly qualified individuals, like doctors, to act carelessly. In India, more than 52 lakh medical injuries are reported annually. A major source of concern for the entire county is the fact that medical incompetence causes 10 deaths every minute and over 11 deaths per hour throughout the county. It became necessary to use rules and sanctions to dissuade doctors in order to get the best care possible from them. A medical practitioner faces a fine, up to two years in jail, or both if their carelessness causes a patient to pass away. The Indian Criminal Code, Section 337, deals with harm resulting from acts that endanger one's life or personal safety. The Indian judiciary works to guarantee that every Indian person receives "complete justice," drawing on the country's Constitution. The Supreme Court has the authority to issue any decree to carry out "complete justice" under Article 142. In recent years, Article 142 has grown to be a significant component of the Supreme Court's decision-making process, frequently being used to provide "complete justice" in medical malpractice cases.[4]

Medical Negligence and Article 21

It is the duty of the state-run government hospitals to offer life-preserving medical treatment. A government hospital's failure to provide timely medical attention to someone in need constitutes a violation of that person's right to life, as guaranteed by Article 21.[5]

Time-line for Medical Negligence Case in India

You have two years from the date of the incident to report the incident if you are certain you were the victim of medical negligence. The Medical Council of India (MCI) is where you can register the complaint. As an alternative, you can register a complaint with the neighborhood police department or consumer court.[6]

Review of Literature

Dahlawi, S., et.al.The author has taken "Medical Negligence" for a Bibliometric Study and selected the WOS database to download related research contents from 1954 to 2020. Biblioshiny and VOS Viewer have been utilized apart from Microsoft Excel for analysis and interpretation. The analysis includes the impact of the author, the collaboration of authorship patterns, country-wise assessment and organization-wise research output. The article reveals that the number of publications was in increasing trend. Bird contributes more number of research publications and Brennan is considered as prolific cited author. The United States was leading country in number of publications. University of South Florida was highest in productivity and institution wise citation credit goes to Harvard University. The Lancet and British Medical Journal published most research articles on "Medical Negligence".[7]Shi, G.,et.al.Research Publications

related to "Medical Malpractice" from 1975 to 2018 have been downloaded by from the WOS by the author to do bibliometric analysis. The analysis reveals that 44 source titles are involved in producing 379 papers in medicine. Three years viz., 1975, 1980 and 1985 published no research publications on "Medical Malpractice". 2013 published the most number of publications of 33 papers. It was identified that the earliest paper was published in 1976. It was found that the sponsoring bodies and organizations of the United States of America were the best in publishing papers on "Medical Malpractice". The contribution of the journal entitled "Journal of Law, Medicine and Ethics" was the best in productivity with 51 research publications.[8]Huang, H. C., et.al.From 1961 to 2013, the Web of Science database was examined for records of medication mistakes and adverse drug occurrences. The pictorial representation was made through HistCite software and Ucinet software. The most cited articles and references were profiled and examined. The healthcare sector is particularly concerned about medication errors and adverse drug occurrences. Thus, the author mapped out the conceptual framework of the studies on errors in medication and unfavorable drug-related occurrences, as well as looked at how the literature and various themes related to one another have been developed. 3342 adverse drug event documents and 3343 medication mistakes were found in the database search. The three main themes that dominated the most referenced articles on errors between 1961 and 2013 were medicine mistakes in adults, pediatrics, and computerized. From 1987 to 2013, the following was the development route for the most referenced papers concerning adverse medication events: detection, analysis, effect, and prevention in adult inpatient settings moving to pediatric inpatient settings and hospitalized care moving to outpatient settings. Additionally, a close correlation was found between prescription errors and adverse drug events using social network analysis based on the most cited sources.[9]Kaya, A. E. et.al.Research publications published on Psychiatric Malpractice and indexed in Web of Science have been downloaded from 1980 to 2020 by the author for the bibliometric study. The Web of Science Core Collection database search produced 426 publications in all, spanning the years 1980–2022, as a result. Psychiatry, government law, and psychology had the highest number of items on psychiatric malpractice (n = 219, 51.4%, n = 73, 17.1%, and n = 53, 12.4%), respectively. With 11 and 10, respectively, Scott C. (n=11, 2.5%) and Gutheil TG (n=10, 2.3%), were the writers with the most publications in the field. In this sector, articles made up 312 (73.2%) records, while reviews made up 39 (9.1%) records were the most common type of publications. With 279 (65.4%) publications, the United States was the most productive nation in this sector. With 19 publications apiece, Germany (4.4%) and England (4.4%) behind the United States. A globe map with colours according to each country's amount of publications is shown in Figure 1. The number of publications generated by the nations on mental malpractice and their GDP, GDP PPP, and HDI indicators showed a statistically significant correlation (r=0.670, p, respectively). This study showed that there were not enough publications on the subject of psychiatry and malpractice and that few researchers were working in this area with weak linkages among them. As far as the authors' research effect is concerned, we think these results are significant. We anticipate that increased research on psychiatric malpractice will

make psychiatrists better knowledgeable about the field, which will reduce the number of mistakes that have legal repercussions.[10]

Research Design

Appropriate Hypotheses are framed based on the needs and Objectives of the study. Judgments on "Medical Negligence" are downloaded from the online database "SCC Online". Data on the research output on "Medical Negligence" are also downloaded from SCOPUS. Regression Test and F-test are applied for proven results.

Need & Objectives of the Study

The study aims know the awareness of the people on "Medical Negligence" through the relevant Judgments sentenced and indexed in the database "SCC Online" from 1994 to 2023. Simultaneously, the research publications on "Medical Negligence" indexed in SCOPUS are also assessed for the same number of years.

- To observe the number of Judgments delivered on "Medical Negligence"
- To ascertain the awareness created by the researchers on Medical Negligence through research publications
- To identify the variance between the number of verdicts delivered from 1994 to 2023
- To know the relationship between the judgments delivered and the number of publications from 1994 to 2023

Limitations

i. The Judgments on "Medical Negligence" considered for the research have been limited to the database SCC Online.
ii. The years are limited from 1994 to 2023.
iii. The research impact on "Medical Negligence" is limited to SCOPUS.

Hypotheses

1. "H0: There is a significant relationship between the number of judgments sentenced in the first half and the second half of the judgments sentenced in 30 years from 1994 to 2023"
2. "H0: There is no significant relationship between the number of judgments delivered and the number of publications published on "Medical Negligence".
3. H0: There is no significant variance between the number of judgments delivered and the number of publications published on "Medical Negligence"

Research Methodology

The research methodology applied in the article is descriptive. The way of approach towards description is as follows:

- Data on Judgments have been downloaded from 1994 to 2023 from SCC Online
- Data on the Research Publications on "Medical Negligence" Indexed in SCOPUS from 1994 to 2023 were downloaded
- Regression Test and Correlation have been applied for the test.

Analysis and Interpretation

Percentage Analysis

The percentage analysison the "Judgments" delivered on "Medical Negligence" indexed in the database "SCC Online" has been downloaded for 30 years starting from 1994 to 2023 and displayed in Table No.4.1. 2016 was the year that most of the judgments were pronounced with a judgment count of 2076(8.71%). The year 2015 rated second rank with a judgment count of 1724(7.24%). The year 2014 was rated in third place with a judgment count of 1643(6.90%). 23822 judgments sentenced from 1994 to 2023 at an average of 794.

Table No.4.1. Percentage Analysis of the Judgments delivered on "Medical Negligence"

Sl. No.	Year	No. of Judgements	Percentage Analysis	Sl. No.	Year	No. of Judgements	Percentage Analysis
1	1994	129	0.54%	16	2009	833	3.50%
2	1995	155	0.65%	17	2010	1208	5.07%
3	1996	192	0.81%	18	2011	1063	4.46%
4	1997	172	0.72%	19	2012	1509	6.33%
5	1998	161	0.68%	20	2013	1597	6.70%
6	1999	182	0.76%	21	2014	1643	6.90%
7	2000	260	1.09%	22	2015	1724	7.24%
8	2001	268	1.13%	23	2016	2076	8.71%
9	2002	216	0.91%	24	2017	1556	6.53%
10	2003	296	1.24%	25	2018	1196	5.02%
11	2004	309	1.30%	26	2019	1524	6.40%
12	2005	377	1.58%	27	2020	1135	4.76%
13	2006	447	1.88%	28	2021	837	3.51%
14	2007	459	1.93%	29	2022	873	3.66%
15	2008	494	2.07%	30	2023	931	3.91%
Total Judgments						23822	100.00%

Regression Test

Table 4.2. Regression Test for the Year wise Distribution of Judgments on "Medical Negligence"

Regression Test Results								
Multiple R		0.418046155						
R Square		0.174762588						
Adjusted R Square		0.111282787						
Standard Error		113.2416205						
Observations		15						
	df	SS	MS	F	Signifi-cance F			
Regression	1	35304.09	35304.09	2.75	0.12			
Residual	13	166707.64	12823.66					
Total	14	202011.73						
	Coeffi-cients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
X Variable 1	-0.13	0.08	-1.66	0.12	-0.31	0.04	-0.31	0.04

The P-value of 0.12 is not lesser than the critical value of 0.05, therefore, the null hypothesis is accepted and interpreted that there is no relationship between the number of judgments sentenced in the first half and judgments sentenced in the second half from 1994 to 2023. Courts involved in the Judgments from 1994 to 2023 on Medical Negligence

Table No.4.3. Court responsible for the Judgments of 23822

Ranking	Description	Judgments	Percentage Analysis
1	High Court Cases	17074	71.67%
2	Tribunal & Commissions	3156	13.25%
3	Foreign Cases	2767	11.62%
4	Supreme Court Cases	455	1.91%
5	International Cases	359	1.51%
6	District Court Cases	11	0.05%
Total Judgments		23822	100.00%

The23822 judgments indexed by the SCC Online have been sentenced by 6 different courts. The Percentage analysis of the ranking of the Honorable Courts responsible for sentencing the 23822 judgments is available in Table No.4.3. The High Court is placed in the first place in sentencing the maximum number of judgments with a verdict count of 17074(71.67%) on "Medical Negligence".

Percentage Analysis of the Research Publications published on Medical Negligence and indexed in SCOPUS from 1994 to 2023

The table No.4.4. reveals that 4885 research publications have been published and indexed in SCOPUS for the past 30 years on "Medical Negligence". From 1994 to 1998 published below than hundred papers every year. The year 2004 was the most prolific year at the outset of 30 years with a 230(5%) research contents.

Table No.4.4. Percentage Analysis of the Year-wise Research Contents on Medical Negligence indexed in SCOPUS

Year	Record Contents	% Analysis	Year	No. of Record Contents	Percentage Analysis
1994	75	2%	2009	168	3%
1995	78	2%	2010	159	3%
1996	72	1%	2011	159	3%
1997	87	2%	2012	160	3%
1998	86	2%	2013	182	4%
1999	108	2%	2014	193	4%
2000	122	2%	2015	215	4%
2001	165	3%	2016	179	4%
2002	190	4%	2017	152	3%
2003	204	4%	2018	175	4%
2004	230	5%	2019	208	4%
2005	179	4%	2020	224	5%
2006	191	4%	2021	215	4%
2007	190	4%	2022	203	4%
2008	154	3%	2023	162	3%
Total No. of Publications				4885	100%

Percentage Analysis of the type of Research Publications Published on Medical Negligence

Table 4.5. Percentage Analysis of the Type of Research Publications on Medical Negligence indexed in SCOPUS

Sl. No.	Type of Publications	No. of Publications	Percentage Analysis
1	Article	2540	52%
2	Review	851	17%
3	Note	341	7%
4	Editorial	266	5%
5	Letter	252	5%
6	Book Chapter	226	5%
7	Conference Paper	201	4%
8	Short Survey	175	4%

9	Book	24	0%
10	Erratum	8	0%
11	Conference Review	1	0%
Total Type of Publications		4885	100%

4.5. table gives clarity about the type of research contents involved in publishing 4885 research publications on "Medical Negligence". Eleven types of research output are involved in the distribution. Out of those eleven type of research publications, articles are ranked first with a record count of 2540(52%). Reviews on "Medical Negligence" placed in second place with a record count of 851(17%). Other types of publications such as Notes, Editorial, Letter, Book Chapters, Conference Paper, Short Survey, Book, Erratum and Conference Review indexed in SCOPUS on "Medical Negligence" are below 7%.

F-Test to find out the variance of the distribution of the Judgments and Research contents indexed in SCOPUS.

Table 4.6. Thirty Years Judgments and Thirty Years Research Publications on "Medical Negligence" (1994-2023)

Sl. No.	Year	No. of Judgments in SCC On-line Database	No. of Publications in SCOPUS	Sl. No.	Year	No. of Judgments in SCC Online Database	No. of Publications in SCOPUS
1	1994	129	75	17	2010	1208	159
2	1995	155	78	18	2011	1063	159
3	1996	192	72	19	2012	1509	160
4	1997	172	87	20	2013	1597	182
5	1998	161	86	21	2014	1643	193
6	1999	182	108	22	2015	1724	215
7	2000	260	122	23	2016	2076	179
8	2001	268	165	24	2017	1556	152
9	2002	216	190	25	2018	1196	175
10	2003	296	204	26	2019	1524	208
11	2004	309	230	27	2020	1135	224
12	2005	377	179	28	2021	837	215
13	2006	447	191	29	2022	873	203
14	2007	459	190	30	2023	931	162
15	2008	494	154		Total	23822	4885
16	2009	833	168				

Table number 4.6. is very clear to let us know about the thirty years (i.e., 1994 to 2023) of judgments and research publications indexed in SCOPUS. The judgments sentenced for the above-mentioned period are almost five times the number be publications

indexed in SCOPUS. To prove statistically that the two outputs have a variation or not, the above-mentioned data have been tested with F-test and the results are as follows:

H0: There is no significant variance between the number of judgments delivered and the number of publications published on "Medical Negligence"

Table4.7. F-Test Two Sample for Variances

F-Test Two-Sample for Variances		
	Variable 1	Variable 2
Mean	794.0666667	162.8333333
Variance	355157.2368	2172.971264
Observations	30	30
df	29	29
F	163.4431355	
P(F<=f) one-tail	2.69256E-25	
F Critical one-tail	1.860811435	

Since the P-value of 2.69 is greater than the critical value of 0.05, the H0 is accepted and there is no significant variance between the two variables. Therefore, it is interpreted that the impact of research publications cannot be a cause for the increasing awareness about "Medical Negligence".

Conclusion

It was found that 23822 judgments delivered from 1994 to 2023 in an average of 794 judgments for a year. 2016 was the most prolific year for the most number of judgments of 2076(8.71%). The Regression Test proved that there was no relationship between the number of judgments sentenced in the first half and second half of the judgments sentenced from 1994 to 2023. The 23822 judgments indexed by the SCC Online have been sentenced by 6 different courts. The High Court is placed in the first place in sentencing the maximum number of judgments with a verdict count of 17074(71.67%) on "Medical Negligence". It is found that 4885 research publications have been published and indexed in SCOPUS for the past 30 years on "Medical Negligence". Eleven types of research publications are involved in the distribution. Out of those eleven types of research publications, articles are ranked first with a record count of 2540(52%).The judgments sentenced for the above-mentioned period are almost five times the number be publications indexed in SCOPUS. It is found and proved that the impact of the research publications and the sentenced judgments have no variance through the F-test. Even though the research publications are much lower than the sentenced judgments, the judgments pronounced are very high. It seems many people who are affected by the negligence of the medical science filed cases against medical

negligence. Therefore, it is concluded that the research alone cannot be a cause for the increasing awareness about "Medical Negligence", but also some other means of communication played a vital role in creating awareness among the people towards legal aid. But at the same time, global researchers are requested to publish many more articles on medical negligence to play an important role in creating an impact among the awareness of the people about "medical negligence" to live and lead a smooth life in their day-to-day lives.

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BIBLIOMETRIC ANALYSIS OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

S. Murugan[1] & Natarajan N.O[2]

Introduction

Agriculture is a primary economic activity that involves the tillage or cultivation of land. Its primary goal is to obtain sustenance for humans and to supply raw materials to companies. Agriculture is seen as an important component of a country's economic development. According to World Bank estimates from 2018, agriculture accounts for 4% of global GDP. In certain developing nations, it may account for more than 25% of GDP.[1] However, the agriculture sector faces a big problem. In addition to expanding food production, it must consider utilizing more efficient and sustainable production methods, as well as adjusting to climate change.[2] New technologies and Artificial Intelligence (AI) have been identified as essential components in addressing these difficulties. AI is a discipline of computer science concerned with the creation of intelligent beings capable of perceiving their surroundings and responding appropriately to the information they perceive.[3] AI has been used to construct systems that optimize human processes or jobs, such as expert systems in healthcare that help diagnose and monitor diseases.[4] The development of intelligent systems in education allows for creative teaching and learning approaches that are tailored to the student profile.[5] In business and production, systems can convert data into meaningful and valuable information that permits decision-making.

Methodology

This paper aims to analyse scientific literature on artificial intelligence in agriculture. The data were retrieved from the Scopus multidisciplinary database on June 29, 2024. The search key for TITLE, "Artificial Intelligence" or "AI" or "Computer Intelligence" and "Agriculture". The time duration from 1990 to 2024 (June -29). With a total record of 417 article title only, we used MS Access, MS Excel, and Bibliomatrix of Biblioshiny software for data analysis.

Results

1 Assistant Librarian SRM Institute of Science and Technology
2 Assistant Professor Annamalai University

Year wise Growth of Publications

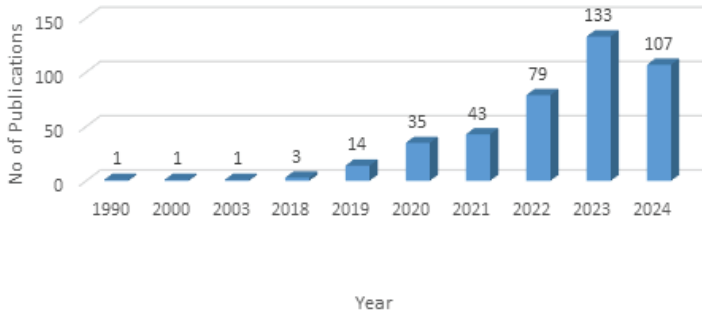


Figure 1. Graphical Representation of Annual Growth in AI in Agriculture Research from 1990 to 2024.

Figure 1 shows the distribution of articles published by year related to the application of AI in agriculture. The first paper identified was published in 1990. In this paper, Robinson L.M. Regulating what we eat: Mary Engle Pennington and the Food Research Laboratory. In Marcus AI, Lowitt R, ed: The United States Department of Agriculture in historical perspective. Furthermore, since 2019. The number of publications dealing with AI applications in agriculture has an increasing trend, it is evident that many documents have been published during the last two years (2023 and 2024), with 133 and 109 documents, respectively. At the same time, 73.4% (417) of the total publications of AI in agriculture were written in the last five years (2020 -2024).

Most Relevant Countries

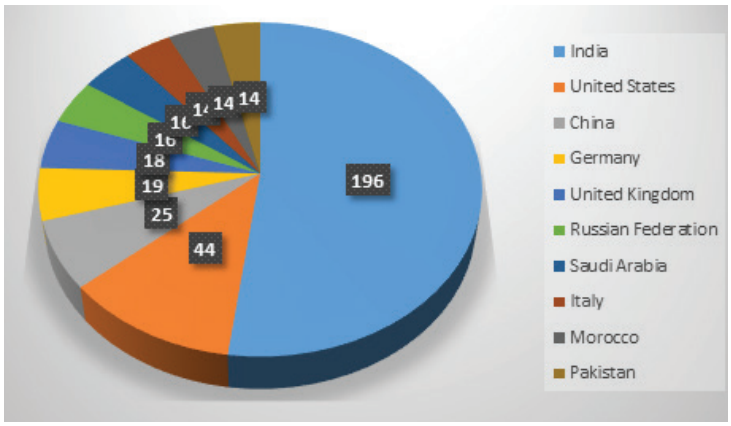


Figure 2. Graphic representation of top ten countries where the most articles that use AI in agriculture are published.

Figure 2 shows the top ten productive countries in terms of the number of documents

published in AI application in agriculture. Countries with the highest number of publications are India first, with 196 documents, The USA follows it with 44 and China with 25 and to a lesser extent Italy, Morocco, and Pakistan same number with 14 documents.

Top Ten Author Contribution

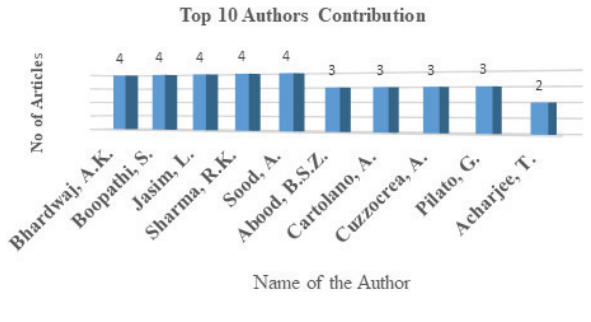


Figure 3. Top ten authors with the highest number of papers published in AI applications in agriculture.

Figure 3 shows the top author in the AI applications in agriculture, it has most articles published by the first five authors has same number of articles published with 4 they are Bhardwaj, A.K., Boopathi, S., Jasim, L., Sharma, R.K., Sood, A. Followed by Abood, B.S.Z., Cartolano, A., Cuzzocrea, A., Pilato, G. they were produced with same article with 3. Leaset of the article puroduced by Acharhee T. with 2 articles.

Top Ten Affiliation

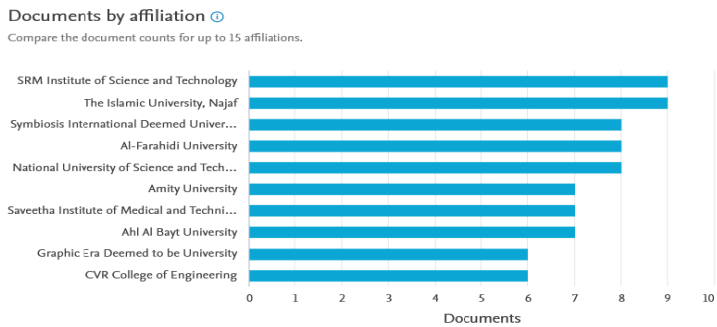


Figure 4. Top 10 Affiliation produced by the application of AI in agriculture.

Figure 4 presents the top 10 affiliation contribution in the application of AI in agriculture. Here top two institutions same number of the article has been published there were SRM Institute of Science and Technology and The Islamic University, Najaf with 9. Followed by three institutions same number of articles has been published there were Symbiosis International Deemed University, Al-Farahidi University, and National University of Science and Technology with 8.

Top Ten Subject Area

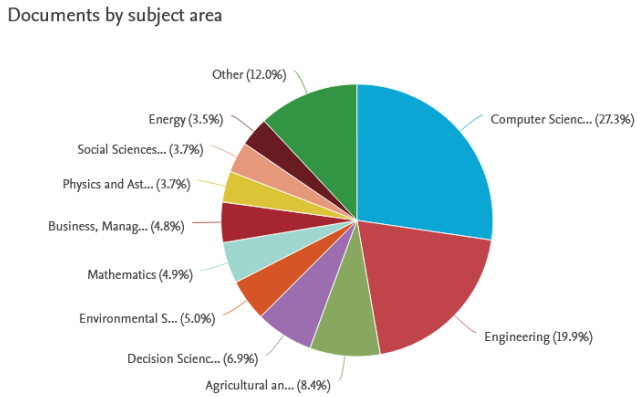


Figure 5 Subject Area of the AI in Agriculture.

Figure 5 shows the subject area application of AI in agriculture, the computer science area most of the articles has been published with 27.3%, followed by the Engineering 19.9%, and Agricultural and Biological Sciences 8.4% in this study find out the most of the subject area has been computer science and engineering.

Table 1. Top 10 Highly Cited Publications

S. No	Paper	DOI	Total Citations
1	PATRÃCIO DI, 2018, COMPUT ELECTRON AGRIC	10.1016/j.compag.2018.08.001	596
2	JHA K, 2019, ARTIF INTELL AGRIC	10.1016/j.aiia.2019.05.004	582
3	TALAVIYA T, 2020, ARTIF INTELL AGRIC	10.1016/j.aiia.2020.04.002	419
4	MISRA NN, 2022, IEEE INTERNET THINGS J	10.1109/JIOT.2020.2998584	314
5	JUNG J, 2021, CURR OPIN BIOTECHNOL	10.1016/j.copbio.2020.09.003	203
6	AYOUB SHAIKH T, 2022, COMPUT ELECTRON AGRIC	10.1016/j.compag.2022.107119	185
7	ELI-CHUKWU NC, 2019, ENG TECHNOL APPL SCI RES	10.48084/etasr.2756	184
8	ZHANG P, 2021, NATURE PLANTS	10.1038/s41477-021-00946-6	163
9	VINCENT DR, 2019, SENSORS	10.3390/s19173667	140
10	BHAT SA, 2021, IEEE ACCESS	10.1109/ACCESS.2021.3102227	133

The table 1 presents the highly cited publications of application of AI in agriculture, the article Patrício, Diego Inácio. Computer vision and artificial intelligence in precision agriculture for grain crops: A systematic review, *Computers and Electronics in Agriculture* with 596 citations. Followed by Kirtan Jha, Aalap Doshi, Poojan Patel, Manan Shah, A comprehensive review on automation in agriculture using artificial intelligence, *Artificial intelligence in agriculture* with 582 citations.

Conclusion

We present a bibliometric analysis based on the 417 articles retrieved from the Scopus. The study results enable researchers to identify that documents reporting the use of AI in agriculture have been published since 1990. However, since 2023 the number of publications has been increasing. The countries with the highest number of publications are India, the United States, and China. The institution with the highest published number of documents was SRM Institute of Science and Technology and The Islamic University, Najaf.

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GROWTH OF BLOCK CHAIN TECHNOLOGY RESEARCH OUTPUT FROM SCOPUS DATABASE DURING 2015- 2023: A SCIENTOMETRIC ANALYSIS

Dr. S Vivekanandhan[1], Dr.P Ganesh[2] & Mrs. S. Kalaimani[3]

Introduction

Blockchain technology is revolutionizing the way we conduct transactions, share information, and ensure the security of data in the digital age. This innovative technology, which was first introduced by the mysterious creator of Bitcoin, Satoshi Nakamoto, is a decentralized and distributed ledger system that records all transactions across a network of computers. Block chain is a sophisticated database system designed for secure and transparent information sharing within a network. Imagine a digital ledger recording transactions chronologically and securely. This ledger is then distributed across a network of computers, making it decentralized and tamper-proof.

Here are some key characteristics of block chain technology: **Distributed Ledger:** Data is stored in blocks that are chained together. Each participant in the network has a copy of the ledger, ensuring consistency and transparency. **Security:** Cryptographic hashing and verification protocols make it nearly impossible to alter data entries without altering subsequent blocks, upholding data integrity. **Decentralization:** There's no central authority controlling the network. Instead, participants collaboratively maintain the ledger through consensus mechanisms. Especially this study analysed the growth of block chain technology in the recent trends.

Review of Literature

Navasakthi C and Suresh B (2013) analyzed authorship pattern of coffee plantation research in India from 2000 to 2012 with 1231publications. Multiple authors formed 48% of the total research output, while double authorship formed 19.43%. Degree of collaboration was 0.63 in the years 2005 and 2006 and 0.71 in the year 2012.

Vivekanandhan S, Rajendran p and Sivasamy K (2019) analyzed the pollution control research publications by Indian from the Scopus database between 2007 and 2018 with 33084 research publications. The relative growth rate was found that, 0.61

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to 0.12 between 2007 and 2018, at the same time doubling time values are 1.14 to 5.77. Maximum of 112(5.61%) publications are collaborated by United States. The average degree of collaboration was 0.92.

Objectives

- To analyze the year–wise growth of publications
- To study the Relative Growth Rate (RGR) and doubling time (Dt)
- To study the types of Document
- To study the top 10 authors and authorship pattern
- To study the top 10 journals, institutions and countries publication
- To analysis the language wise research and publication efficiency index

Limitation

This study aim to analysis the research output on block chain technology and the data has been downloaded from the Scopus database for nine years from 2014 to 2023. The data has been extracted from the following search keyword: (TITLE-ABS-KEY "Block Chain Technology" and PUBYEAR > 2014 and PUBYEAR < 2024. The data was collected on 20.06.2024

Methodology

A total number of 1008 research publications in the field of block chain technology research were retrieved and extracted for further analysis. The extracted data has been processed and analyzed using MS-Excel. The following scientometric techniques such as relative growth rate, doubling time, authorship pattern, top 10 authors, journals, institutions and countries and languages are used.

Data Analysis and Interpretation - Year wise Growth of Publications

Table 1: Year wise Growth of Publications

S. No	Year	No of Publications	%	Cum. No of Publications	%
1	2015	2	0.2	2	0.2
2	2016	2	0.2	4	0.4
3	2017	19	1.88	23	2.28
4	2018	56	5.56	79	7.84
5	2019	138	13.69	217	21.53
6	2020	136	13.49	353	35.02
7	2021	199	19.74	552	54.76
8	2022	207	20.54	759	75.3
9	2023	249	24.7	1008	100
Total	**1008**	**100**			

Table 1 shows that, year wise growth of research publications in block chain technology research between the study periods of 2015 and 2023, with a total number of 1008 of research publications. Related to block chain technology research was started in

the year 2015 with 2 papers and the year 2016 also 2 papers. This study identified that, maximum of 249(24.70%) publications are contributed in the year 2023, followed by 207(20.54%) publications in the year 2022. It is identified from the study more than 60% of publications are published in the last three years from 2021-2023.

Relative growth rate and doubling time

Relative Growth Rate: The growth of publications was analyzed by using two parameters namely Relative Growth Rate and Doubling time using the Mahapatra (1985) formula. RGR is measure the increases in number of articles in a particular period of time.

$$\text{It is calculated as } R(a) = (W_2 - W_1) / (T_2 - T_1)$$

Where as Explain W_1, W_2, T_1 and T_2 R (a) = RGR = the mean relative growth rate over the specific period of interval W_1 = the logarithm of beginning number of publications/pages W_2= the logarithm of ending number of publications/pages after a specific period of interval $T_2 - T_1$ = the unit difference between the beginning time and the ending time. Doubling time is the time taken for the doubling of the number of records actually published within a stipulated period. Doubling time is calculated from the relative growth rate and the natural logarithm number is used, the difference has a value of 0.693. Thus, the corresponding doubling time can be calculated by the following formula, Dt = 0.693/ R(a).

Table 2 : Relative growth rate and doubling time

S. No	Year	Publications	Cum.	W_1	W_2	RGR [R(a)]	Dt
1	2015	2	2		0.69	0.69	1.00
2	2016	2	4	0.69	1.39	0.69	1.00
3	2017	19	23	1.39	3.14	1.75	0.40
4	2018	56	79	3.14	4.37	1.23	0.56
5	2019	138	217	4.37	5.38	1.01	0.69
6	2020	136	353	5.38	5.87	0.49	1.42
7	2021	199	552	5.87	6.31	0.45	1.55
8	2022	207	759	6.31	6.63	0.32	2.18
9	2023	249	1008	6.63	6.92	0.28	2.44
Total		1008					

Table 2 explain the relative growth rate and doubling time in block chain technology research publcations from 2015- to 2023. On the observation of the current study, it is found that the maximum RGR is 1.75 has been recorded in the year 2017 and the minimum RGR of 0.28 has been counted in the year 2023, while the maximum of doubling time is 2.44 has been counted in the year 2023 and the minimum doubling time is 0.40 in the year 2017. It can be seen in table 2 that the value of the relative growth rate of publications [R (a)] is decreased gradually from 1.75 to 0.28. at the same time doubling time is increasing trend from 0.40 to 2.44.

Types of Documents

Table 3: Types of Documents

S. No	Document Type	No of Publications	%	Cum.	%
1	Conference Paper	567	56.25	567	56.25
2	Article	312	30.95	879	87.20
3	Book Chapter	64	6.35	943	93.55
4	Conference Review	29	2.88	972	96.43
5	Review	23	2.28	995	98.71
6	Retracted	5	0.50	1000	99.21
7	Book	4	0.40	1004	99.60
8	Erratum	3	0.30	1007	99.90
9	Editorial	1	0.10	1008	100.00
Total		1008	100.00		

Table -3 shows that types of documents in block chain technology research output during the selected nine year study period. Out of that, maximum of 567(56.25%) research publications are in conference paper, followed by articles into 312(30.95%) and book chapter 64(6.35%). Out of which top three documents were published 93.55% publications.

Authorship Pattern

Table 4: Authorship Pattern

S. No	Authorship	No of Authors	%
1	Anonymous Author	30	2.98
2	Single Author	115	11.41
3	Two Authors	264	26.19
4	Three Authors	169	16.77
5	Four Authors	146	14.48
6	Five Authors	118	11.71
7	Six Authors	121	12.00
8	Seven Authors	19	1.88
9	Eight Authors	14	1.39
10	Nine Authors	7	0.69
11	Greater Than 9 Author	5	0.50
	Total	1008	100.00

Table 4 identified that, authorship pattern in the field of block chain technology research publications during the 9 years study period. From the study, it is identified that, 30(2.98%) research publications are anonymous author and the anonymous author publi-

cations are published in the conference proceedings. Out of 1008 research, 115(11.41%) publications are contributed by single author's publications and remaining 863(85.61%) research publications are multi author's publications. From the multi authors publications, maximum of 264(26.19%) research publications are contributed by two authors, followed by 169(16.77%) publications are contributed by three authors. During the ten years study period it is identified that more than nine authors are contributed 5(0.50%) research publications.

Top 10 Authors Contribution

Table 5: Top 10 Authors Contribution

S. No	Name of the Author	Country	No of Publications	Rank
1	Antonidoss, A	Chennai, India	6	1
2	Elshin, L A	Russian Federation	5	2
3	Safiullin, M R	Russian Federation	5	2
4	Abdukaeva, A A	Russian Federation	4	3
5	Cui, G	China	4	3
6	Inayatulloh	Indonesia	4	3
7	Lai, J	China	4	3
8	Li, B	China	4	3
9	Qi, B	China	4	3
10	Singh, R	Dehradun, India	4	3
	Total		44	

Table – 5 shows that, top 10 authors along with the ranking towards the publications of block chain technology research. It is identified from the study, maximum of 6 papers are contributed by Antonidoss, A, Chennai, India with top rank. Followed by Elshin, L A and Safiullin, M R from Russian Federation with 5 publications and they are in 2nd rank. It is identified from the study, top 10 authors are contributed 44 publications. Out of top 10 authors, 4 authors from China, three authors from Russia, two authors from India and one from Indonesia. Figure 1 shows the collaboration between the authors in the study field.

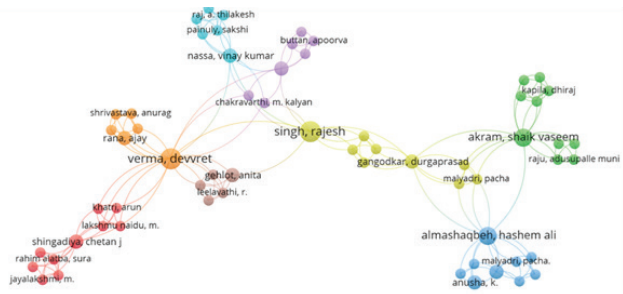


Figure 1: Authorship Collaboration Map

Top 10 Journals Contributions

Table 6: Top 10 Journals Contributions

S. No	Name of the Journal	No of Publications	%	Rank
1	ACM International Conference Proceeding Series	35	3.47	1
2	Journal of Physics Conference Series	28	2.78	2
3	Lecture Notes in Networks and Systems	20	1.98	3
4	AIP Conference Proceedings	19	1.88	4
5	Advances in Intelligent Systems and Computing	16	1.59	5
6	Lecture Notes in Electrical Engineering	16	1.59	5
7	Lecture Notes on Data Engineering and Communications Technologies	16	1.59	5
8	International Journal of Innovative Technology and Exploring Engineering	14	1.39	6
9	Journal of Advanced Research in Dynamical and Control Systems	14	1.39	6
10	2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering ICACITE 2023	13	1.29	7
	Total	191	18.95	

Table - 6 shows the top 10 journals along with the ranking towards the publications of block chain technology research. It is identified from the study, maximum of papers are contributed by ACM International Conference Proceeding Series with 35(3.47%) publications and it was placed in first rank. Followed by Journal of Physics Conference Series with 28(2.78%) and Lecture Notes in Networks and Systems was third place with a publication of 20(1.98%). The remaining journals in the top 10 were chronologically arranged and cited in the table very clearly with their respective publication count and their rank. It is identified from the study, top 10 journals contributions are 191(18.95%) publications.

Top 10 Institutions Contribution

Table 7: Top 10 Institutions Contribution

S. No	Name of the Institution	No of Publications	%	Rank
1	SRM Institute of Science and Technology, Chennai, TN	19	1.88	1
2	K L Deemed to be University, Andhra Pradesh	19	1.88	1
3	Graphic Era Deemed to be University, Dehradun, Uttarakhand	17	1.69	2

4	Lovely Professional University, Bengaluru, Karnataka	16	1.59	3
5	Amity University, Noida, India	14	1.39	4
6	State Grid Corporation of China, Beijing, China	13	1.29	5
7	North China Electric Power University, Beijing, China	12	1.19	6
8	Uttaranchal University, Dehradun, Uttarakhand	12	1.19	6
9	Tsinghua University, Beijing, China	11	1.09	7
10	Chandigarh University, Punjab, India	11	1.09	7
	Total	**144**	**14.29**	

Table – 7 shows the top 10 institutions along with the ranking towards the publications of block chain technology research. It is identified from the study maximum number of papers are contributed in SRM Institute of Science and Technology, Chennai, TN and K L Deemed to be University, Andhra Pradesh with 19 (1.88%) publications and it is placed in first rank. Followed by Graphic Era Deemed to be University, Dehradun, Uttarakhand with 17(1.69%) and Lovely Professional University, Bengaluru, Karnataka is third place with a publication of 16(1.59%). The remaining institutions in the top 10 were chronologically arranged and cited in the table very clearly with their respective publication count and their rank. It is identified from the study, top 10 institutions are contributed 144(14.29%) research publications in the field of the study of block chain technology. Figure 2 shows the institutions collaborations in the field of block chain technology.

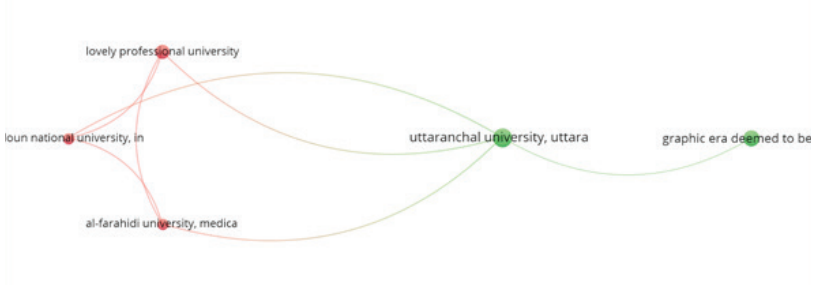


Figure 2: Institution Collaboration Map

Top 10 Countries contributions

Table 8: Top 10 Countries contributions

S. No	Country	No of Publications	%	Rank
1	India	399	39.58	1
2	China	370	36.71	2
3	United States	31	3.08	3

4	South Korea	27	2.68	4
5	Malaysia	25	2.48	5
6	Saudi Arabia	21	2.08	6
7	Russian Federation	18	1.79	7
8	Iraq	16	1.59	8
9	Pakistan	16	1.59	8
10	Indonesia	15	1.49	9
Total		938	93.06	

Table -8 showed that the top 10 countries wise research contributions on block chain technology research. From the study it is identified that, India contribute a maximum number of 399(39.58%) publications and it is top rank, followed by China with 370(36.71%) publications with 2nd rank, and United States responsible for 31(3.08%) publications with 3rd rank. During the 9 year study period, out of 1008 research publications, 938(93.06%) publications are published by top 10 countries in the field of block chain technology research. Figure 3 identified the collaboration between the institutions.

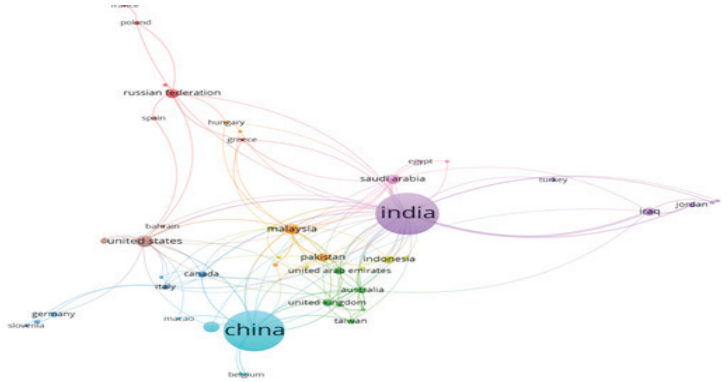


Figure 3: Country Collaboration Map

Types of Languages

Table 9: Types of Languages

S. No	Language	No of Publications	%
1	English	951	94.35
2	Chinese	53	5.26
3	Spanish	3	0.30
4	Japanese	1	0.10
5	Russian	1	0.10

Table – 9 identified the number of languages is adopted related to this study. Out of that maximum of 951(94.35%) research publications are in English language, followed by Chinese with 53(5.26%) publications, Spanish 3(0.30%) publications and Japanese and Russian are each one publication.

Publication Efficiency Index

The relative research effort was being measured by the Publication Efficiency Index (PEI). This is another derivative of the above-mentioned Activity Index introduced by PRICE (1981), and was used by GARG (2002) and GUAN & MA (2007), Vivekanandhan (2016) and it is based on the references appended to the research articles by the authors. PEI is calculated by the formula used by Guan, J., & Ma, M. (2007).

$$PEI = \frac{TNC_i/TNC_t}{TNP_i/TNP_t}$$

Where, TNC_i = total number of references in a year, TNC_t = total no of references for all years

TNP_i = total number of papers in a year, TNP_t = total number of papers for all years

If the PEI value is greater than 1 for a year, it is indicating that the impact of publications is more, and the research effort is highly devoted that particular Year.

Table 10: Publication Efficiency Index

S. No	Year	No of Publications	No of References	Average Reference per Paper	PEI
1	2015	2	20	10.00	0.49
2	2016	2	23	11.50	0.56
3	2017	19	375	19.74	0.97
4	2018	56	985	17.59	0.86
5	2019	138	2240	16.23	0.79
6	2020	136	2667	19.61	0.96
7	2021	199	3792	19.06	0.93
8	2022	207	4593	22.19	1.09
9	2023	249	5895	23.67	1.16
Total		1008	20590	20.43	

From the study it is identified that total number of 1008 publications are containing 20590 references. Out of that maximum number of 249 publications are used by 5895 references in the year 2023 and the average reference per paper is 20.43. The PEI value is 0.49 in the year 2015 and 1.16 in the year 2023, 1.09 in the year 2022.

Major Findings

The present study concludes that, the block chain technology research publications are contributed from the Scopus database during the period of 2015-2023 with 1008 publications. During the study period maximum of maximum of 249(24.70.58%)

publications are contributed in the year 2023. The relative growth rate of publications [R (a)] is decreased gradually from 1.75 to 0.28. At the same time doubling time is increasing trend from 0.40 to 2.44.

Out of 1008 research publications, maximum of 567(56.25%) research publications are in conference paper, 115(11.41%) publications are contributed by single author's publications and remaining 863(85.61%) research publications are multi author's publications. Maximum number of 6 papers are contributed by Antonidoss, A, Chennai, India with top ranking author. Maximum number of 19 (1.88%) publications are contributed by SRM Institute of Science and Technology, Chennai, TN and K L Deemed to be University, Andhra Pradesh and it was 1st rank.

India researchers are contributing a maximum number of 399 (39.58%) publications and it is top rank and most of 951(94.35%) research publications are in English language.The average reference per paper is 20.43. The PEI value is 0.49 in the year 2015 and 1.16 in the year 2023, 1.09 in the year 2022.

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GLOBAL RESEARCH ON SPICE: A SCIENTOMETRIC ANALYSIS

S. Ravichandran[1] & P.Ganesh[2]

Introduction

A spice is a plant material used to flavor or colour food. Although health advantages of spices are widely claimed, there is currently inadequate data to support these claims. India produces 75% of the world's spices. Their food reflects this; historically, the spice trade stretched over the Indian subcontinent, as well as East Asia and the Middle East. One of the economic and cultural elements that propelled early modern travel was the demand for spices throughout Europe. Spain and Portugal were seeking new ways to trade spices and other lucrative Asian commodities. Control of trade routes and spice-producing regions were the key objectives for Portuguese captain Vasco da Gama's visit to India in 1499. When da Gama discovered the pepper market in India, he was able to obtain peppers for a much lesser price than Venice had sought. Around the same period, Christopher Columbus returned from the New World. He told investors about the new spices that were available. He told investors about the new spices that were available. Ragusans from the maritime republic of Dubrovnik in southern Croatia were another source of competition in the spice trade throughout the 15th and 16th centuries. The Portuguese could now conduct direct trade with Siam, China, and the Maluku Islands. With the discovery of the additional World came the introduction of additional spices, such as allspice, chili peppers, vanilla, and cocoa. This advancement kept the spice trade profitable well into the nineteenth century, with America as a latecomer with its novel seasonings.

Scientometrics Study

Scientometrics is a truly multidisciplinary research field that encompasses practically all scientific disciplines. Furthermore, many significant bibliometric analyses of important scientific topics have arisen in the recent two decades. Bibliometrics is now defined as the study of measuring documents. The term measurement refers to the use of mathematical and statistical approaches to determine the growth of documents, scattering of literature in various forms of documents, publication of documents by an author, influence of documents, and so on. Cole and Eales (1917) used statistical analysis to analyze the literature in their publication on the history of comparative anatomy.

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Ranganathan (1948) developed the word librametry to describe the measurement of various library operations and services using mathematical and statistical methodologies. Alan Prichard (1969) invented the term bibliometric to define the use of statistical and mathematical approaches to texts and other news, the process of written expression, and the character and course of a discipline.

Review of Literature

P. Rajendran, J. Manickaraj, B. Elango (2013) Examine the SCOPUS database for research output in wireless communication contributed by Indian scientists from 2001 to 2012. 1128 records are retrieved and exported to MS Excel. The distribution of Indian scientists' various modes of communication has been revealed, with 808 (71.63%) appearing as conference papers. RGR declines from 0.56 in 2002 to 0.26 in 2012, although DT increases from 1.24 to 2.67.

Donthu, Kumar, and Pattnaik (2020) an examination of the business research journal's bibliometrics over a 45-year period. They discovered that Michel Laroche and Jean-Charles Chebat both had 39 JBR publications, with Arch G. Woodside coming in second with 30. The United States (4810) and the United Kingdom (2817) have the highest number of writers affiliated with JBR articles.

Sujatha and Padmini (2015) The IEEE Transactions on Antennas and Propagation periodical was researched by 20. Between 2010 and 2014, it published 3442 papers, with a high of 789 articles in 2014 and an average of 688 pieces each year. In 2013, 86 countries submitted 3442 papers, with the United States providing the most (921) followed by China (572), and India coming in 21st with 52 articles.

objectives of the Study

- To investigate the publication and growth pace of literature over the Spice publications.
- To investigate the authorship pattern.
- To identify the most prolific authors and institutes in the Spice sector.
- To investigate the distribution of research publications by country.
- To investigate the time series analysis on the Spice.

Research Methodology

The researcher gathered the necessary research data from the Scopus database on Spice from 2013 to 2022, and it is the primary source of data for the current study. (TITLE-ABS-KEY ("Spices") and PUBYEAR > 2012 and PUBYEAR < 2023). On 04.12.2022, data for the Scopus database were collected in MS Excel sheets.

Data Analysis and Interpretation

Year-Wise Growth Spice

Table 1 Year-Wise Growth Spice

S.No	Year	Publi cations	%	Cum.	%	Cita tions	%	H-Index	CPP	RCI
1	2013	1681	8.13	1681	1.56	32881	15.18	83	19.56	1.87
2	2014	1816	8.79	3497	3.24	32560	15.03	79	17.93	1.71
3	2015	1858	8.99	5355	4.96	31309	14.45	74	16.85	1.61
4	2016	2026	9.80	7381	6.84	25815	11.92	65	12.74	1.22
5	2017	2055	9.94	9436	8.74	25175	11.62	64	12.25	1.17
6	2018	2125	10.28	11561	10.71	23885	11.03	53	11.24	1.07
7	2019	2223	10.76	13784	12.77	19769	9.13	54	8.89	0.85
8	2020	2261	10.94	16045	14.87	14873	6.87	44	6.58	0.63
9	2021	2457	11.89	18502	17.15	8397	3.88	29	3.42	0.33
10	2022	2162	10.46	20664	19.15	1939	0.90	15	0.90	0.09
	Total	20664	100.00	107906	100.00	216603	100.00			

Table 1 displays the increase in Spice research papers from 2013 to 2022. Based on a selection of 20664 articles. The most articles, 2457 (11.89%), are published in 2021. Followed by the number of articles in 2261(10.94%) research publications contributed in 2020. These two years are regarded as the most fruitful. In these two years, the production of publications climbed to 22.83%. However, the minimal number of publications published in 2013 was 1681 (8.13%).

With 32881(15.18%) research publications, the H-index is 83, the Citations per paper is 19.56, the Related Citations Index is 1.87, the H-index is 79, the citations per paper is 17.93, and the related citations index is 1.71. The h-index is 15, the citations per paper are 0.90, and the related citations index is 0.09. 20664 research publications (100%) were published over the ten-year study period.

Authors in the Spice

Table-2 Authors in the Spice

Sl. No	Authors	Country	Pub.	%	Cita tions	%	H-Index	CPP	RCI
1	Pandey, N.	India	88	15.49	621	12.57	14	7.06	0.81
2	Eguchi, K.	United States	60	10.56	255	5.16	9	4.25	0.49
3	Tangsrirat, W.	China	56	9.86	310	6.27	9	5.54	0.64
4	Yuce, E.	Iran	53	9.33	763	15.44	17	14.40	1.65
5	Górecki, K.	Japan	52	9.15	448	9.07	12	8.62	0.99
6	Herencsar, N.	Italy	52	9.15	686	13.88	14	13.19	1.52
7	Kumngern, M.	Germany	52	9.15	303	6.13	9	5.83	0.67
8	Pandey, R.	Turkey	52	9.15	364	7.37	11	7.00	0.80
9	Radwan, A.G.	South Korea	52	9.15	952	19.27	19	18.31	2.10

10	Srivastava, M.	United Kingdom	51	8.98	239	4.84	8	4.69	0.54
	Total		568	100.00	4941	100.00			

The contribution of the most prolific authors on the topic of spice is shown in Table -2, with Pandey, N. contributing the most articles, 88(15.49%) research publications in India, followed by Eguchi, K. 60(10.56%) research publications in the United States, and Tangsrirat, W. 56(9.86%) research publications in China. The lowest author in Srivastava, M. 51(8.98%) research papers in the UK.The maximum of citations is 952 (19.27%) in research publications, the h-index is 19, the citations per paper is 18.31, and the related citations Index is 2.10

Spice the Country-wise Research

Table 3 Spice the Country-wise Research

Sl. No	Country	No of Publications	%	No of Citations	%	H-Index	CPP	RCI
1	India	3877	25.88	32031	17.42	69	8.26	0.67
2	United States	3046	20.33	53939	29.33	90	17.71	1.44
3	China	2529	16.88	25879	14.07	68	10.23	0.83
4	Iran	1016	6.78	14255	7.75	51	14.03	1.14
5	Japan	861	5.75	7053	3.84	39	8.19	0.67
6	Italy	850	5.67	15558	8.46	57	18.30	1.49
7	Germany	824	5.50	10505	5.71	46	12.75	1.04
8	Turkey	688	4.59	7906	4.30	40	11.49	0.94
9	South Korea	657	4.39	7335	3.99	36	11.16	0.91
10	United Kingdom	634	4.23	9414	5.12	46	14.85	1.21
	Total	14982	100.00	183875	100.00			

Table 3 depicts the global distribution of publications; India contributed the most, accounting for more than 3877 (25.88%) of the total publication, followed by the United States (2046 (20.33%) and China 2529 (16.88%); all three of those nations contributed more than 63.09% of the global papers in the field of spices. Furthermore, Iran 1016(6.78%), Japan 861(5.75%), Italy 850(5.67%), Germany 824(5.50%), Turkey 688(4.59%), South Korea 657(4.39%), and the United Kingdom 634(4.23%) are all represented.

Spice of the authorship pattern

Table 4 Spice of the authorship pattern

Authorship Pattern							
Year	1	2	3	4	5	>5	Total
2013	175	332	356	294	224	300	1681
2014	200	384	379	307	211	335	1816
2015	200	412	369	327	206	344	1858
2016	219	396	422	337	267	385	2026
2017	186	399	420	382	264	404	2055
2018	166	426	448	386	247	452	2125
2019	155	371	471	412	261	553	2223
2020	168	362	452	385	277	617	2261
2021	169	402	460	394	329	703	2457
2022	135	310	385	349	284	699	2162
total	1773	3794	4162	3573	2570	4792	20664

Table 4 depicts the year-by-year authorship trend in the spice research across the 10-year study period. According to the study, 1773 research papers are contributed by single authors, the remaining 18891 scientific papers have multiple authors. The total number of 3794 study papers had two authors, followed by 4162 publications with three authors. 3573 publications with four authors, and 2570 publications with five authors. During the ten-year study period, more than five writers submitted 4792 pieces.

CC, CI, MCC in Spice

Table-5 CC, CI, MCC in Spice

Authorship Pattern										
Years	1	2	3	4	5	5<	CC	CI	MCC	Total
2013	175	332	356	294	224	300	0.63	3.57	3.57	1681
2014	200	384	379	307	211	335	0.62	3.52	3.53	1816
2015	200	412	369	327	206	344	0.62	3.52	3.52	1858
2016	219	396	422	337	267	385	0.63	3.59	3.59	2026
2017	186	399	420	382	264	404	0.64	3.66	3.66	2055
2018	166	426	448	386	247	452	0.65	3.70	3.70	2125
2019	155	371	471	412	261	553	0.66	3.86	3.86	2223
2020	168	362	452	385	277	617	0.67	3.93	3.93	2261
2021	169	402	460	394	329	703	0.67	3.99	3.99	2457
2022	135	310	385	349	284	699	0.69	4.13	4.13	2162
total	1773	3794	4162	3573	2570	4792				20664

Table 5 shows how the collaboration coefficient was calculated and presented for spice research papers during a ten-year period. According to the table, the maximum CC is 0.69 in 2022, the fewest CC is 0.62 in 2014, and in 2015, the median CC is 0.65.

Table 7 shows that the largest CI is 4.13 in 2022, the fewest is 3.52 in 2014 and 2015, and the median CI is 3.74. The Modified Collaboration coefficient recorded in Table 7 has a maximum of 4.13 in 2022, a minimum of 3.52 in 2015, and a median MCC of 3.74.

Institutions in the Spice

Table 6 Institutions in the Spice

Sl. No	Institutions	Publi cations	%	Cita tions	%	H-Index	CPP	RCI
1	Chinese Academy of Sciences	206	14.43	2067	14.18	22.00	10.03	0.98
2	King Mongkut's Institute of Technology Ladkrabang	196	13.73	1121	7.69	16	5.72	0.56
3	CNRS Centre National de la Recherche Scientifique	152	10.64	1346	9.23	19	8.86	0.87
4	Ministry of Education China	148	10.36	1991	13.66	23	13.45	1.32
5	Brno University of Technology	144	10.08	1790	12.28	24	12.43	1.22
6	Delhi Technological University	141	9.87	794	5.45	15	5.63	0.55
7	University of Dschang	120	8.40	2076	14.24	27	17.30	1.69
8	Cairo University	117	8.19	1738	11.92	23	14.85	1.46
9	Islamic Azad University	105	7.35	1098	7.53	19	10.46	1.02
10	University of Chinese Academy of Sciences	99	6.93	557	3.82	13	5.63	0.55
	Total	1428	100.00	14578	100.00			

Table -6 presents the scientific publications of the top ten global research organizations on spices. In total, they published 1428 articles, which is approximately double global papers during the study period. The Chinese Academy of Sciences research institute alone published 206(14.43%) articles, followed by King Mongkut's Institute of Technology Ladkrabang contributing nearly 196(13.73%) articles, CNRS Centre National de la Recherche Scientifique 152(10.64%), Ministry of Education China 148(10.36%), Brno University of Technology 144(10.08%), and Delhi Technological University 141(9.87%).

Time Series Analysis

TSA provides estimated growth values based on previous data. Based on existing data, an exponential equation is adjusted to forecast future values. Jeyshankar and Ramesh Babu (2013) used TSA Ravichandran.S, Vivekanandhan.S, & G.Vinita Angeline (2022)

Spice of the Time Series Analysis Spice

Table 7 Spice of the Time Series Analysis

Sl. No	Year	Publications Y	X	X^2	XY
1	2013	1681	-5	25	-8405
2	2014	1816	-4	16	-7264
3	2015	1858	-3	9	-5574
4	2016	2026	-2	4	-4052
5	2017	2055	-1	1	-2055
6	2018	2125	1	1	2125
7	2019	2223	2	4	4446
8	2020	2261	3	9	6783
9	2021	2457	4	16	9828
10	2022	2162	5	25	10810
	Total	20664		110	6642

Table 7 shows that the time series analysis formula has been predicted for the spice research publications for the years 2025 and 2030

The straight Line Equation is

$Y = a + bx$

Here,

$\sum Y = 20664,\ \sum X^2 = 110,\ \sum XY = 6642$

$a = \sum Y/N = 20664/10 = 2066.4 = 2066$

$b = \sum XY/\ \sum X^2 = 6642/110 = 60.38 = 60$

Estimated publications in the year 2025 are when X=2025-2015=10

$Y = a + bx$

$= 2066 + (60*10) = 2066+600 = 2666$

Projected research in 2030 is when X=2030-2015=15

$Y = a + bx$

$= 2066 + (60*15) = 2066 + 900 = 2966$

According to a TSA statistical tool, the expected increase in spice papers in 2025 is about equivalent to 2666, and in 2030 is approximately equal to 2966. As a result, a comprehensive investigation at the time confirmed that the number of papers on spice research is increasing.

Major Findings of the Study

The current analysis used a sample of 20664 papers written on the subject of Spice to assess the growth of research publications issued between 2013 and 2022. The year 2021 saw the most papers released, with 2457 (11.89%).

Among the majority of active authors in the discipline of spice, it is found that Pandey, N. has written the largest amount of 88(15.49%) research publications in India. Authorship pattern is 1773 research papers provided by single authors, with the DC ranging between 0.90 in 2013 and 0.94 in 2022. The average degree of collaboration is 0.91.

During the collaborative measure, the largest CC is 0.69 in 2022, the lowest CC is 0.62 in 2014, 2015, and the median CC is 0.65. The greatest CI is 4.13 in 2022, the minimum is 3.52 in 2014 and 2015, and the median CI is 3.74. The largest Modified Collaboration coefficient is 4.13 in 2022, the minimum is 3.52 in 2015, and the median MCC is 3.74. The Institutions of the Chinese Academy of Sciences research institute alone published 206(14.43%) articles, while the periodicals discovered that IEEE Transactions on Electron Devices is on top of the list with the publication of 197(14.40%) publications achieving first spot.

The TSA quantitative applicability is projected in spice studies in the year 2025 to be about 2666, and in the year 2030 to be around 2966. As a result, comprehensive investigation at the time verified that the number of papers on spice research is increasing.

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ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DEEP LEARNING RESEARCH DURING THE LAST TEN YEARS (2014-23): A BIBLIOMETRIC STUDY

C. Socrates[1], O. Sugunaraj[2] & M. Prabhakaran[3]

Introduction

People generally understood that machines created by humans execute artificial intelligence. An approach to artificial intelligence called machine learning describes computer systems that can learn from experiences or examples without explicit programming. In the context of automatic feature discovery through representation learning, deep learning has also become a key methodology for applying machine learning as an artificial neural network-based method. Artificial intelligence is one of the most innovative scientific fields nowadays, having gained significant attention and inspiring many interdisciplinary studies [1].

AI is now widely used and indispensable in every field, including technology, business, industry, medicine, and education. It has shown itself in numerous real-world applications, including facial recognition [2], speech recognition [3], object recognition [4], malware detection [5], and spam filtering [6]. In particular, over the past two decades, the increasing trend of big data and machine learning has significantly contributed to the educational development of artificial intelligence (Song & Wang, 2020 WoS). More precisely, the use of AI in education can facilitate learning activities across a wide range of disciplines for both teachers and students, which significantly contributes to the improvement of the quality of the education system. Artificial intelligence applications include various tools and applications such as smart lesson systems, teaching robots and adaptive learning systems [7,8]. It is noteworthy that the number of studies on the application of AI in education has increased. Nevertheless, further study is required to guarantee the successful implementation of AI applications in the sector of education.

Literature Review

Research publications on artificial intelligence in education are increasing every year. In 2017, the total publication was 14, but in 2021, the total publication was 257 [9].

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Additionally, this study can use a statistical approach to evaluate the value of research to knowledge development, specifically for Artificial Intelligence (AI) in education, and offer a more comprehensive understanding of the field at a comparatively low cost [10]. AI in education may make it easier for teachers and students to complete learning tasks in a variety of disciplines; it plays a significant role in raising the standard of education [11, 12].

Furthermore, current research on artificial intelligence in education [13] has eloquently defined the primary issue with the learning process, where AI can play a more significant role. The AI Index Report 2021 [14] further corroborates this, revealing a 102.9% increase in undergraduate and graduate courses over the previous four academic years, equipping students with the necessary skills to develop or implement a functional AI model by 2020. The amount of material gathered is still insufficient, despite bibliometric analysis and systematic reviews of AI trends in mathematics education that have been done in the past [25].

Researchers have conducted bibliometric analysis on AIED [16, 17, 18]. In this study, we employ the Web of Science database for data mining and the Science Mapping Analysis Tool program for mapping. Consequently, this research will use metadata from the Scopus database and the VOSviewer mapping program to perform a bibliometric analysis of AIED throughout the last ten years (2014–2023).

Methodology

Artificial intelligence has recently become increasingly important and inspired many interdisciplinary studies, and it is one of the most up-to-date study fields of today (Russel & Norvig, 2016; Yabanova, 2016). As such, this study will conduct a bibliometric analysis of artificial intelligence, machine learning, and deep learning in the field of education over the last ten years (2014–2023) using metadata from the Scopus database. Specifically, in terms of the desired study goal, Scopus has wider journal coverage when compared to Web of Science, particularly in the social sciences, arts, and humanities [19].

To map the most prominent subcategories of artificial intelligence, the terms “machine learning” and “deep learning” were included in the search, and “artificial intelligence” was the general term [20]. The authors adopted on advanced search with the word in the article title “Artificial Intelligence” OR “Machine Learning” OR “Deep Learning” and article title “Education” OR “Educational”. We specifically filter the findings for documents in journals and conference proceedings, as they contain primary research results that are more credible and up-to-date than books, book chapters, and editorials. These documents undergo a peer-reviewing process by experts [21], and this study exclusively utilizes English. We identified a total of 1952 papers for analysis during the study period of 2014–2023. R-Studio (biblioshiny) was used to find the main information about the data, like author’s collaboration, document type and year-wise distribution, citations which were calculated using Microsoft Excel. In addition,

the VOSviewer mapping and visualization application is used to analyse the size and strength of the link between nodes, author keywords, and most productive countries.

Results and Discussion

Table 1 – Main Information about data

Description	Results
Timespan	2014:2023
Documents	1952
Annual Growth Rate %	72.66
Average citations per doc	10.85
AUTHORS	
Authors	5072
Authors of single-authored docs	392
AUTHORS COLLABORATION	
Single-authored docs	456
Co-Authors per Doc	3.16
International co-authorships %	17.01
DOCUMENT TYPES	
Article	1061
Conference Paper	891

Table 1 represents the main information about the data extracted from the SCOPUS database, It shows that the annual growth rate of artificial intelligence, machine learning, and deep learning with education-related research publications is more than 72%, the average citation per document is 10.85, and it also shows that the authorship of single-authored documents is 392 (20%) and the overall authorship is 5072, While considering author collaboration, single-authored documents are 456 and co-authored per document is 3.16, and the international co-authorship is 17.01%. Articles accounted for 1061 (54.35%) of the documents, while conference papers account for 891 (45.65%).

Table 2 shows the year wise growth of research publications in artificial intelligence, machine learning, and deep learning with education related research publications for the selected 10-year study period from 2014 to 2023, with a total of 1952 publications. A maximum of 682 (34.94%) publications were published in 2023, while 527 (27%) publications were published in 2022. Out of 1952 publications, in the in the first 5 year study period, only 99 (5.07%) publications were published, and remaining 94.93% of publications were published in the last five years.

Table 2 - Year-Wise Publication

Year	Publications	%	Cum.	%	Cita-tions	%
2014	5	0.26	5	0.26	44	0.21
2015	13	0.67	18	0.92	267	1.26
2016	15	0.77	33	1.69	770	3.63
2017	18	0.92	51	2.61	942	4.45
2018	48	2.46	99	5.07	1338	6.32
2019	111	5.69	210	10.76	2005	9.46
2020	205	10.50	415	21.26	3470	16.38
2021	328	16.80	743	38.06	4206	19.85
2022	527	27.00	1270	65.06	4389	20.72
2023	682	34.94	1952	100.00	3754	17.72
Total	1952	100.00			21185	100.00

Table 3 - RGR & Doubling time in the field of Education

Year	Publica-tions	%	Cum.	%	W_1	W_2	RGR	DT
2014	5	0.26	5	0.26		1.61		
2015	13	0.67	18	0.92	1.61	2.89	1.3	1.8
2016	15	0.77	33	1.69	2.89	3.50	0.6	0.9
2017	18	0.92	51	2.61	3.50	3.93	0.4	0.6
2018	48	2.46	99	5.07	3.93	4.60	0.7	1
2019	111	5.69	210	10.76	4.60	5.35	0.8	1.1
2020	205	10.50	415	21.26	5.35	6.03	0.7	1
2021	328	16.80	743	38.06	6.03	6.61	0.6	0.8
2022	527	27.00	1270	65.06	6.61	7.15	0.5	0.8
2023	682	34.94	1952	100.00	7.15	7.58	0.4	0.6
Total	1952	100.00						

Relative growth rate and doubling time

Relative Growth Rate: The growth of publications was analysed by using two parameters namely Relative Growth Rate and Doubling time using the Mahapatra [22] formula. RGR is measure the increases in number of articles in a particular period of time.

$$\text{It is calculated as } R(a) = (W_2 - W_1) / (T_2 - T_1)$$

Whereas Explain W_1, W_2, T_1 and T_2 R (a) = RGR = the mean relative growth rate over the specific period of interval W_1 = the logarithm of beginning number of publications/ pages W_2= the logarithm of ending number of publications/pages after a specific period of interval $T_2 - T_1$ = the unit difference between the beginning time and the ending time.

Doubling time is the time taken for the doubling of the number of records actually published within a stipulated period. Doubling time is calculated from the relative growth rate and the natural logarithm number is used, the difference has a value of 0.693. Thus, the corresponding doubling time can be calculated by the following formula, Dt = 0.693/ R(a).

Table 3 shows that, relative rate and doubling time in the field of artificial intelligence, machine learning and deep learning with education related research publication for the selected 10-year study period. It is identified from the study, relative growth rate is 1.3 in the year 2015 and 0.4 in the year 2023. At the same time doubling time is 1.8 in the year 2015 and 0.6 in the year 2023. It is conformed from this study, the relative growth rate and doubling time are fluctuated trend.

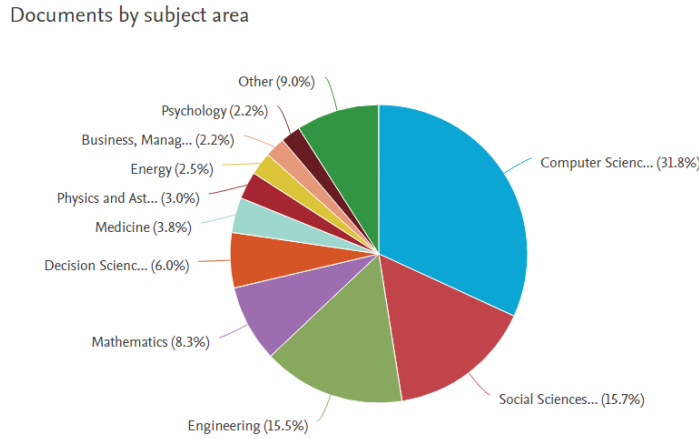


Figure 1- Subject wise publications

Figure 1 shows the subject wise growth of publications in artificial intelligence, machine learning, and deep learning with education-related research publications for the selected 10-year study period. A maximum of 31.8% of publications are in computer science, followed by

15.7% in social science and 15.5% in the engineering fieldThe study reveals that the top three subject areas account for a maximum of 63% of all publications.

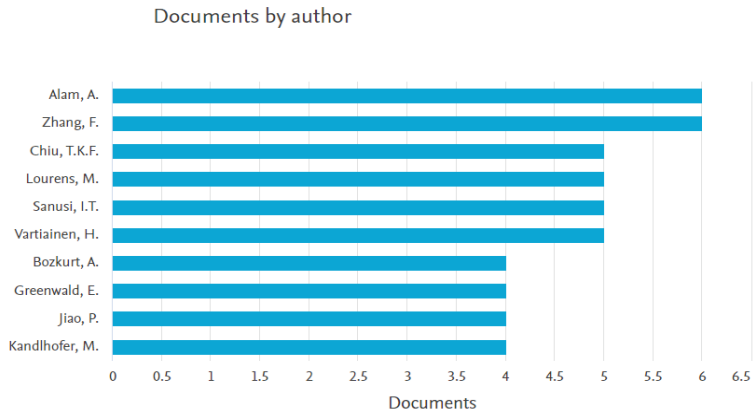


Figure 2- Top 10 Authors

Figure 2 shows that the top 10 authors contributed to the field of artificial intelligence, machine learning, and deep learning with education-related research publications for the selected 10-year study period. Alam A and Zhang F have published a maximum of six publications, while four other authors have published five publications each. Figure 3 illustrates the authors' collaboration network within the study field. Wang Y. and Wang J. collaborated on more publications.

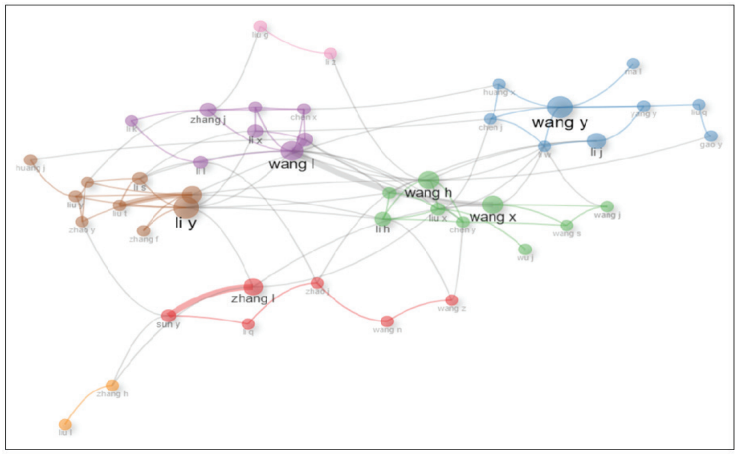


Figure 3 - Author Collaboration Network Map

Figure 4 shows the usage of author keywords for artificial intelligence, machine learning, and deep learning in education-related research publications for the selected 10-year study period. The study reveals that artificial intelligence uses a maximum of 1025 keywords, while students use 559, machine learning uses 429, and deep learning uses 321.

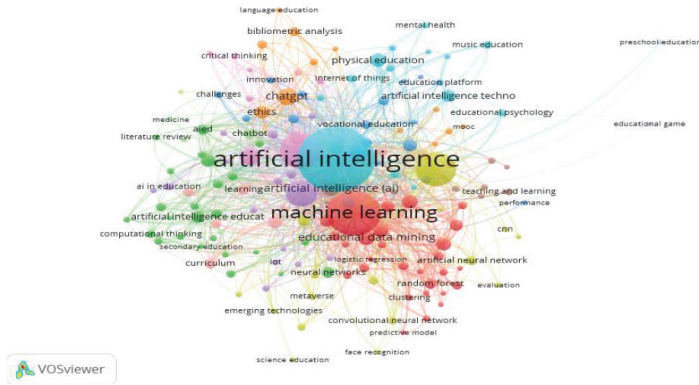


Figure 4 – Author Keywords

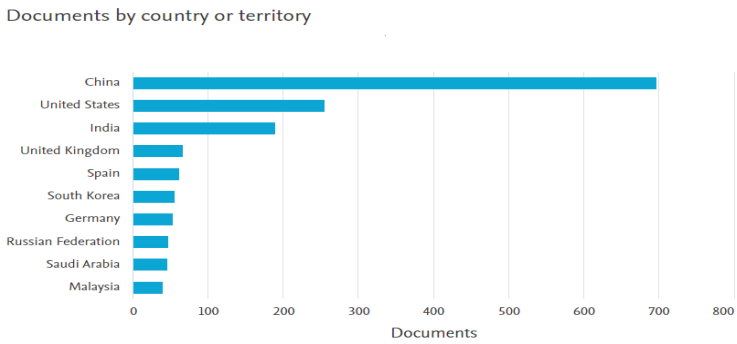


Figure 5- Top 10 Countries

Figure 5 shows country-wise research publications in the fields of artificial intelligence, machine learning, and deep learning, along with education related research publications for the selected 10-year study period. China publishes a maximum of 697 research publications, while the United States follows with 254 publications. With 189 publications, India is in third place. Figure 6 shows the collaboration between the countries in the field of research.

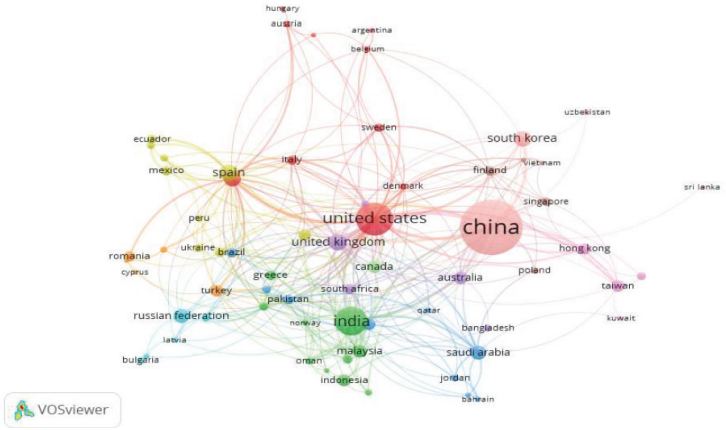


Figure 6 – Country Collaboration

Conclusion

The study concludes that the annual growth rate of artificial intelligence, machine learning, and deep learning with education-related research publications is more than 72%, with an average citation per document of 10.85. The year 2023 will see a maximum of 682 (34.94%) publications, compared to 94.93% in the last five years. The relative growth rate and doubling time are erratic trends. In the subject area, a maximum of 31.8% of publications are in computer science, followed by 15.7% in social science and 15.5% in the engineering field. Alam A. and Zhang F. accounted for a maximum of six publications among the top 10 authors. Artificial intelligence confirms the use of up to 1025 keywords by the authors. In the top 10 countries, a maximum of 697 research publications are published in China, followed by 254 publications in the United States.

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SECTION VIII

LIS EDUCATION

LIS EDUCATION FOR THE NEXT GENERATION IN INDIA: SOME RANDOM THOUGHTS

Prof. B. Ramesh Babu[1]

Introduction

A cornerstone of the contemporary information and knowledge society has always been library and information science (LIS) education and research. For the next generation of information professionals and researchers, proper LIS education and training is more crucial than ever due to the challenges posed by the swift advancements in technology, society, and the global arena. The library and information science (LIS) education in India dates back to the 20th century. With more than a century of history under its belt, it has evolved into a unique field to address the expanding scope of library services brought about by shifting societal demands. Although LIS education has grown astronomically, it is regrettable that this growth has not been balanced. Every discipline, including library and information science (LIS), is undergoing a revolutionary shift in its educational approach. The 21st century has seen a paradigm shift in LIS education, training, and research rather than merely a slow and steady advancement in theory and practice, which has led to many uncomfortable conflicts. The advent of technology and its application to library development and services has caused a paradigm shift that has an impact on LIS education, training, and research, either directly or indirectly. The librarianship profession is in a crisis at the start of the twenty-first century. Globalization, privatization, the information revolution, and the ICT revolution are just a few of the groundbreaking and revolutionary developments that have defined this century. The current state of most LIS schools has been harshly criticized in discussions about education for library professionals.

LIS Education in India: An Overview

India has been providing training and education in Library and Information Science (LIS) since 1911, keeping pace with other developed nations. Since then, it has been progressively growing and spreading across the nation. Although LIS education has grown astronomically, it is regrettable that this growth has not been balanced. Currently, LIS education is offered by numerous establishments, including affiliated colleges, polytechnics, open universities, deemed universities, traditional universities, professional

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associations, documentation centers, etc. At the moment, over 150 universities offer undergraduate and graduate-level courses, and many more offer M.Phil. and PhD programs in library and information science. Additionally, 40–45 institutions, including government polytechnics and library associations, offer LIS education at the certificate and diploma levels. In addition to these, associateship training in LIS is provided by the Documentation Research and Training Centre (DRTC) and the National Institute of Science Information and Information Resources (NISCAIR), both in New Delhi, with a stronger focus on IT application.

Current Scenario of LIS Education in India

- The growth of LIS institutions offering training programs at different levels (Diploma, Bachelor, Master, M.Phil, and Doctorate). As can be observed, the unintended quantitative growth in professional education has deeply ingrained itself into the standard of instruction (Khan, 1998).
- The focus is on offering courses in regional languages, such as Tamil, Marathi, Telugu, etc. Part-time faculty, contract lecturers, or contributory lecturers are responsible for running the classes.
- The LIS schools' inadequate infrastructure and facilities.
- The creation and rapid expansion of DE programs in LIS at the certificate, bachelor's, master's, M.Phil, PGDLAN, and research levels (e.g., IGNOU, Annamalai, Madras, Bharthiyar, and Alagappa Universities) (Ramesh Babu, 1999).
- A mismatch between the development of manpower and the evolving needs of information management.
- Some private universities are offering self-financed courses, which completely commercializes professional education.
- Some universities offer one-year bachelor's and one-year master's courses; others offer two-year integrated master's courses; still others are starting to offer five-year integrated courses. • Private management institutions and deemed universities also offer courses at the bachelor's, master's, MPhil, and Ph.D. levels. (Annamali University, for instance).
- Some educational institutions, like the University of Madras and Kuvempu University, provide programs in the Choice Based Credit System (CBCS) and the Credit Based System (CBS).
- Organizing short-term courses and workshops for advanced training programs .
- There are two categories of refresher courses under which continuing education programs are provided: To meet the UGC requirement for awarding Career Advancement for academic professionals, Academic Staff Colleges of Universities will provide (i) need-based refresher courses and (ii) specific subject-oriented refresher courses.

The following are the trends in LIS education in India:

- Developments in information technology and services have a major impact on curriculum design, and it is common for a curriculum to change with the time and technology.

- It becomes harder to determine the core while electives tend to be the mainstream in course selections.
- There appears to be an increasing emphasis on theory and research in course content.
- Lifelong learning becomes the focal point in curriculum development.

Status of LIS curriculum in India

The majority of the curriculum used in Indian LIS programs is antiquated, and it pays little or no attention to what libraries and IT organizations need. Although programs may include traditional courses like bibliographic searching, reference, classification and cataloguing, and professional values, the curriculum does not reflect the demands of the LIS field today. Every Indian university typically modifies its LIS curriculum once every few years to incorporate fresh perspectives from the industry. This aids in assimilating new ideals and getting rid of outdated ones.

The following are the factors that characterize the present LIS curriculum in India

- No harmonization of curriculum among LIS schools
- No periodic revision of curriculum
- Lack of Innovation in curriculum
- Curriculum fails to address adequately the education of librarians (Ramesh Babu and Butdisuwan, 2013).
- Observations on the LIS Curriculum in India
- Different universities have different names for their LIS degrees. There are 14 different categories of nomenclature that have been identified, including library and information science, library science, and information science and information studies (UGC, CDC 2001).
- In Indian universities, degree titles like BLIS/BLISc or MLIS/MLISc /M.Sc. are noticeable.
- The majority of universities have implemented either a Choice Based Credit System or a Credit Based System.
- There is variance in the overall quantity of credits between universities. The majority of master's degree core courses have three or four credits, and the electives typically have two or three credits.
- There is also variation in the course titles. Most of the courses have different names at each university than at the others. However, it's been noted that core titles and subjects are more closely adhered to.
- Some LIS schools offer courses for "Independent Study," which is a special kind of credit system.
- Project reports and dissertations are not required to be submitted to any university.
- Other from traditional LIS subjects, a lot of emphasis is placed on ICT components. The way that traditional and modern subjects are taught is flawless, though some universities do teach their courses in regional languages.

- The MLISc and BLISc curricula in library and information science programs vary, and there is insufficient focus on the skills that LIS professionals will need to perform in the library once they start working there.
- The length of each level's course varies within LIS schools as well. The majority of LIS programs are two years long, consisting of four semesters at the Master's level.
- Correspondence courses have their own unique curriculum, duration, and nomenclature.
- Course length, number and titles of papers, contents, number of lectures and practical periods, teaching and assessment strategies, and grading scheme vary greatly nowadays.
- The LIS curricula in many universities are quite outdated, and in order to meet changing user expectations and library changes, they should be reorganized with updated objectives.
- At the moment, the majority of Indian university departments use standard curricula to teach LIS courses. Nonetheless, there are certain gaps that need to be filled in order for Indian LIS professionals to be completely satisfied with the current curriculum and instruction.
- Despite the fact that the CDC had an influence on curriculum design, it is noted that each university has created its own curriculum framework. Here, every university is independent.

Next Generation LIS Education: Certain Strategies

The foundation of knowledge societies is LIS education and the profession, which offers people and communities vital resources and specialized knowledge. This field fosters critical thinking and provides education and professional development to enable people to find, assess, and use information efficiently. Additionally, it is essential for maintaining cultural heritage, advancing intellectual freedom, and fighting for universal access to information. Professionals in information and libraries have always been essential in helping people acquire knowledge and allowing information to flow freely. But because of the deluge of information unleashed by the digital revolution, information and library professionals must adapt and arm themselves with the know-how and resources needed to successfully traverse this intricate terrain.

The next generation of LIS students must be prepared to meet the information needs of users living in a media- and technology-driven world where an abundance of information predominates. Users of today interact with technology in an environment that is characterized by rapid advancement, strong teamwork, and unprecedented individual contribution via digital media such as social media and e-publishing. By helping students acquire the necessary life and career skills, LIS educators can better equip them to navigate the complex life and work environments of the globally competitive knowledge era.

The educational system of today requires LIS educators to be more adaptable and closely collaborates with other LIS professionals to determine the competencies needed

to manage contemporary information management practices. It is acknowledged that LIS educators will never be able to close all skill gaps. However, it undoubtedly necessitates more collaboration between library professionals and educators in order to collaborate, continuously update curricula to meet market demands, and close the knowledge gap between theory and practice. Together, they can help young professionals be ready to take advantage of exciting and demanding career opportunities.

The following strategies may be considered for the next generation LIS education in India

Networking of Schools of Library and Information Science

A vast array of options for sharing, exchanging through interlinking, and gaining intra- and inter-organizational access to resources, services, and facilities have been made possible by the web, or Internet. In this sense, Indian library schools would create a network system. All that is required is the hosting of a home page featuring a few webpages from the Departments or Schools of Library and Information Science, indicating which resources (like DRTC, Bangalore) are available for sharing. All departments will find this very helpful in coordinating and monitoring the activities. Staff resources and departmental libraries can be shared during this process. In this setting, joint authorship can produce papers and books, accelerating collaborative activities. This is made possible by the availability of Web-publishing facilities.

Harmonization of LIS Education

There are slight variations in the course contents, paper count, and duration between universities as well as between states. IFLA has called for the harmonization of LIS education and training programs since 1987. A cursory look at the LIS curricula offered by different library schools at different levels suggests that, from a broad standpoint, harmonizing the programs for library and information science education and training is both feasible and possible. Through its CDC Reports, the UGC in India has made recommendations in this regard. The universities and other institutions will work together to develop curricula, which will harmonize the teaching of LIS. The promotion of quality in LIS education and training would be the outcome of such an endeavor. The result of developing the LIS curricula will be in line with other developing nations and will highlight the motto, "TEACH and LEARN BEYOND THE NATION" (Choon and Ramesh Babu 2013).

Revision and improvement of the curriculum is the most important step toward achieving internationalism in LIS education, as it impacts all students regardless of their ability to participate in exchange programs. One of the most creative courses offered by colleges and universities is probably the one where students from all backgrounds come together to discuss suggested subjects, events, or areas of life and exchange ideas, expertise, and firsthand experiences. One of the overarching ideas that needs to be addressed in these types of learning exploratory contexts is global or world librarianship. International curriculums should be designed to prepare graduates for clearly defined

international professions; they should also be interdisciplinary programs leading to internationally recognized professional qualifications, such as regional and area studies spanning multiple countries; and they should broaden traditional/regional course areas through the application of international and cross-cultural/intercultural approaches.

Suggestions for Improving Standards and Quality and Maintaining LIS Education Performance

The current buzzword in the LIS field is "quality," which may be a sign of the declining caliber of LIS education. It is recommended that LIS schools implement measures to promote quality assurance, control, and improvement. Some specific actions, as listed below, will be taken to enhance and uphold the caliber and standard of library and information science education in India. These actions should be included in the program with a deadline.

- Teachers' and students' skill development ought to be comparable to that of their international counterparts. Innovative, imaginative, and enterprising approaches to student skill development should characterize LIS teacher education.
- It is recommended that LIS educational institutions experiment with alternative models of teacher education programs.
- Teachers of library and information science ought to be involved in creating print and digital teaching and learning resources.
- The minimal infrastructure needed by every library school should be in place;
- • The methods and approaches used to evaluate LIS education institutions should be flexible. in order for the quality assessment to be utilized in a range of scenarios while taking into account the unique requirements and purposes of LIS education.
- Minimum standards and parity should be established for course length, curricula, examination procedures, physical facilities, teacher-to-student ratios, etc.
- Admission to library schools ought to be determined not only by academic background but also by aptitude for working in libraries and information;
- Each library school ought to uphold a minimum standard;
- An accrediting body following the Indian Medical Council's model ought to be established;
- Training ought to be focused on the precise requirements found in Indian libraries.
- Before receiving a certificate of degree completion, students must complete a minimum amount of practical training as an intern or apprentice in any recognized institution; and
- Special courses may be introduced to train personnel required in various types of libraries and information centers.

Task Ahead

The field of library and information science is incredibly dynamic, and as technology advances, so do its requirements. It is imperative that LIS departments adopt a forward-thinking strategy and update their syllabus frequently to include

relevant technology topics in their courses. LIS schools should make extensive use of technology in their instruction, as well as active learning approaches that let students work independently or in groups to further their education while receiving guidance from teachers. Undoubtedly, technology will make it possible for students to participate more actively in their education. The inclusion of multicultural classrooms in LIS departments will give students even more chances to acquire technological applications and develop soft skills.

Eliminating the shadow gap between push and pull technology and between theory and practice is the largest challenge facing Indian providers of LIS education. The real-world information needs and problems should be taken into consideration when developing LIS curricula and training programs at Indian LIS schools. Some of the persistent problems that LIS schools face on a daily basis are a lack of funding, faculty, exceptional students, infrastructure, learning resources, courses that are relevant to the job market, and the disconnect between theory and practice (Ramesh Babu, 2014).

It is imperative that LIS departments work in conjunction with non-LIS departments, such as those in philosophy, psychology, computers, management, etc., to provide students with the chance to attend lectures in other fields and gain an understanding of their presumptions and methodologies. Additionally, this will support students as they comprehend and collaborate on interdisciplinary projects in groups or alone. To provide students with greater exposure, LIS departments should work even more in conjunction with LIS software developers, database publishers, information service providers, and management consultants. To begin the modernization of LIS education in the country, opportunities for collaboration with other stakeholders such as editors, media professionals, corporate entities, and active library users should be investigated. Working together with different stakeholders within open innovation ecosystems is likely the best approach to ensure that everyone stays relevant for everyone else in the current highly dynamic, ever-evolving environment. The multifaceted skills that LIS students need to thrive in this fiercely competitive labor market must be developed. These days, teaching pupils specific skills is not enough to support their learning.

The revised syllabuses of library Science schools, in addition to the traditional subjects, shall try to include the following topics

- Create, communicate and share information using ICT tools
- Management and analysis of Research data including big data
- Management of scholarly output of the organization
- Use of ICT to research, resolve problems and design responsive services.
- Acquisition, organizing, retrieving, preservation and conservation of digital information
- Searching and evaluating electronic information
- Use of social media for information handling and to connect with users
- Library Management including communication, drafting, interpersonal skills
- Evaluation and Feedback of information services

Suggested courses for the Next Generation LIS education in India

Education for LIS is no longer only technical, but must include consideration of new cognitive, social and situational processes. The education in library and information science is no longer limited to library managers. However, it now serves as instruction for those who use libraries to obtain knowledge. It is a fundamental component of general education and represents a shift from managing libraries by librarians to managing the flow of information by everyone. In the past, it was common for people to acquire this education and go on to become librarians. The current trend in science education is for professionals to teach it, and students from various backgrounds use what they've learned to manage information in their careers (Gangadhara Rao and Ramesh Babu, 1988). It needs to redesign the course contents and add a new course to the existing course. The very basis of the course contents should be the various aspects of the developing / emerging subject which has some kind of relationship with the LIS. As such the course contents should be formulated in such a manner that it precedes from general aspects to developmental perspectives to structural studies. Growth and terminology of the subject should also be discussed.

In this context, the following factors are to be taken into consideration in designing the curriculum of the course:

The objectives of the LIS education

- The roles and functions of Information personnel in the context of the information environment and the changing image of a library; and
- The leadership role of Library and Information Science schools especially in developing countries.
- The following courses may be considered as special courses for the Next generation LIS education in India.

Course Contents of *"Data Science for Librarians"*

As far as Indian LIS schools are concerned, data science has not yet been offered as a stand-alone course, either as a Core or an Elective. Nonetheless, some universities have a unit on this in the ICT paper. The author stresses the need for creating new curricula that will better prepare LIS students to work in libraries in the twenty-first century as data librarians. It is highly recommended that a separate course on data science be made available. The draft model course contents of '*Data Science for Librarians'* is as follows:

Model Course Contents on "DATA SCIENCE FOR LIBRARIANS"

UNIT I: Introduction to Data Science -Data - Quantitative vs. Qualitative; Digital vs. Non-digital; Big Data; Data Saturation; Big Data, and the Data Deluge; Open Data; Data Life Cycle; Machine Learning for Data Science; Library, Information, and Data Science.

UNIT II: Data for various types of libraries -Data for Academic, Public and Special Libraries; E-Science; E-Research; Data Reference Interviews; Data Storage and

Archiving; Data Repositories; Open Government Initiatives; Internet of Things; Census Data; Role of Academic, Special and the Public Library Systems in the Big Data Era

Unit III: Data Creation, Collection and Curation -Data generation and gathering; surveys and online tools; data repositories; metadata; data citation, extraction, transformation and loading; data mining and visualization; data analytics; data curation (archiving/ preservation).

Unit IV: Data Retrieval, Management, and Storage -Solutions for Big Data Storage; Social Networking; Big Data Management; Cloud Computing; Data Cleaning; Big Data Security and Policies; Artificial Intelligence.

Unit V: Data Ethics and Librarians' Role- Data Policies and Ethics; Data Security and Privacy; User Privacy; Data Retention; Copyright and Ownership; Data Analysis Skill Sets for Librarians; Data scientist roles and responsibilities.

Model Course Contents on "Knowledge Management in Libraries"

UNIT I Knowledge Management: Concept and definitions – Need for Knowledge Management in the emerging and changing business environment – Understanding knowledge; Types of knowledge - Knowledge works -Changing role of Library and Information professionals.

UNIT II	Knowledge creation and capturing; Knowledge creation models
UNIT III	Knowledge codification and organization: Knowledge base-Knowledge mapping, decision trees, decision tables and frames etc.
UNIT IV	Knowledge transfer and sharing steps in knowledge transfer. Knowledge transfer in E – Word, Role of internet, E – Business / E- Commerce.
UNIT V	Tools for knowledge Management - Neural network Data mining – Legal and ethical issues in Knowledge Management

(C). Model Curriculum on "Multiple Intelligences and Information Skills"

Unit I:	Over View of Information Skills -Information Literacy Skills -ICT Skills-Information Search Skills – Soft Skills
Unit II :	Conceptual Framework on Multiple Intelligences -Multiple Intelligences and Library and Information Science
Unit III:	Multiple Intelligences - Verbal / Linguistic Intelligences -Musical Intelligence -Logical-Mathematical Intelligence - Visual/Spatial Intelligence -Bodily-Kin esthetic Intelligence -Intrapersonal Intelligence -Interpersonal Intelligences -Naturalist Intelligence
Unit IV:	Behavioural Attitudes -Performance Pressure -LIS Students Behaviour in Pub lic Environment

Unit V: Towards the Development of MI and ICT skills in Digital Librarianship -Characteristics and Traits for the LIS students -Attitudinal changes of LIS students - Acquisition of Teaching Skills - Role of the LIS Departments -LIS Curriculum Development -Role of LIS Students -Role of LIS Faculty - Role of Professional Organisations

Model curriculum on "Preservation and Conservation of Information Materials in the Digital Era"

UNIT I: Introduction to Preservation and Conservation and related concepts- Evolution of Information materials from clay tablets to digital forms

UNIT II: Nature and types of Information materials – Detailed study -Hazards to Information materials: Environmental; Physical and Chemical, Biological and Disasters etc.

UNIT III: Physical and Chemical methods of treatment: Fumigation, Lamination, Encapsulation, Binding and Mending, Restoration, Leaf casting etc.,- Preservation and Conservation of Print, Digital and Non-Book Materials and Building and Equipment.

UNIT IV: Role of Micrography and Reprography in Preservation - Digitisation: means and methods; Practical and strategic issues in the digitization of information materials; Overview of major digitization projects

UNIT V: Digital Preservation: Issues, Trends, Challenges and Strategies – National and International initiatives in digital preservation.

The above courses may be offered as a Core Paper or an Elective at Master's degree level.

To prepare their students for the new fields of librarianship, LIS departments must continuously modify their curricula to include new modules and modern information handling techniques. The foundational subjects of library science education should be maintained, and on top of these should be layered a layer of specialized knowledge and abilities from contemporary information handling practices. Additionally, the social and ethical facets of the library profession ought to be highlighted. Young professionals ought to support open access, intellectual freedom, and IPR laws in addition to facilitating and disseminating knowledge. The idea that "technology will replace LIS teachers" is occasionally discussed.

Competencies and skills development

By 2030, LIS education must equip students to meet the information needs of users living in a media- and technology-driven world where an abundance of information is the norm. Users of today interact with technology in an environment that is characterized by rapid advancement, strong teamwork, and unprecedented individual contribution via digital media such as social media and e-publishing. By helping students acquire

the necessary life and career skills, LIS educators can better equip them to navigate the complex life and work environments of the globally competitive knowledge era.. Teaching students how to handle increasingly complex information services is a new duty that LIS instructors must take on. The Indian government is currently pushing MOOC use in the educational system. Academic librarians ought to assume this duty proactively and take the initiative to introduce MOOCs into their institutions.

The learning and innovative skills LIS students need to acquire include:

- Creative & innovative
- Critical thinking & problem solving
- Communication & Collaboration.
- Initiative & self-direction
- Leadership & responsibility
- Flexibility & adaptability,
- Productivity & accountability
- Social & cross-cultural skills

Conclusion

"The quality of entrants is very poor; the library profession did not attract the best talent in the country for a variety of reasons" (Ranganathan, 1969). However, nothing has changed and the situation is still the same today. Not much has changed. It can occasionally give the impression that things won't get better in the future. Nonetheless, some people choose—by accident, chance, or as a substitute course—to pursue research and study LIS education. In light of the aforementioned, it is preferable that Indian LIS schools adjust to the changing environment in order to produce goods that can handle the challenges presented by it. In the future, library schools that are unable to change with the times may find themselves obsolete and forced to close. There is a lesson in history. In the United States, library schools that did not adapt to the changing times were either shut down or combined with other information science and information studies schools (Barron, 1991).

In order to support the evolving needs of society and libraries/information centers, it can be said that the current state of LIS education in India, and distance education in particular, needs to be reorganized and restructured. It is encouraging to see that, compared to other Asian nations, library and information science education has advanced significantly in India since independence. More libraries are not necessary in today's world; instead, we need better institutions with sufficient funding, a well-stocked library, and equipment in addition to knowledgeable and experienced faculty. They ought to set the standard for excellence in education and act as leaders. These educational institutions ought to aim to create a new generation of professionals capable of using emerging information technologies, like word processors (specialized microcomputers with a single purpose) and telecommunications, to effectively carry out their roles in a rapidly evolving society. Hopefully, laying down and putting into practice will help to

generate enough labor to adequately staff the nation's libraries, documentation centers, information centers, and library schools. *"The challenge for the LIS schools is to revamp their facilities and course curricula to transform into institutions that educate and train professionals who are competent enough to create a stir in the market, a demand for their skills, societal hunt for their talents, and who can substantially contribute to management of knowledge resources, dissemination of information and create an often sought after brand name for their service and niche for themselves"* (Malhan, 2009, p.57). The library schools should assume the role of leadership and responsibility to produce competent manpower for the present as well as future needs of different kinds of information centers. To conclude in the words of Lancaster (1983), "*We must shift the focus of our professional concern away from the Library as an institution and towards the skilled professionals, who will become a professional practitioner on par with medical and legal practitioners"*

In this digital age, when the field not only makes intelligent use of technology but also changes in other dimensions as society advances, LIS education in India will advance and even thrive. A combination of knowledge, multiple skills, and multiple intelligences should be the main emphasis of LIS education (Gardner, 1983). In order to restore LIS's standing and recognition as a respectable professional course, it is necessary to ask important questions and come up with viable solutions. Practice and instruction should work together to produce better workers with useful skills. The foundation for LIS as a discipline to stand out as a strong professional course is quality in both teaching and research. In order to ensure that trained professionals have 100% employment opportunities, we must strategically design and develop the next level of LIS education, training, and research programs. Additionally, we must assist trained professionals in transforming their learning and training into good and productive earning in terms of both job satisfaction and financial satisfaction.

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PROPOSAL OF A FRAMEWORK FOR MULTI LITERACY EDUCATION IN SCHOOL LIBRARIES

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Introduction

In today's rapidly evolving world, characterized by an information overload and technological advancements, the ability to adapt to diverse information and communication methods has become paramount. Multi literacy, encompassing more than just reading and writing, entails the comprehension and interpretation of various media, including visual information, videos, and audio, as well as effective communication across these mediums. In this context, texts means information expressed by systems of verbal, visual, auditory, numeric, and kinesthetic symbols and their combination (Ylivuori et al, 2023). Multi literacies refer to the diverse ways of understanding and producing knowledge through multiple modes of communication and representation, including digital, visual, auditory, and textual forms. The concept of multi literacies also encompasses various literacies such as visual literacy, media literacy, and digital literacy, highlighting the importance of diverse ways of understanding and producing knowledge across different modes of communication (Cope & Kalantzis, 2009).

The significance and necessity of multi literacy education are widely recognized in the educational systems of countries around the world. This recognition stems from the understanding that students need to be proficient in various forms of literacy, such as digital, media, and visual literacies, to effectively navigate and succeed in the modern, interconnected world. However, there is a lack of clarity regarding which subject or teacher should be responsible for teaching multi literacies. This ambiguity presents a challenge, as it requires a collaborative approach across different disciplines and educators to ensure that students develop these essential skills. The integration of multi literacies into the curriculum necessitates careful planning and coordination to provide a comprehensive and cohesive educational experience. Additionally, there is an ongoing debate about whether various literacies should be taught independently or in an integrated manner. Traditionally, teacher librarians at school libraries have been in charge of reading education as part of literacy, and recently, they are in charge of

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information literacy education. The teacher librarians have a unique, unprecedented, and unparalleled opportunity to affirm their role in students' use of basic literacy skills – reading and writing – while highlighting their relatively new role, guiding students through the acquisition of information through multiple modes of communication with new technologies (Harper & Sarah, 2021).

Therefore, this study aims to highlight the necessity of developing multi literacy education centered school libraries, which have traditionally been responsible for reading education and information literacy. The objective is to propose a framework for information literacy education based on multi literacy.

School Library and Information Literacy Instructin

School libraries play a crucial role in the educational ecosystem by providing students with access to a wide range of resources and fostering a culture of reading and inquiry. Historically, school libraries have been instrumental in supporting reading education, helping students develop fundamental literacy skills. In addition to promoting traditional literacy, school libraries have become pivotal in teaching information literacy, which involves the ability to locate, evaluate, and use information effectively.

Knuth (1997) explains the factors influencing the development of school libraries as: (1) the evolution of, acceptance of, and consensus on a viable service-delivery model; (2) the influence exercised by professional organizations; (3) the generation of acceptable standards; (4) overt government support; and (5) acceptance of a coherent educational rationale or mission, which can influence the receptivity of individual schools and systems.

From the perspective of information literacy education, I would like to briefly discuss the acceptable standards and government support in the Korea and United States.

Standards and regulations for information literacy education in Korea

In Korea, the curriculum for information literacy education in elementary and secondary schools includes the "Library and Information Life" published by the Korean Library Association (School Library Curriculum Committee of Korean Library Association, 2007). This curriculum outlines the educational objectives and goals, educational content, and unit-specific learning objectives for information literacy education. Based on this curriculum, four textbooks were developed (for grades 1-3 in elementary school, grades 4-6 in elementary school, middle school, and high school) (Textbook Compilation Committee of Korea School Library Association, 2011). These textbooks are used in school libraries across South Korea. The main content of these textbooks focuses on enhancing the abilities to access and search for information, analyze and interpret information, and synthesize and express information.

Article 40 of the Library Law in Korea stipulates that every school shall establish a school library and conduct information literacy education through cooperation class, reading education. Furthermore, Article 12 of the School Library Promotion Act in Korea

mandates the compulsory employment of teacher librarians or library staff in school libraries. Teacher Librarian must acquire qualifications as both librarians and teachers.

Standards and regulations for information literacy education in US

In 1998, the United States emphasized information literacy Instruction and library collaboration Instruction classes in the "Information Power: Building Partnerships for Learning," school library standards. These standards presented the categories of information literacy skills as information seeking and access, information analysis and interpretation, and information synthesis and communication. The AASL Standards for the 21st-century Learner (2007) presented a framework for information literacy with four elements: function, disposition, responsibility, and self-evaluation strategy. The most recent edition of the American Association of School Librarians' (AASL) National School Library Standards for Learners, School Librarians, and School Libraries (2018) outlines a comprehensive framework for information literacy, encompassing six key areas: inquire, include, collaborate, curate, explore, and engage.

The Every Student Succeeds Act (ESSA), enacted in 2015, replaced the No Child Left Behind Act (NCLB) as the elementary federal education law in the United States. ESSA has provisions regarding support for educational services provided by school library programs. In the case of New York State, the Laws and Regulations related to school library services are as follows: (1) Commissioner's Regulations Section 91.1 - school libraries shall be established and maintained in each school, (2) Commissioner's Regulations Section 91.2 - employment of school librarians, (3) Commissioner's Regulations Section 100.4 - units of study in 7th and 8th grade, library and information skills, (4) Commissioner's Regulation Section 80-3.2 – certification requirements for school library media specialist.

As seen in the cases of Korea and the United States, educational effectiveness can be maximized if appropriate standards for information literacy education are developed and legal support is provided to implement the standards.

Comparing Various Literacies

This study aims to compare and analyze the frameworks for reading literacy, media literacy, and digital literacy from the perspective of information literacy, extract elements, and then schematize and present a framework for multi literacy education. In this study, PISA's reading literacy framework, media literacy framework of ALMA(Australian Media Literacy Alliance), and DigComp2.2's digital literacy framework, visual literacy framework of ENViL (European Network for Visual Literacy), The DALI Data Literacy Framework were compared and analyzed from the perspective of information literacy. From the perspective of information literacy, a multi literacy framework centered on school libraries was proposed after extracting elements from various literacies.

In the American school library standards (Information Power: Building Partnerships for Learning), the main areas of information literacy are presented as

follows (AASL, AECT 1998).

- **Standard 1:** The student who is information literate accesses information efficiently and effectively.
- **Standard 2:** The student who is information literate evaluates information critically and competently.
- **Standard 3:** The student who is information literate uses information accurately and creatively.

Here, Standard 1 can be summarized as information search and access, Standard 2 as information analysis and interpretation, and Standard 3 as information synthesis and expression. The core areas of information literacy are defined as information search and access, information analysis and interpretation, and information synthesis and expression. From this perspective, we aim to compare various literacies.

Reading is the major domain of assessment of the 2018 cycle of the Programme for International Student Assessment (PISA). In the PISA 2018 definition of reading literacy, Reading literacy is understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential and to participate in society. The 2018 framework replaces the phrase "cognitive aspects", used in previous versions of the framework, with the phrase "cognitive processes". Here, cognitive processes refer to the activities related to the reading process, including Locating information, Understanding, Evaluating, and Reflecting (OECD, 2019).

The ALMA (Australian Media Literacy Alliance) is an unincorporated group of organizations whose objectives in the area of media literacy are closely aligned. The Australian Library and Information Association (ALIA) participates in the AMLA and contributes to media literacy education. AMLA defines media literacy as "the ability to critically engage with media in all aspects of life." AMLA's media literacy framework consists of the elements reflects, understands, use, and achieves. Reflects: Reflects on their own media use and is curious about how media are made. Understands: Knows that media influence and impact people and society, recognizes that a range of institutions impact media participation, and understands that media construct versions of reality. Uses: Uses technologies to consume and produce media, can use and critique a variety of media formats, and communicates using the language conventions of a variety of media forms. Achieves: Successfully manages personal, social, and public relationships using media, and confidently achieves personal objectives and goals through media.

In DigComp2.0, digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. DigComp2.2's digital literacy framework identifies the key components of digital competence in 5 areas (Information and data literacy, Communication and collaboration, Digital content creation, Safety, Problem solving). The elements of information and data literacy include articulating information needs, locating and retrieving digital data, information, and content, and judging the relevance of the source and its content. These are related to AASL's information search and access,

as well as information analysis and interpretation. The components of communication and collaboration are related to AASL's information synthesis and expression. The components of digital content creation, which include creating and editing digital content, adjust to AASL's information synthesis and expression. Safety components are essential elements for protecting devices, content, personal data, and privacy in digital environments. They are closely aligned with the information synthesis and expression of AASL. Problem solving is to identify needs and problems, and to resolve conceptual problems and problem situations in digital environments (Vuorikari, Kluzer, and Punie, 2022).

European Network for Visual Literacy (ENViL) focuses on visual skills that learners can acquire in the classroom or in non-formal settings. ENViL presents 16 sub-competencies related to visual literacy: analyse, communicate, create, describe, draft, empathise, envision, experience aesthetically, experiment, interpret, judge, perceive, present, realise, use, and value (Wagner & Schönau, 2016).

Data literacy is about the competences people need to engage with and use the data encountered in everyday life. The DALI Data Literacy Framework describes the competences that characterise a data literate citizen. The DALI Data Literacy Framework comprises three main elements: understanding data, acting on data, engaging through data. The first element, understanding data, integrates three aspects: knowledge, awareness and critical thinking. The second element, acting on data, refers to the skills needed to take action on data. It has three sub-elements: collecting data, managing data, sharing data artifacts. Engaging through data has four sub-elements: policy and regulation, taking decision, data action (DALI, 2024).

Table 1. Comparison of Various Literacies

AASL Information literacy	Information search and access	Information analysis and interpretation	Information synthesis and expression
PISA Reading literacy	Locating information	Understanding,	Evaluating and reflecting
AMLA Media literacy	Understands	Use	Reflects, Achieves
DigComp2.2 Digital literacy	Information and data literacy, Problem solving	Information and data literacy, Problem solving	Communication and collaboration,Digital content creation, Problem solving
ENViL Visual literacy	Describe, Envision, Value, Perceive	Analyse, Empathise, Experience aesthetically, Experiment, Interpret, Judge, Use	Communicate, Create, Draft, Present, Realise
DALI Data literacy	Understanding data	Acting on data	Engaging through data

Media literacy, digital literacy, visual literacy, and data literacy can all be integrated into information literacy, as they all involve the abilities to search for and access information, analyze and interpret information, and synthesize and express information, despite their different forms or perspectives. Therefore, in elementary and secondary

schools, it is essential to consider developing a multi literacy education program centered the school library as the field for information literacy education and the teacher-librarian as the information specialist. However, information literacy education centered on the school library and the teacher-librarian must include multi literacies.

Proposal For Multi Literacy Based Information Litteracy Framework

The framework proposed in this study is composed of the ideal type of talent, competencies, achievement standards, content areas, and content elements. The subject name for multi literacy based information literacy has been designated as "Library and Information Life" in accordance with the standards of the KLA (Korean Library Association).

The "Library and Information Literacy" is a curriculum aimed at fostering multi literacy, including library literacy, reading literacy, visual literacy, media literacy, digital literacy, data literacy from the perspective of information literacy which involves exploring, analyzing, interpreting, synthesizing, and communicating information to create and disseminate new knowledge and information.

"Ideal talent" refers to the envisioned characteristics and abilities that an educational program aims to cultivate in students. The ideal talent to be cultivated through the "Library and Information Life" course is 'a students with information literacy based on multi literacy.

The core competencies that this educational course aims to cultivate and prioritize to realize such talents are critical and creative thinking, information literacy and multi literacy, collaborative communication skills, and ethical and social responsibility. These are based on the 4C skills (Communication, Collaboration, Critical Thinking, and Creativity) as 21st-century learner competencies and the 6 core competencies at the national level in South Korea (based on the revised curriculum of 2022: self-regulation, knowledge and information processing, creative thinking, aesthetic sensibility, collaborative communication, community competence). These have been adjusted and supplemented to incorporate competencies related to information literacy and multi literacy.

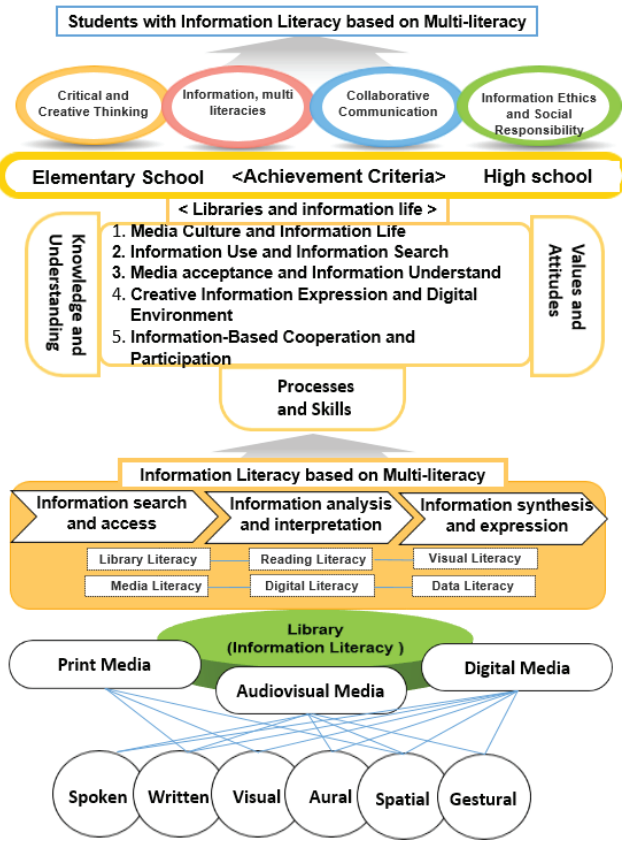


Figure 1. Concept Map of Multi literacies Based Information Literacy Education

A multi literacy based information literacy course can be categorized into content areas of information search and access, information analysis and interpretation, and information synthesis and expression. Within these branches, it comprehensively covers library literacy, reading literacy, visual literacy, media literacy, digital literacy, and data literacy. The curriculum for multi literacy based information literacy course is organized into five content areas based on three categories:

- Media Culture and Information Life,
- Information Use and Information Search,
- Media Acceptance and Understanding of Information,
- Creative Information Expression and Digital Environment,
- Information-based Cooperation and Participation.

The area 1 (media culture and information life) and area 2 (information use and information search) correspond to information search and access in information literacy. The area 3 (media acceptance and understanding of information) corresponds to information analysis and interpretation of information literacy. The area 4 (creative information expression and digital environment) corresponds to information synthesis

and expression of information literacy. The area 5 (information-based cooperation and participation) corresponds to information activity evaluation and social responsibility of information literacy. The Big6™ is a process model for information problem-solving. It integrates information search and use skills along with technology tools in a systematic process to find, use, apply, and evaluate information for specific needs and tasks. The Big6 was developed by Mike Eisenberg and Bob Berkowitz and is the popular approach to teaching information and technology skills for schools in the world (theBig6org, 2024). Comparing The Big6 Model with "Library and Information Life" from the perspective of content areas, the comparison is as follows (Table 2):

Table 2. Content Area Comparison of TheBig6 and "Library and Information Life"

TheBig6	Library and Information Life
1. Task Definition	1. Media Culture and Information Life 2. Information Use and Information Search
2. Information Seeking Strategies	
2. Information Seeking Strategies	
3. Location and Access	
4. Use of Information	3. Media Acceptance and Understanding of Information
5. Synthesis	4. Creative Information Expression and Digital Environment 5. Information-based Cooperation and Participation
6. Evaluation	

Area 1 (Media Culture and Information Life) primarily covers topics related to media culture and information life, development of media and information life, and library and multi literacy. Area 2 (Information Use and Information Search) covers topics related to inquiry and problem-solving using information, understanding information sources, and information searching and access. Area 3 (Media Acceptance and Understanding of Information) deals with critical evaluation of information, information analysis and strategies based on the nature of information, and information analysis using digital tools. Area 4 (Creative Information Expression and Digital Environment) covers understanding of information synthesis and expression, information representation and practice through multimodality, and digital communication. Area 5 (Information-based Cooperation and Participation) deals with topics such as information ethics and social responsibility, utilizing digital tools for collaboration, and information sharing and social participation.

These 5 content area not only deliver knowledge to students but also enable learning related to knowledge and understanding, process and skills, and value and attitudes. Knowledge and understanding refer to essential learning content that students should acquire through the "Library and Information Life" course. Process and skills refer to the inquiry process and skills, thinking process and skills, and learning process and skills. Furthermore, values and attitudes refer to the emotional, ethical, and affective values and attitudes that students should develop through the curriculum content. Knowledge and understanding, process and skills, values and attitudes are related to achievement standards. Achievement standards refer to the ultimate expectations of what students should ultimately be able to do or accomplish as a result of learning knowledge and

understanding, process and skills, and values and attitudes. Achievement standards should be described according to the levels of elementary, middle, and high school students. Although the achievement standards have been developed, they were not included due to this paper space constraints. An example of achievement standards for middle school students is as follows:

- Knowledge and understanding: Middle school students understand objective information, persuasive and argumentative information, and analysis and strategies for appreciation and social interaction.
- Process and skills: Middle school students can apply the process of analyzing objective information, persuasive arguments, and information for appreciation and social interaction.
- Values and attitudes: Middle school students have an attitude and disposition to understand and practice information analysis and strategies based on the nature of information.

Conclusion and Remarks

With the advent of the digital AI era, besides the traditional 3Rs (reading, writing, arithmetic), various literacies such as visual literacy, media literacy, and digital literacy are necessary. Rather than teaching various literacies independently in elementary and middle schools, they should be taught from the perspective of multi-literacy-based information literacy. In this study, various literacies were compared and analyzed, and then a framework for multi literacy based information literacy was proposed.

The perception of teachers and the general public toward school libraries, the materials and standards of school libraries, the training and employment of teacher librarians, as well as the legal status and identity of school libraries and teacher librarians, vary from country to country. Despite these differences, considering the operation of sustainable school libraries, the educational role of teacher librarians is crucial. Many studies have shown that students from primary school to postgraduate lack crucial information literacy and IT skills, hence there is a need for an effective pedagogical approach that will develop these skills (Chu, et al, 2011).

Therefore, this researchers hope to strengthen comparative studies on school libraries and teacher librarians worldwide using I-LISS as a platform, aiming for school libraries to take a central role in 21st-century education.

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LIS EDUCATION: CHANGING LANDSCAPE OF SCIENTIFIC RESEARCH

B. Elango[1] & P. Rajendran[2]

Introduction

The domain of Library and Information Science (LIS) is a multidisciplinary field engaged in the creation, organization, and utilization of information in diverse formats, with aim of enlightening individuals through facilitating interaction between information seekers and documented records. Within the realm of LIS, there exists a convergence of various theoretical perspectives, placing particular emphasis on information representation as a mirror of societal development, along with attention to information access technologies and institutions. Emerging in the late 1960s and early 1970s, the LIS domain encompasses elements of library science, information science, and communications, with historical roots tracing back to the nineteenth century. Information science is chiefly concerned with the characteristics and administration of information, while library science focuses on the organization and retrieval of material resources.

In the early 1960s, educational institutions providing training in librarianship, transitioning from professional training to academic disciplines in the latter half of the 20th century, started incorporating the term "information science" into their names. Leading the way in 1964, the University of Pittsburgh was among the first to make this transition, followed by numerous academic institutions in subsequent years. By the 1990s, a majority of library schools in the United States had integrated information science into their curricula. In Tromsø, Norway, the term "documentation science" continuous to be employed, despite global shifts such as the renaming of Denmark's Royal School of Librarianship to the Royal School of Library and Information Science in 1997. France has combined information science with communication studies, while Sweden has fused archival, library, and museum studies. Although some distinctions between library science and information persist, contemporary usage often treats them as interchangeable or focuses on information departments and i-schools.

Libraries and their services are significantly impacted by technological advancements compared to other sectors. Notably, the digital library has progressed

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from a basic digital collection to a comprehensive digital library system, and further to a digital library management system. Correspondingly, the roles of librarians have evolved over time, leading to the delineation of various specialised positions such as reference librarian, collection librarian, technical librarian, among others. Presently, these roles are known as knowledge managers, information managers, information scientists, knowledge brokers, and the like.

In this context, it is imperative to examine the evolving landscape of research on LIS education with the following objectives

- examining the annual publication trends
- identifying the most influential articles
- determining the core journals
- recognizing the prominent authors, institutions and countries
- unveiling the major themes and topics

Data and methods

Scopus was selected over Web of Science for the present study due to its wider array of journals and articles, with 99% of Web of Science journals being cross-listed in Scopus (Falagas et al. 2008; Singh et al. 2021). The exploration literature pertaining to LIS education involved querying specific keywords in the combined fields of title, abstract and keywords, such as "LIS education*" OR "library and information science education*" OR "library & information science education*" OR "library science education*". Moreover, filters were implemented to include only articles published in English and in journals. These criteria resulted in the identification of 749 documents, which were subsequently exported in CSV format for further analysis. The database was accessed on June 24, 2024. The final dataset was scrutinized using MS-Excel, and Bibliometrix R Package (Aria & Cuccurullo 2017) were used to analyse the final dataset. This study has employed the methodology utilized by Oh and Elango (2024).

Results

The results derived from the data analysis have been given in two sections. The first section of the study examines the assessment of the publication performance of literature related to LIS education. This includes analyzing the quantity of published literature and its rate of growth, identifying the authors who have made the most contribution and their institutions and countries, and determining the preferred journals for sharing research findings. The following part explores the investigation of the intellectual structure of LIS education using different network maps, including word cloud, co-occurrence network, trending topics, thematic mapping and factorial analysis. These maps are created based on author keywords. Lastly, the analysis also includes a discussion on the articles that had the greatest impact.

General overview

Table 1 presents an overview of the number of articles published and their content, the authors involved, and their collaborative efforts. In the field of LIS education, a total of 749 research articles were published by researchers and scientists from various countries worldwide. These articles were published in 137 different journals during a period of 40 years, from 1984 to 2024 (as of June 24, 2024). On average, each article received 7 citations, as determined by the impact of publications. The authors appended a total of 20,921 references, with an average of 28 references per article. Approximately 44% of the articles were authored by single authors. The average number of co-authors per article is 2.01, indicating that the research team for this topic typically consists of two authors. Furthermore, only 11% of articles included in the analysis involved international collaboration.

Table 1 – General overview

Description	Results
Articles	749
Timespan	1984:2024
Journals	137
Average citations per doc	7.003
References	20921
Author's Keywords (DE)	1557
Authors	1191
Authors of single-authored docs	276
Single-authored docs	328
Co-Authors per Doc	2.01
International co-authorships %	10.95

Figure 1 illustrates the yearly increase in research articles from 1984 to 2023. However, the data for year 2024 has been excluded from the analysis as it is incomplete. There was no discernible pattern in the fluctuation of the literature. Nevertheless, there has been a steady rise in the quantity of articles since 2001 forward. The year 2020, worldwide COVID-19 pandemic had the most articles. There were no notable spikes in article growth in some years, such as 1985, 1987, 1991 and 1994. This is because there were very few articles published throughout the early period. In the twenty-first century, there are two noticeable peaks, specifically in the years 2003 and 2015.

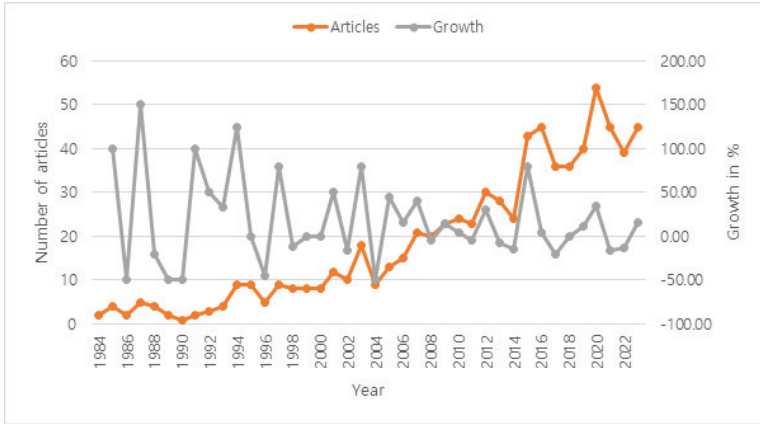


Figure 1 – Temporal evolution of articles and their growth

To account for the lack of a consistent growth pattern in articles, the entire publication period has been split into two distinct periods: 1984-2000 and 2001-2023 (Table 2). As 2024 is still ongoing, it has been discussed separately. The majority of the articles were published between 2001 and 2023, covering a duration of 23 years. In contrast, the earlier period from 1984 to 2000 only included 85 articles. There has been a 9% growth in the publication of articles in the early era, compared to a 6% growth between 2001 and 2023.

Table 2 – Distribution of articles by different periods

Period	# Articles	Share	Per year	CAGR (%)
1984-2000	85	11.35	5	9.05
2001-2023	653	87.18	28	6.19
2024	11	1.47		
Total	749	100	18	

Top actors

A total of 1,191 authors, affiliated with 433 different institutions across 78 countries, contributed to a sum of 749 articles. Table 3 outlines the top authors, affiliations and countries, revealing a notable skewness in author contributions. The most productive author credited with merely 10 articles, while only 14 authors had a minimum of 5 articles. A similar distribution pattern was noted for contributing institutions, with an average of three authors affiliated with each. Notably, over 40% of the articles originated from the authors in the United States, with other countries trailing behind at a considerable distance. Noteworthy mentions include smaller countries like South Africa, Pakistan, Iran, Kuwait and Bangladesh, which also featured prominently alongside the leading countries.

Table 3 – Top authors, affiliations and countries

Authors	# Arti cles	Affiliation	# Articles	Country	# Articles
Dali, K.	10	University of Illinois Urbana-Champaign	19	United States	303
Ameen, K.	9	Simmons University	19	Canada	51
Ocholla, D.N.	8	University of Maryland, College Park	17	India	50
Saunders, L.	8	University of the Punjab	17	South Africa	43
Raju, J.	7	University of Zululand	16	Australia	38
Roy, L.	7	University of Toronto	15	United Kingdom	36
Malik, A.	6	Kuwait University	13	Nigeria	25
Mehra, B.	6	Western University	12	China	23
Caidi, N.	5	San Jose State University	12	Pakistan	23
Carroll, M.	5	Charles Sturt University, Wagga Wagga	12	Iran	19
Hazeri, A.	5	University of Pittsburgh	11	Denmark	12
Jaeger, P.T.	5	Victoria University of Wellington	10	Kuwait	12
Julien, H.	5	University of South Africa	10	Malaysia	12
Ndumu, A.	5	The University of North Carolina at Chapel Hill	10	Spain	12
				New Zealand	11
				Bangladesh	10
				Japan	10

Core journals

A total of 137 journals were utilized for publishing the 749 articles on LIS education, indicating a limited number of journals dedicated to this field. Out of these, 5 journals were identified as core journals based on Bradford's law of scattering (Table 4) and collectively responsible for one-third of the total articles. It is noteworthy that two of these core journals were excluded from Scopus coverage due to various publication concerns. All five journals were classified under Social Sciences, with one additionally classified under Computer Science, and another under Arts & Humanities. These journals published by distinct publishers, including two from university presses.

Table 4 – Core Journals

Journals	Publisher	Subject	# Articles
Education for Information	IOS Press	CS, SOS	84
Journal of Education for Library and Information Science	University of Toronto Press	SOS	69
Library Philosophy and Practice*	University of Science & Technology Beijing	A&H, SOS	50
International Information and Library Review	Taylor & Francis Ltd.	SOS	37
New Library World*	Emerald Publishing	SOS	29
*these two journals have been discontinued from Scopus coverage CS – Computer Science, A&H – Arts & humanities, SOS – Social Sciences			

Topics and themes

Given the low article count in the initial period (1984-2000), it was insufficient for generating science mappings, prompting the utilization of the subsequent corpus (2001-2024) for this purpose.

Through keyword analysis, researchers can discern the thematic trends and focal points within a research topic (Su & Lee 2010), while author-keyword analysis forms the basis for scrutinizing research trends in LIS education (Dhawan, Gupta & Elango 2021). The visualization of a word cloud aids in exploring key concepts and prominent research areas within the domain of LIS education. Figure 2 illustrates the distribution authors' frequent usage of LIS education-related keywords in published articles, showcasing additional explored topics such as curricula and curriculum, higher education, library education, lis curriculum, curriculum development, pedagogy, experiential learning, alongside country-specific research on Australia, China, India and Pakistan.



Figure 2 – Word cloud of author keywords

(Parameters: Field – Author's keywords; default parameters except Occurrence measure which has set to Square root)

A co-occurrence network map has been generated to examine the interrelations among the most prominent author keywords. Figure 3, segmented into five clusters based on the proximity of topics, illustrates the association between the various themes. The interpretation of the outcomes presents a considerable challenge. Nevertheless, the primary red cluster spearheaded by LIS education in conjunction with LIS curriculum, curriculum development, experiential and service learning, pedagogy, online and e-learning, higher education, information literacy and competencies. Some investigations have a focus on developing countries such as India and Pakistan. The purple cluster pertains to information and information science, library science, curricula and curriculum, libraries and librarians, education and training. The green cluster comprises library and information science education, professional development, distance and continuing education, cataloging education, and academic libraries. The blue cluster encompasses library and library science education, classification and China. Lastly, the minor "orange" cluster incorporates iSchools and their accreditation.

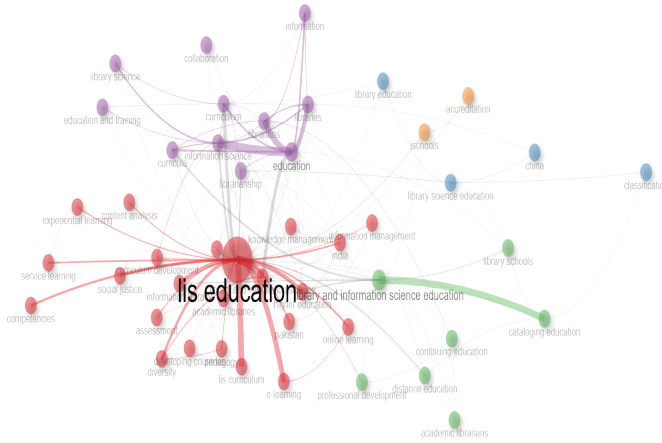


Figure 3 - Co-occurrence network of top author keywords (default parameters)

By employing trend-topic analysis, it is feasible to recognize the evolving topics / themes over time based on the prevalent author keywords (see Figure 4). The researchers have progressively delved in to a myriad of topics. Notably, the early twenty-first century commenced with a focus on information and librarians, transitioning to LIS curriculum and higher education, and culminating in discussions on social justice, content analysis and equity. The researchers' attention has been drawn to country-specific studies, such as those pertaining to China, India, Iran, Nigeria and Pakistan.

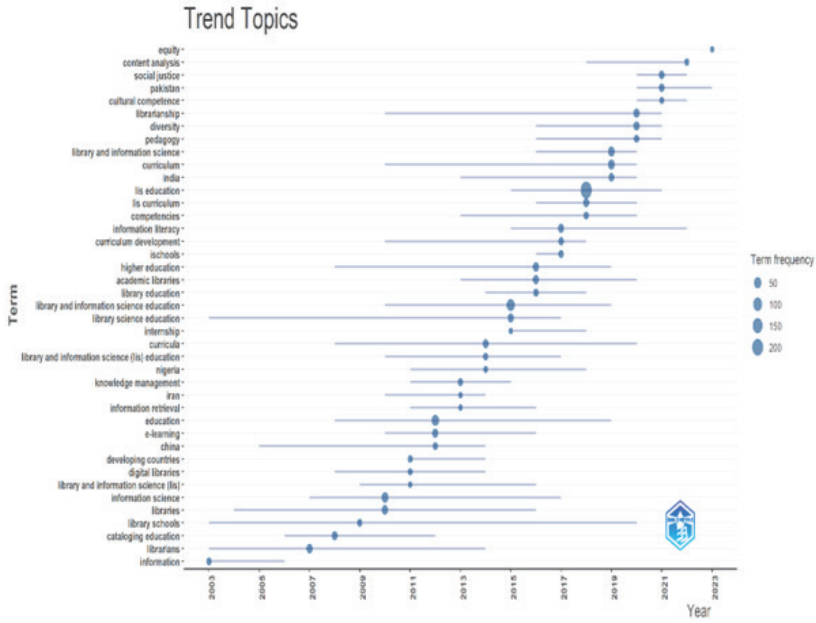


Figure 4 – Trend topics of author keywords (default parameters)

The fundamental basis for creating thematic maps is established through clustering and co-word network analysis. Utilizing a specific methodology enables the examination of themes in correlation with their geographical locations. Aria & Cuccurullo (2017) elaborates on the thematic map, offering valuable insights into patterns, trends, seasonality and anomalies within research domain. Segregating maps into four quadrants based on centrality (X-axis) and density (Y-axis), results in visually clear representations. This quadrant system facilitates the recognition of four theme types: niche, motor, basic, and emerging or declining themes. Research primarily concentrates on motor themes, which cover fully developed topics. Topics with high density but moderate centrality are categorized as peripheral and well-developed or isolated themes. Developing or less significant topics are identified as emerging or declining. Basic and transversal topics pose challenges due to insufficient density. Figure 5 illustrates the thematic mapping of author keywords in articles related to LIS education. Ten clusters are classified into four quadrants: (a) two clusters in the basic theme – competencies (skills, knowledge and LIS schools) and academic libraries (LIS programs and curriculum, research methods and developing countries). (b) three clusters in the niche theme - Academic publishing (critical pedagogy), bologna process (learning outcomes and outcomes assessment) and Bangladesh (digital library). (c) two clusters in the motor theme - LIS education (includes 130 topics) and South Africa (information technology, bibliometrics, LIS education and training). (d) Artificial intelligence and content analysis are considered emerging or declining themes.

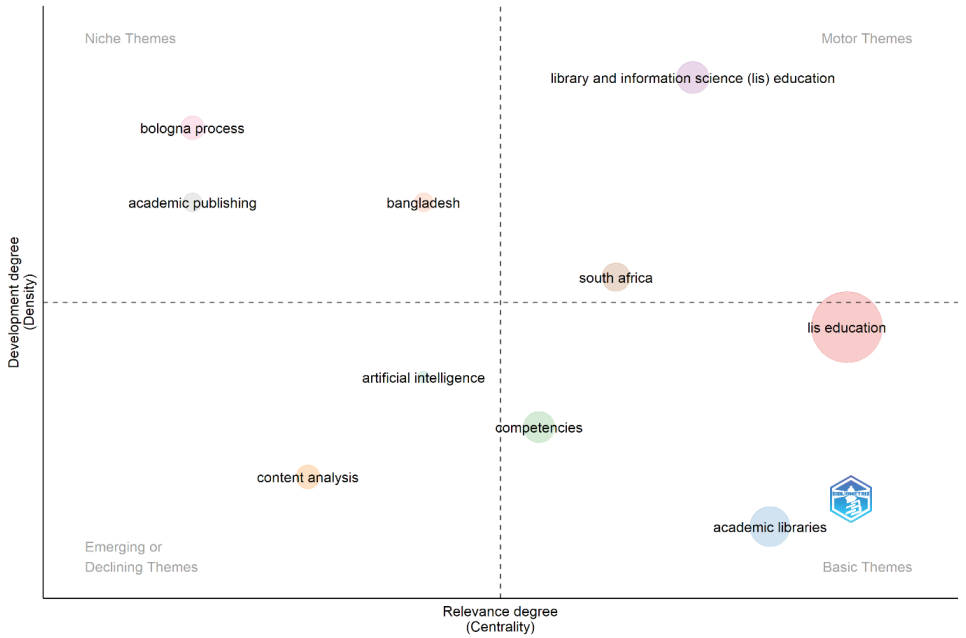


Figure 5 – Thematic mapping of author keywords

(Parameters: Field – Author's keywords, Number of words – 250, Number of clusters – 5, Number of labels – 1 for each cluster, Clustering algorithm – Infomap, Community repulsion - 1)

A multiple correspondence analysis (MCA) was employed to create a conceptual structure map of author keywords, presenting clusters in a two-dimensional map (see Figure 6). MCA, a common analytical method, is utilized to break down extensive categorical data into smaller components. Closer dots on the graph symbolizing each topic indicate more frequent co-occurrence of keywords in articles. Topics near the center attract significant interest from the research community, while those on the periphery hold minimum influence. The resulting concept map comprises five clusters, with information and cultural competence forming separate clusters. Curriculum and professional development, pedagogy, social justice and diversity are grouped together. A prominent blue cluster includes lis curriculum, developing countries, library and library science, education, libraries and librarians, curriculum, assessment, and academic librarians along with Australia, India and South Africa. The red cluster consists of library schools, classification and cataloging education, and accreditation, China and Nigeria.

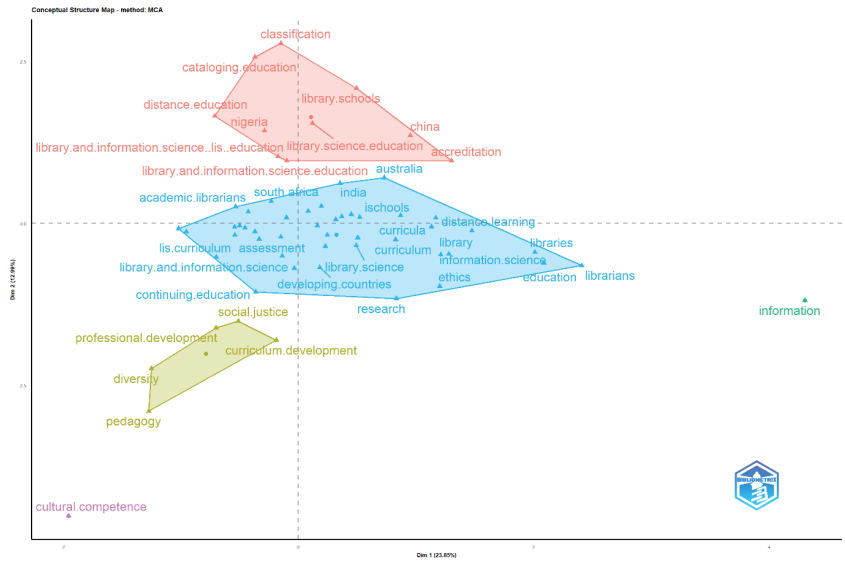


Figure 6 – Multidimensional scaling analysis of most-frequently used author keywords (Parameters: Method – Multiple Correspondence Analysis, Field – Author's keywords, Number of items – 50, Number of clusters – 5)

Most significant publications

A sum of 613 constituting approximately ~82% of the total, have been cited, with an average of 8.5 citations per article. The leading 9 articles, representing close to 1.2% of the total, garnered no fewer than 50 citations from the date of publication until June 24, 2024 (refer to Table 5). These 9 articles, each having an average of 72 citations, stand

out as the most referenced works in this field, amazing a total of 649 citations (equivalent to more than 12% of all citations across the 749 articles). Among these articles, three were authored by a single author and three had co-authors from international institutions. All nine articles were published within the timeframe of 2005 to 2021.

Table 5 – Significant publications (TC > 50)

Article title	Author (s)	Journal	Year	TC	TC / Year	Country
What Qualifications and Skills are Important for Digital Librarian Positions in Academic Libraries? A Job Advertisement Analysis	Choi Y;Ras mussen E	Journal of Academic Librarianship	2009	145	9.06	US, Canada
Use of Web 2.0 Technologies in LIS Education: Experiences At Tallinn University, Estonia	Virkus S	Program	2008	89	5.24	Estonia
Reinventing Our Work: New and Emerging Roles for Academic Librarians	Goetsch La	Journal of Library Administration	2008	68	4.00	US
Unequal Legacies: Race and Multiculturalism in The LIS Curriculum	Pawley C	Library Quarterly	2006	66	3.47	US
Ranking the Research Productivity of Library and Information Science Faculty and Schools: An Evaluation of Data Sources and Research Methods	Meho Li; Spurgin Km	Journal of The American Society for Information Science and Technology	2005	60	3.00	US
Utaut as a Model for Understanding Intention to Adopt AI and Related Technologies Among Librarians Andrews Je;Ward H;Yoon J Journal of Academic Librarianship 2021				57	14.25	US, South Korea
Trends, Challenges and Opportunities for LIS Education and Training in Eastern and Southern Africa	Ocholla D; Bothma T	New Library World	2007	57	3.17	South Africa
Public Libraries, Values, Trust, and E-Government	Jaeger Pt;Fleisch mann Kr	Information Technology and Libraries	2007	57	3.17	US
"Making Space" in Practice and Education: Research Support Services in Academic Libraries	Kennan Ma; Corrall S; Afzal W	Library Management	2014	50	4.55	Australia, US

Most local cited articles

Among the 749 articles, 226 which is almost 30% of the total, made references to the articles linked to LIS education. Out of the articles mentioned, the nine most frequently cited ones were published between 2006 and 2019, with each of them being quoted at least 9 times (refer to Table 6). Out of the total, five were published in the scholarly journal "Library Quarterly".

Table 6 – Most local cited articles (LC >9)

Article Title	Journal	Year	Local Citations	Global Citations
Unequal Legacies: Race and Multiculturalism in the LIS Curriculum	Library Quarterly	2006	19	66
Professional Perspectives on Library and Information Science Education	Library Quarterly	2015	14	45
Trends, challenges and opportunities for LIS education and training in Eastern and Southern Africa	New Library World	2007	13	57
The Virtuous Circle Revisited: Injecting Diversity, Inclusion, Rights, Justice, and Equity into LIS from Education to Advocacy	Library Quarterly	2015	11	40
Learning about Diversity: The Roles of LIS Education, LIS Associations, and Lived Experience	Library Quarterly	2015	11	26
Core and More: Examining Foundational and Specialized Content in Library and Information Science	Journal of Education for Library and Information Science	2019	9	41
Are Library Science Programs Preparing New Librarians? Creating a Sustainable and Vibrant Librarian Community	Journal of Library Administration	2016	9	40
Empowered to Name, Inspired to Act: Social Responsibility and Diversity as Calls to Action in the LIS Context	Library Trends	2016	9	33
Preparing Future Librarians to Effectively Serve Their Communities	Library Quarterly	2013	9	42

Conclusion

The findings of the current investigation on the worldwide LIS education research output from 1984 to 2024, as documented in Scopus, delved into essential aspects such as the research's growth rate, leading publishing nations, top-performing institutions, most prolific authors, favored journals, citation impact, highly cited articles, and prevailing research trends. The yearly publication count witnessed an increment of 8.3%, rising from just 2 publications in 1984 to 45 in 2023. A total seventy-eight countries partook in research on LIS education. Two out of five core journals have terminated their inclusion in the Scopus database. The United States emerged as the principal contributor to published articles. An examination of authorship pattern highlighted the substantial influence of single-authored works on the research domain. Exploration of evolving subjects and motifs uncovered a focal point on the LIS curriculum and higher education within the research sphere. The outcomes of this investigation hold the potential to aid stakeholders in the LIS education realm by offering insights into global research tendencies and facilitating the identification of future research trajectories.

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LIBRARY INSTRUCTION, AI LITERACY AND ACADEMIC INTEGRITY: A REFLEXIVE STANCE

Paschalia Terzi[1] & Reysa Alenzuela[2]

Introduction

In the ever-evolving landscape of modern academia, the integration of artificial intelligence (AI) technologies has become increasingly prevalent. With the influence of AI that brought sudden transformation, the UN Secretary-General's AI Advisory Body has launched an "Interim Report: Governing AI for Humanity" (Advisory Body on Artificial Intelligence, 2023) to see alignment between international norms and how AI is developed and rolled out. Moreover, UNESCO released a roadmap for using AI in education (UNESCO, 2023b). In Europe, the Artificial Intelligence Act or AI Act is in its final draft (as of April 2024). The "AI Act" is a proposed regulation by the European Union is aimed at establishing a legal framework for artificial intelligence (Novelli et al., 2024). Its goal is to ensure that AI systems used within the EU are safe, transparent, and respect fundamental rights.

In the context of information literacy, the AI Act plays a crucial role by promoting awareness and understanding of AI technologies and their implications. It encourages educational initiatives that help individuals critically evaluate AI systems, understand their ethical considerations, and recognize their impact on society. The Association of Research Libraries (ARL) and the Coalition for Networked Information (CNI) recently embarked on scenario planning to imagine a future influenced by artificial intelligence (AI) and to explore the range of uncertainty associated with AI in the research and knowledge ecosystem (Association of Research Libraries & Coalition for Networked Information, 2024). In the library, discussions look into AI Literacy in academic libraries have significantly grown (Bongiovanni et al., 2024); (Lo, Leo, 2024); (Tzanova, 2024).

Among the myriad applications of AI one area that has garnered considerable attention is the role of AI in instruction and information literacy (Coleman, 2024); (Molopa et al., 2024)). Moreover, discussions on whether the use of this tool aligns with values of academic integrity or not have become ubiquitous. Since ChatGPT came out in 2022, the issue of academic integrity has likewise been connected. Lo (2024) in his study showed that librarians feel the weight of responsibility in maintaining the integrity of their services in the age of AI.

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Exploring the scenario within our respective libraries, we investigated how connecting AI literacy instruction to information literacy impacts changes in instructional delivery methods. To deduce significant insights from first-hand experience, along with our interaction with stakeholders within the academic community, decided to reflect on our journey with the coming of AI as we both use AI for instruction which has a significant implication to the overall library instructional services and academic integrity. Thus, this autoethnographic study is conceptualized.

Literature Review

AI Literacy and related concepts

Long before ChatGPT burst into the scene, there were already calls by UNESCO to academic and civil society organisations for developing students' and citizens' AI "awareness and literacy" skills (UNESCO, 2021, p. 23) from the aspect of ethical AI. Moreover, in the guidance document to education policy makers, the term "AI literacy" is mentioned as an essential skill that relates to broader skills like "literacy and numeracy" (United Nations Educational et al., 2021, p. 23). In addition, the 2024 UNESCO document on User empowerment through Media and Information Literacy responses to the evolution of Generative Artificial Intelligence (GAI) recommends "incorporating AI literacy as a subset of nested literacies (data-, algorithms, and AI-literacy) to ensure familiarity for educators and learners" (Frau-Meigs & UNESCO, 2024, p. 5) and the 2024 EDUCAUSE Horizon Report on teaching and learning urges "all higher education stakeholders [...] learning how to use AI responsibly" and calls for "AI fluency" skills to be taught (p.24)(Pelletier et al., 2024, p. 24).

AI Literacy as a concept is evolving. Yi (2021) explained that AI literacy involves the acquisition of learner competencies required in the AI era based on learning functional, social, and technical literacy. Long & Magerko (2020) elucidate that AI Literacy is a set of competencies that enables individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI; and use AI as a tool online, at home, and in the workplace. Moreover, Lo (2024, p. 2) expounded this definition:

> *"AI literacy, a subset of the broader digital literacy, specifically pertains to understanding AI's principles, applications, and ethical considerations. It involves not just the ability to use AI tools effectively, but also the capacity to evaluate their outputs critically, understand their underlying mechanisms, and contemplate their ethical and societal implications."*

Studies about AI and information literacy share various perspectives. Bongiobanni, et al., (2024) revealed that instruction on AI literacy varies widely in format and content, influenced by a range of factors. As academic librarians increasingly engage in this domain, further research is required to delve into the motivations, instructional approaches, and assessment methods employed in AI literacy instruction.

Academic Integrity

With the arrival of ChatGPT in late 2022, a flurry of documents and recommendations on the ethical use of AI tools arrived: the 2023 EDUCAUSE Horizon Action Plan on Generative AI urges institutions to "increase stakeholder commitment to ethics" (Robert & Muscanell, 2023, p. 5) and from the perspective of researchers, the 2023 STM guidelines on "Generative AI in Scholarly Communications" asks authors to "disclose any use of GenAI that transcends" uses of AI as "a basic tool that supports authors in refining, correcting, formatting and editing texts and documents" (STM, 2024, p. 6).The same call to researchers to "Use AI transparently" is repeated in the 2024 "Living guidelines on the responsible use of generative AI in research" document released by the European Commission (European Commission, 2024, p. 6).

All the above hints at the importance of the concept of Academic Integrity in higher education and research. The International Center for Academic Integrity (ICAI) "[...] defines academic integrity as a commitment to six fundamental values: honesty, trust, fairness, respect, responsibility, and courage" (International Center for Academic Integrity, 2024, p. 4). Nevertheless, not adhering to Academic Integrity values occurs for various reasons; for example, Cinali mentions that "Cheating as a social coping mechanism and survival tool is prevalent and commonplace throughout the MENA and Gulf region, but the same can be said of many other regions of the world" (Cinali, 2016, pp. 116–117). Moreover, the ease of access to AI tools such as ChatGPT has been blamed by at least one study for contributing to cheating (Sevnarayan & Maphoto, 2024).

The 2023 UNESCO Quick Start Guide on ChatGPT for Higher Education makes an explicit reference to ChatGPT and Academic Integrity concerns, specifically students using AI tools for plagiarism and cheating (UNESCO, 2023a, p. 11). Moreover, a recent report by JISC connects the use of AI tools and Academic integrity. Specifically, students stated their "strong request for clear unambiguous guidance on generative AI use in learning and assessment"(JISC, 2024, p. 7) something that apparently is lacking for the time being.

AI Literacy and Library Instruction

The call to teach students and researchers how to use AI tools ethically and within the framework of values for Academic Integrity is apparent in almost all of the documents mentioned above. Issues like bias (Rozado, 2023), misinformation, privacy and using the tools transparently are all raised. On the other hand, there are calls for the integration of AI tools in the learning and research process (Cox & Tzoc, 2023). How to craft effective prompts, a skill referred to as "Prompt Engineering" has gathered considerable attention (Lo, 2023b, 2023a) but other uses of AI, for example as a tool for brainstorming and outlining, have all been mentioned in recent studies that try to find ways to incorporate AI literacy skills into information literacy instruction in a library context. For example, James & Filgo (2023), try to find overlaps in the teaching of ChatGPT as a tool and concepts from the ACRL Framework for Information Literacy, and Boehme et al.(2023)

in their document list ideas on how to teach ChatGPT features according to 3 Frames from the ACRL Framework. Lastly, Scott-Branch et al. mention raise the importance of teaching proper citing of AI tools according to popular citation styles like Chicago, ALA and MLA (Scott-Branch et al., 2024).

Reflexivity in Information Science Research

Reflexivity as a qualitative autoethnographic approach used in information science research can be considered as a novel way to provide to describe a scenario. We explored this approach as we wanted to delve deeper from our personal perspectives as researchers drawing connections within our practices, emotions and reflections to see the intersection of our self and society figuring out what to do. For example, the discussion of Crilly (2019) provides examples of emerging practices that highlight some of the complexities and ambiguities of critical librarianship, around novelty, compliance, institutionalisation, and the challenge of how we convert these theoretical insights into the power structures at play in libraries and archives into meaningful changes for the benefit of all of our students. Moreover, an analysis of #MIL4Democracy Handbook of Santos, et al., (2023)using reflexivity as one way to explain the study as a Media and Information Literacy (LIS) professor adds a complex layer to the study that offered unique insights and opportunities to deepen understanding of the scenario being described. Bearman & Ajjawi (2023) explained that emphasizing the need for emotional reflexivity can prompt students to examine their interactions with AI systems critically. These are a few of the cases among other discussion that has employed the lens of reflexivity to see a different angle that would be an important avenue for discussion.

Methodology

Autoethnography is a qualitative research method that: 1) uses a researcher's personal experience to describe and critique cultural beliefs, practices, and experiences; 2) acknowledges and values a researcher's relationships with others; 3) uses deep and careful self-reflection—typically referred to as "reflexivity"—to name and interrogate the intersections between self and society, the particular and the general, the personal and the political; 4) Shows people in the process of figuring out what to do, how to live, and the meaning of their struggles; 5) balances intellectual and methodological rigor, emotion, and creativity; and 6) strives for social justice and to make life better (Adams et al., 2015, p. 2).

We collected personal memory data, self-observational and self-reflective data, and external data, and then analyzed and interpreted these data (Chang (2008) as cited in Ngunjiri, et al., 2020). When we wrote about ourselves we called on memory and hindsight to reflect on past experiences; talked with others about the past; examined texts, photographs, personal journals, and recordings;and consulted with relevant news stories,blogs,and other sources. Then we wrote these experiences to assemble a text that uses tenets of storytelling devices, such as narrative voice, character development, and dramatic tension,to create evocative and specific representations of the culture/cultural

experience and to give audiences a sense of how being there in the experience feels (Adams et al., 2015).

Description of the study

1. For conducting this study, we first choose our topic.
2. Then we collect personal memory data (Chang, 2008).
3. We examined texts, video recordings, personal notes, documents and other media to develop our narratives (Adams, et al., 2015) or any form of self-observational and self-reflective data, and external data.
4. Subsequently, we engage in reflexivity, examining our own feelings, reactions, motives and how these influences why and how we do this library instruction where we focused on AI literacy.
5. To ensure authenticity and be aware of our vulnerabilities in developing our narratives, we take into consideration our cultural background, prejudices, biases that might influence our interpretation
6. We draft our narratives describing our experiences and the processes of creating library instructions specifically on AI literacy. We also paid special attention to its relation to academic integrity. Part of our narratives is to explore or probe into the responses of our stakeholders (students, researchers, faculty, scholars). As how emotions are involved needs further thought, an essential part of this study is the sentiments and emotions of stakeholders who have interacted with us.
7. Subsequently, we analyzed the patterns and themes.
8. We finalized our findings incorporating our personal stories, striking anecdotes, personal reflections. To provide context, we connect these stories to relevant theoretical concepts and literature.

Validity

Wiesner (2020) emphasized the importance of authenticity and vulnerability in this process, particularly when dealing with difficult emotions. Koopman et al. (2020) suggested using visual methods and autoethnography to uncover hidden perspectives that may impact knowledge production. Cummins, et al. (2022) underscore the need for continual reevaluation and collaboration in engaging with reflexivity, while McIlveen (2008)highlights the role of autoethnography in embedding the researcher in the research, promoting trustworthiness and critical consciousness. To validate the accuracy of your interpretations with those who shared the experiences, we include member-checking. This includes discussion with each other as co-authors and peers.

Discussion

Perspectives as an Instructional Librarian

View from the students

I was surprised when one of the students told me that she just uses it as a tool to write better English, and to deliver a good product. Students don't seem to regard

using generative AI tools like ChatGPT as cheating. I think to myself that these differing points of view could be due to the generational gap between us and the ways we adopt technology.

I also noticed in our personal interactions, that students are very quick to try out new AI tools but lack the depth of testing that tool's scope and limitations. I try to learn from them, which tools they use, so I can adapt my lesson plans to the ones they are using. I also suggest tools to them that might not be as popular among them but are equally useful, like Copilot, essentially a free version of ChatGPT 4. Another tool, ResearchRabbit, that doesn't generate text, so less popular than ChatGPT and Claude, is more effective on literature searches, for example, it doesn't "hallucinate" made-up papers like Generative AI tools like ChatGPT do(We Used ChatGPT to Generate Citations, 2023). I incorporate this crucial difference on knowledge generation to my classes: I point out that AI tools are not limited to text generation, which might get them into trouble for plagiarism and cheating, but can speed up their research process, without compromising academic integrity.

View from the Faculty

As a general rule, it has come to my attention, that the majority of syllabuses that I have had access to since the last 2-3 semesters have prohibited any use of AI tools at any stage of the research project, regardless of the students doing a research paper or another type of assessment like a portfolio or a video presentation. From personal conversations I had with faculty, it is implied that this happens because faculty themselves are not aware of how these tools work or have not found yet a way to incorporate them into their assessment practices. In contrast, in our conversations before the library sessions, asking them if I could include in the instruction AI tools for the students to learn how they can use them for brainstorming in order to generate keywords for library research, all agreed. I make the inference that using AI tools for brainstorming for keyword searching is not considered a violation of academic integrity, at least not as much as straightforwardly generating text for answering assessment questions. This agrees with the recommended uses by UNESCO (UNESCO, 2023a) which makes me feel safer to proceed with teaching AI tools in library sessions.

AI Literacy

I remember encountering the term AI literacy before ChatGPT came into the picture, mainly from the various UNESCO publications related to media and information literacy. By following citations I discovered that an article in 2020 had already provided a framework on what AI literacy can be (Long & Magerko, 2020). Various sourcesalso pointed out that AI Literacy is related to Digital Literacy and its various competencies. On the other hand, Digital Literacy is grouped under the umbrella term Media and Information literacy where AI literacy is also included, specifically the latest UNESCO curriculum for Media and Information Literacy (UNESCO, 2022) has a section on this newer form of literacy.

Moreover, during the summer of 2023, our librarians team produced a conference paper on the topic of AI literacy. The process of researching that article provided me with a wealth of new knowledge about AI literacy issues and their relationship with library instruction. A lot of the skills mandated for example do overlap with notions of Digital literacy, like evaluating the digital tools one is using, but also with traditional Media and Information literacy, like detecting bias.

I wondered if we as instructor librarians should use the term in our instruction and communication with the faculty. I think yes, for two reasons: it communicates to our patrons that we are keeping up with the latest developments in education and it also helps us as professionals to target our training to new skills. For example, I have tried during my discussion with faculty, to mention a couple of skills that AI literacy instruction might equip students with, like brainstorming. Also, when searching for professional development opportunities, AI literacy bodes well with terminology widely used in the library profession, like Media and Information literacy, making it thus easier to engage with.

Privacy issues

Because I was already highly sensitive to the use of personal data by social media companies, I was very reluctant to create a registered account with any of these tools because I didn't want to share my data for free. Aware of the work by Zuboff "Surveillance Capitalism" (Zuboff, 2019) I saw this new development as an additional way for companies to take our data for free. Although I have been trained as a digital librarian, I realized that I have grown weary of the ways technology corporations use to invade our lives and work (Mance, 2023). Nevertheless, we cannot push back if we want to stay relevant and professional, a thought that still worries me a lot.

Artificial Intelligence and ACRL Framework for Information Literacy in Higher Education

By the summer of 2023 all three major citation styles, Chicago, APA and MLA, had released some information, whether on their blogs or as new sections on their web pages, on how to cite the use of AI tools. In collaboration with the Writing Center, we created an "AI citing cheatsheet" which was disseminated to faculty and students. Since a lot of the discussion revolves around AI and cheating, it is better to be transparent when our community is using these tools, and this cheat sheet provided them with a roadmap to do this quickly and safely.

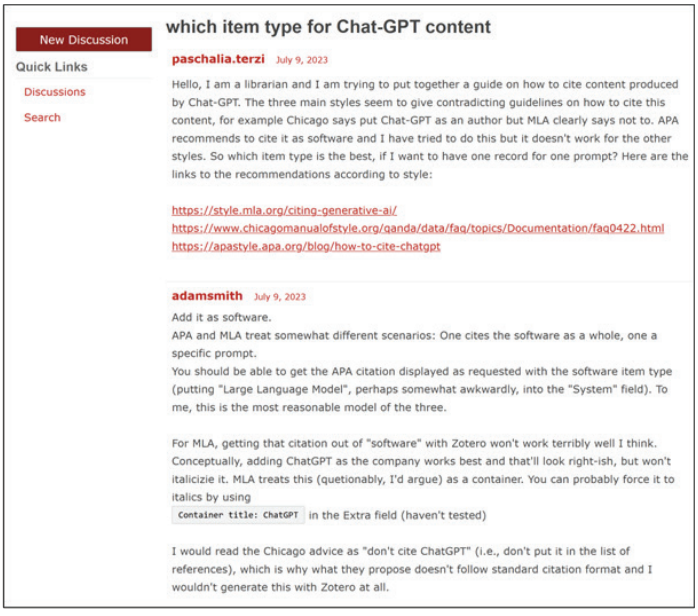
In my classes, I started explaining biases and hallucinations of AI tools to bring awareness to their limitations as soon as Fall semester 2023. Crucial for students is to understand that these "bugs" are related to the way these tools create information, namely their training datasets and the algorithms that power them. One example that was widely discussed between students, librarians and faculty, was the way ChatGPT generated text about Israel and Palestine, which are currently in conflict, in very obviously biased ways, including stereotypes. In this sense, the "Information Creation as a Process" Frame gave

me a theoretical start to incorporate teaching these issues in a library session. Some of the knowledge practices for this Frame can be applied to AI tools as it is a tool that creates information. Nevertheless, students need to understand how this is done and then decide if and how to use it in their research workflow.

Academic Integrity

In the university where I work, there are strict Academic Integrity rules and an Honour Council to implement its principles, a body consisting of students and faculty. If a student is suspected by faculty or other students of an Honor Council violation, needs to be checked. In my experience, violations are usually cheating, sloppy citations, and lately use of AI tools for text generation. Numerous students have been forwarded to the Honor Council for judgment since the release of ChatGPT. As an instructional librarian, I am participating in Honour Council activities by retraining the students on how to research effectively and quickly and how to cite with citation tools like Zotero to avoid plagiarism.

In the summer of 2023, I participated in the "Citing AI cheat sheet" tool which was disseminated to students and faculty through emails and workshops throughout the Fall semester. In the cheat sheet instructions by APA, MLA and Chicago styles on how to cite AI tools like ChatGPT were summarized. The cheat sheet was intended to be short to increase uptake, especially by students. Instructions on how to use Zotero to cite these sources were also included. This was the most difficult part since Zotero Item Types do not contain one for AI content. My first step was to submit a question to Zotero forums where I asked this question. A suggested workaround was to just cite it as software.



Source: https://forums.zotero.org/discussion/106107/which-item-type-for-chat-gpt-content

But when I ran some tests to see if the exported citation from Software item type to Zotero was matching the Chicago and MLA instructions for AI content, I was disappointed that it did not. After a meeting with the Writing Center coordinator, a common decision was made that for MLA and Chicago styles we had to suggest to students to use another Item Type, and not Software, to match the correct output. This was Encyclopedia and Website instead.

Faculty heads welcomed our contribution and shared it with all faculty members in their email lists. The cheat sheet has also been used as a tool in subsequent workshops on AI.

Finally, I was convinced that issues of Academic Integrity and Artificial Intelligence are of the highest priority to our community when the workshop I organized in the library on how to cite AI was the most attended in the spring semester of 2024. Not only students but also staff who feel they need more guidance on these issues participated in excess of the limited seats I initially announced. My takeaway from this experience is that AI citing can be safely taught as a component of information literacy under the ACRL Frame "Information Has Value", which is tied to Academic Integrity values like fairness.

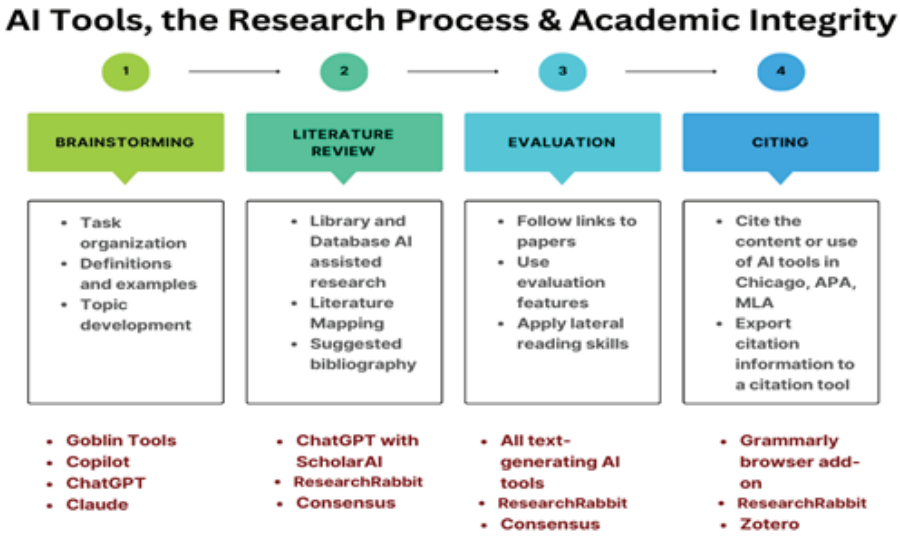
The research process, AI Tools organizing Map & Academic Integrity

In early Spring 2024, I participated in an internal staff presentation for staff development. In that session, various departments showcased how they use AI tools in their day-to-day work. I presented a framework where I tried to map out the various AI tools that are popular lately according to their function and how they can fit into the research process. The research process consists of various stages but 4 are what I found most relevant to library instruction: brainstorming, literature review, evaluating and citing.

1. Brainstorming takes place when students think about their topics: how to focus them and make them more specific, how they can break down a research question and find relevant concepts, and how they can define search terms based on those concepts. It can also be a time when they think about the various tasks they need to carry out later and how to organize their time. AI tools that are based on text generation, like Copilot, and ChatGPT can help them in this stage. Also, tools like Goblin Tools estimate times for tasks.
2. Literature Review takes place right after or at the same time as brainstorming. With the help of tools like Research Rabbit, Consensus, or plugins to ChatGPT like ScholarAI, students can find relevant sources for their research questions. They can also ask the AI tool which library databases to use for various topics.
3. Evaluation takes place during the literature review when students need to evaluate the reliability, authority, and relevance of the sources suggested by the AI tools. They need to be taught skills like lateral reading, where they double-check with Google, or the library catalog the suggested sources. Also, some AI tools have in-built evaluation features: Consensus has a filter for limiting to sources that come

from the most cited journals according to Scopus.

4. Citing takes place probably last for many students, but it should actually be done throughout the research process, where students make sure they save the citation information of every source the AI tools suggest and also save their use of AI tools. Some AI tools can generate citations, but based on my experience, they are not perfect. I think that traditional citation management tools like Zotero, still do a better job, so students should be knowledgeable about them and how to use them in combination with AI tools. Also, the Grammarly add-on to browsers can be useful when citing ChatGPT content.



Among the above-mentioned tools, Research Rabbitt, a literature visualization tool, proved to be of great interest to faculty, staff and students. I took this opportunity to showcase a tool like that in contrast to text-generating tools like ChatGPT so our users, especially faculty, understand that AI is not just about cheating but can also help accelerate the research process. In this way, I have tied it to the "Information Creation is a Process" ACRL frame because it neatly falls under a very specific research process, and it does not generate text, so it is easier for our users to understand how AI tools come in many flavors.

AI and the digital divide

Since the rollout of ChatGPT as a commercial, paid product, as a librarian, I had to choose if I would teach it to students or not. The university to this day does not pay for an institutional subscription to this or any other text/image generating AI tool so if I taught it actively in class, using a personal subscription it could be perceived as promoting a commercial product. I am referring here to version 4 of ChatGPT which is considered the most reliable one for research purposes, and the one that users can add

extensions like ScholarAI that facilitate literature review with actual links to research papers, avoiding hallucinations and made-up papers, a common behaviour for the free version, chatGPT 3.5.

Only when Microsoft made its tool Copilot free to use with the browser Edge I decided to go ahead and demonstrate the brainstorming capabilities of an AI tool for library research. To use this tool the user doesn't need to create an account (although some of the user's data probably can be retained through browser cookies) and doesn't need to pay, as long as they open Copilot in Edge browser. It is also available through Bing. By selecting this product I tried to address both privacy and digital divide issues.

AI and library staff development

Pressure to retrain and upskill for AI was felt from the start. The usual narrative of machines replacing humans, making librarians and especially reference librarians, obsolete, was espoused even within our library team by librarians who are more technology-oriented. Being quick to embrace the technology or otherwise face the danger of extinction was palpable, and even celebrated. I felt that a more critical stance towards the technology was discouraged and instead uncritical enthusiasm of what these new shiny tools can do was expected. To me, this phenomenon is just a replica of the Silicon Valley ideology that favors disruption in expense to worker's labor. Unfortunately, a recent report by ILO does confirm some of these fears; women will be disproportionately affected by the adoption of AI tools in clerical roles, which overlap with some of librarians' job duties currently (Generative AI and Jobs, 2023). Based on that I have formulated an opinion that I have shared with my colleagues at the university, that women librarians should be aware of these dangers and actively try to mitigate them.

II. Narratives from Scenarios in a Research Library

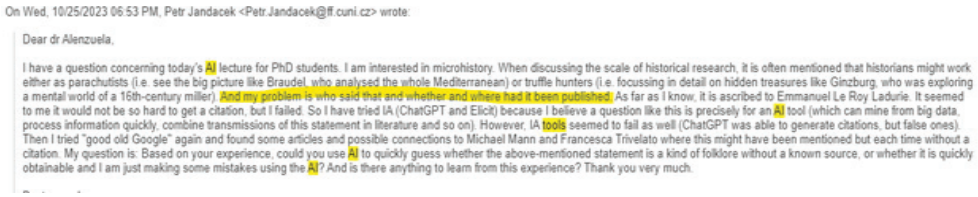
Information Literacy Awareness: As a Starting Point to Building the Initiative

Reflecting on my journey with AI and information literacy, I became aware of AI's significant development as early as 2022 with the launch of ChatGPT. Rather than feeling fear, I was curious. However, due to competing priorities, I did not explore it further until April 2023, when the AI ecosystem expanded significantly. By May 2023, I registered with ChatGPT and began to delve deeper.

I took advantage of an opportunity to learn more by attending an "Introduction to AI in Instruction" session, aware that the presenter was an Instruction Librarian. Her presentation provided valuable insights and introduced various AI tools. Although I may have encountered these tools before, I had never bothered to look into them as my role does not primarily involve instruction. Instead, I am connected to a research institution where scholars are experts in their fields. This experience heightened my awareness of AI's potential and its relevance to my work in information literacy.

Information Literacy and the ACRL Framework

Examining AI tools through the ACRL Framework underscores the need for instruction on their development, ethical use, and specific impacts on students (James, A.B. & Filgo, A.H., 2023). As a researcher and librarian conducting information literacy, the discussion and application of the workshop led to students using AI to find specific topic, seeking guidance from authoritative literature. Their exploration revealed several critical insights about AI tools, which they used in October 2023 (see Image 2). The student discovered that AI-generated citations often suffer from inaccuracies, a phenomenon known as "hallucination," leading to diminished trust in these tools. By comparing AI results with those from Google searches, they demonstrated their ability to evaluate sources and platforms effectively, illustrating the ACRL framework concept of "information as a process."



On Wed, 10/25/2023 06:53 PM, Petr Jandacek <Petr.Jandacek@ff.cuni.cz> wrote:

Dear dr Alenzuela,

I have a question concerning today's AI lecture for PhD students. I am interested in microhistory. When discussing the scale of historical research, it is often mentioned that historians might work either as parachutists (i.e. see the big picture like Braudel, who analysed the whole Mediterranean) or truffle hunters (i.e. focussing in detail on hidden treasures like Ginzburg, who was exploring a mental world of a 16th-century miller). And my problem is who said that and whether and where had it been published. As far as I know, it is ascribed to Emmanuel Le Roy Ladurie. It seemed to me it would not be so hard to get a citation, but I failed. So I have tried IA (ChatGPT and Elicit) because I believe a question like this is precisely for an AI tool (which can mine from big data, process information quickly, combine transmissions of this statement in literature and so on). However, IA tools seemed to fail as well (ChatGPT was able to generate citations, but false ones). Then I tried "good old Google" again and found some articles and possible connections to Michael Mann and Francesca Trivelato where this might have been mentioned but each time without a citation. My question is: Based on your experience, could you use AI to quickly guess whether the above-mentioned statement is a kind of folklore without a known source, or whether it is quickly obtainable and I am just making some mistakes using the AI? And is there anything to learn from this experience? Thank you very much.

Image 2. Conversation about literature search

Moreover, in my discussions with scholars on a separate session for introduction to AI tools, the accuracy of information retrieval, particularly with non-Latin characters like Burmese, Thai and Tibetan, underscored the idea that "information has value." The commitment of OI scholars to ensuring the quality and integrity of information, regardless of its form or origin, reinforced this concept. Their concerns about the credibility of AI-generated content and potential copyright violations highlighted the importance of evaluating information sources critically and considering their ethical implications.

Query 7: (Burmese) History of Burma - မြန်မာ့သမိုင်း		မြန်မာ့သမိုင်း	မြန်မာ့သမိုင်း	မြန်မာ့သမိုင်း
Query 8: Thai ข้อมูลและเอกสารประกอบ (Translation: Information and Documentation)	ข้อมูลและเอกสารประกอบ	ข้อมูลและเอกสารประกอบ	ข้อมูลและเอกสารประกอบ	ข้อมูลและเอกสารประกอบ
Query 9: (Chinese)		정보 및 문서	정보 및 문서	정보 및 문서
Query 10: cultural and religious significance of Tibetan Buddhism ༡། བོད་བཚུན་ནང་བསྟན་ཀྱི་ཚོགས་ཁུགས།	cultural and religious significance of Tibetan Buddhism ༡། བོད་བཚུན་ནང་བསྟན་ཀྱི་ཚོགས་ཁུགས།	Query 10: What is the cultural and religious significance of Tibetan Buddhism in contemporary Tibetan society? ༧། བོད་བཚུན་ནང་བསྟན་ད་ལྟའི་སོང་ཕེའི་སྐྱི་ཚོགས་ནང་ཚོགས་ཁུགས་དང་རིག་གཞུང་གི་ཚོག་ན་གལ་གས་གནད་ཆེ་ཤུགས།	cultural and religious significance of Tibetan Buddhism ༡། བོད་བཚུན་ནང་བསྟན་ཀྱི་ཚོགས་ཁུགས།	cultural and religious significance of Tibetan Buddhism ༡། བོད་བཚུན་ནང་བསྟན་ཀྱི་ཚོགས་ཁུགས།

Image 3. Search queries in various scripts

These experiences emphasized that the value of information encompasses not only its accuracy and reliability but also its ethical and legal dimensions. The student's cautious approach to fully embracing AI assistance demonstrated their understanding of the complexities involved in integrating AI into scholarly work. This reflects a deeper appreciation for the value of information and the importance of meticulous processes in obtaining and verifying it.

AI Literacy

As I mentioned above, I was particularly intrigued by my informal interactions with ChatGPT. While I enjoyed this new way of engaging with technology, I quickly noticed that ChatGPT still had many errors especially when I tried to retrieve academic topics. However, it proved helpful for tasks like sentence construction and casual conversations, and I was amazed at how well it worked in these areas.

Despite its advantages, I had concerns about the credibility of AI-generated content and potential copyright violations. The lack of reliable verification methods made me cautious, leading me to use only the basic features of ChatGPT. This stemmed from the challenge of trusting AI outputs, especially when accuracy and ethical considerations are paramount in academic settings. I continue to explore these tools as I am aware that it will greatly affect the dynamics of finding information as well as how information is processed and shared.

Engaging with AI in this manner has enriched my understanding of scholars' needs. It has highlighted the importance of balancing technological innovation with the integrity of information. This experience has not only enhanced my AI literacy but also underscored the need for ongoing vigilance and critical evaluation when integrating AI tools into academic and research environments. As explained by Lo (2023), acquiring a deeper understanding AI's principles, applications, and ethical considerations involves not just the ability to use AI tools effectively, but also the capacity to evaluate their outputs critically, understand their underlying mechanisms, and contemplate their ethical and societal implications.

Challenges

1. Hallucination and Accuracy: Scholars face significant difficulties in obtaining accurate and reliable information from AI tools like ChatGPT. "Hallucination," where AI generates incorrect or fabricated information, is a major concern (Image 4). This issue is even more problematic in diverse linguistic contexts, where ensuring the quality and integrity of information is crucial. As a librarian involved in promoting information literacy while integrating AI, I have encountered challenges concerning academic integrity. One major hurdle is the issue of "hallucination" in AI-generated content, particularly noticeable in tools like ChatGPT, where inaccuracies or fabrications arise. Similarly, the same observation where frequent problem of providing plausible-sounding but false information or “confabulation” was found by Boehme, et al. (2023). This challenge becomes even more pronounced

in linguistically diverse environments, where ensuring information quality and integrity is paramount.

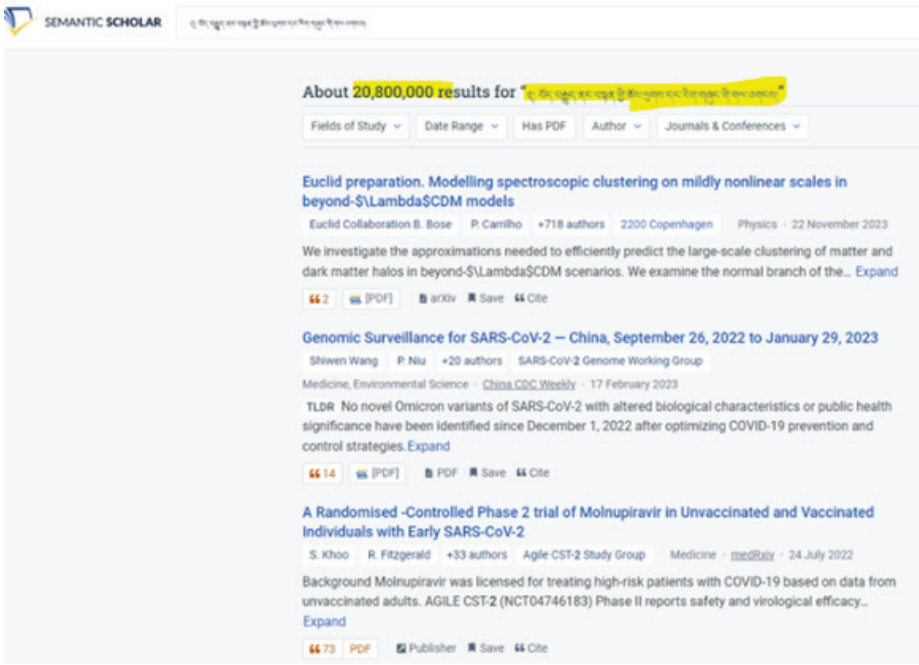


Image 4. Hallucination or confabulation - Search in Tibetan script with irrelevant hits

2. Evolving Nature of Information Creation: The use of AI in information creation is constantly evolving. For example, the idea of using ChatGPT as a co-author showed an interest in collaborative possibilities with AI of some scholars. He is even willing to subscribe for a paid version; however, when I presented the rapid changes in these AI platforms, the interest waned as it posed a risk for inconsistency that might affect his output. Established researchers cannot take such risk.

3. Copyright and Credibility: The potential for copyright violations and credibility issues due to the lack of verification methods remains a significant concern. These challenges make it difficult to fully trust AI-generated content, leading users to rely on basic features and approach AI tools with caution.

4. Error Rates: Persistent errors in AI outputs, especially in academic contexts, further challenge the reliability of tools like ChatGPT. In the early workshops the errors they have observed discoraged them to rely on AI's ability to support research and maintain integrity.

The evolving role of AI in information creation, exemplified by discussions around AI co-authorship, reflects a shifting landscape in knowledge production. While this presents exciting collaborative opportunities, it also necessitates a careful balance to uphold academic rigor and integrity. This uncertainty makes it challenging to fully

trust AI outputs, leading users like myself to exercise caution and rely on basic features rather than fully embracing AI capabilities. Additionally, persistent errors in AI tools, particularly in academic contexts, further erode trust in their reliability. These errors undermine the effectiveness of AI support in research and pose significant obstacles to maintaining research integrity.

Lessons and Insights

From both experiences, we used similar tools like ChatGPT and other AI-driven research assistants such as Research Rabbit, Elicit, etc. Apparently, the level of processing and instructional delivery varied as we have different types of libraries. One thing conclusive in our narratives is that the integration of AI in academic contexts necessitates a careful balance to ensure the integrity, accessibility, and quality of information. The integration of AI tools like ChatGPT in academic settings raises significant challenges related to information literacy, AI literacy, and academic integrity. "Hallucination," where AI generates inaccurate or fabricated information, is a major concern, especially in diverse linguistic contexts where maintaining information quality is critical. Moreover, biases against languages and ethnicities become obvious for users that are coming from diverse backgrounds. As librarians, we need to pay special attention to issues concerning academic integrity due to these inaccuracies and biases, which are exacerbated by the evolving nature of AI and its potential for inconsistent outputs. The risk of copyright violations and credibility issues further complicates the trustworthiness of AI-generated content. Despite the benefits of using AI tools for collaborative possibilities, persistent errors have discouraged reliance on them for research. The digital divide is also a concern, as access to reliable AI tools often requires subscriptions, which may not be feasible for all students.

We acknowledge this issue and emphasize the importance of teaching students to critically evaluate AI-generated content as AI literacy involves the acquisition of learner competencies based on learning functional, social, and technical literacy (Yi, 2021). Facing difficulties ensuring academic integrity we address the risks associated with AI-generated information by incorporating lessons on intellectual property, citation, and the importance of verification. We recommend a cautious approach, using AI tools as supplementary aids rather than primary sources, and we strive to promote free AI tools to ensure equitable access for all students. Prioritizing tools that respect user privacy and are accessible without financial barriers, we are committed to educating our community about both the potential and pitfalls of AI technology, achieving a balanced integration of AI in academic contexts.

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MANAGING WORK EXPERIENCE LEARNING IN INFORMATION SCIENCE UNDERGRADUATE PROGRAMS IN THAILAND

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Introduction

The world of labor markets is rapidly evolving due to the intersection of growth, geoeconomics, sustainability, and technology. In this context, practice-based education is customarily seen as a field for educational activities that combine theoretical knowledge with practical experience through collaboration between higher education institutions and the working world (Sunnemark et al., 2023). Extensive research has shown that work-integrated education is crucial for helping students learn theory and apply their academic and technical knowledge in work environments. Employers are responsible for providing practical skills and evaluating students' capabilities in the workplace (Billett & Valencia Forrester, 2020; Murtazin, Shvets & Piho, 2020). Thus, work experience learning encompasses terms such as work-integrated education (WIE), work-integrated learning (WIL), work-based learning (WBL), cooperative education, clinical placements, service learning, and internships (Bowen, 2020; Dorland et al., 2020). However, for common usage in this article, the term work experience learning refers to the broader concept of WIE, WIL, and WBL.

Work experience learning (WEL) is key to lifelong learning and skills development, which is crucial in a wide range of emerging global economies (Tikkanen, Liv, & Støren, 2018). Thai higher education institutions are proactively addressing this by enhancing students' employability through various strategies aimed at strengthening the WEL system. The Ministry of Higher Education, Science, Research and Innovation, Thailand (MHESRI) emphasized in 2023 the growing importance of work experience within cooperative and work-integrated education. Tuononen et al. (2016) found that working while studying is related to academic success, approaches to learning, and the nature of the work experience. Their research showed that WEL is linked to study success, effective learning approaches, and organized study habits, all of which are crucial for academic progress and achievement. By integrating WEL into academic programs, learners can effectively navigate transitions, maintain employability, and

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enhance their professional skills, contributing to lifelong education and development. Learning through WEL, both within and outside the curriculum, allows learners to gain practical experience, supporting the development of both soft and hard skills. These skills are essential for securing employment and achieving success in the workplace (Makhathini, 2016; Moalosi et al., 2022).

Presently, WEL is emerging as a foundation of workplace-based learning, particularly in the context of practical fieldwork experiences (Mayombe, 2023). For instance, within the domain of library and information science (LIS) curriculum, there is a focus on providing fieldwork courses that offer practical experience in library settings. The structural design of these courses necessitates close collaboration between academic institutions and practical locations. Such hands-on experiences have proven invaluable in bridging the gap between theoretical knowledge and practical application within LIS training programs. Understanding the features of curriculum design and pedagogical practices within WEL programs is crucial for undergraduate students in Information Science, Information Studies, or Library programs at universities, as these experiences directly shape their fieldwork encounters. In recent years, there has been a notable increase in attention towards practicum programs within information science research. For instance, a study by Cha and Bae (2020) explored strategies to enhance the efficacy and satisfaction of fieldwork courses for LIS students, practicum agencies, and academic institutions. Their findings suggest that improving the structure of practicum experiences can lead to greater satisfaction among participants and ultimately enhance the effectiveness of LIS programs.

This article is part of the research on developing a WEL model for undergraduate programs in information science in Thailand. It aims to investigate the current status of WEL course offerings and their management, with a specific focus on students' fieldwork experiences. The term 'Information Science (IS)' in this study encompasses programs offering bachelor's degrees in information science, information studies, and library and information science. According to a preliminary survey by the researchers, there are currently 15 universities in Thailand that offer bachelor's degree programs in LIS, covering information science, information studies, and library and information science. However, due to decreasing enrollment numbers, some universities have only a small number of students, leading to program postponements or closures. Therefore, ten universities currently managing full IS programs were selected for this study.

The findings of this study would detail the WEL course offerings, including course titles, number of credits, expected learning outcomes, course plans, and practice schemes. Additionally, the study will examine course management aspects, such as the process of workplace selection, student preparation, roles and responsibilities of students, lecturers, and workplaces, and student evaluation. This information would benefit IS program managers and educators by providing insight into how WEL courses are managed in IS undergraduate programs. Furthermore, the study will serve as baseline data for future research on developing a WEL model for IS undergraduate programs in

Thailand. More in-depth studies will be conducted involving all stakeholders in the WEL framework, including students, lecturers, workplace staff, and program managers.

Literature review

Work experiential learning

Work Experience Learning (WEL) is an experiential education approach that combines instruction in critical workplace skills. Many education scholars in Thailand have defined similar concepts, such as Cooperative and Work Integrated Education (CWIE) (WACE, 2024), encompassing practicum, post-course, and internship experiences (Cooper, Orrell, & Bowden, 2010). Additionally, it is important to understand the process of creating and designing new experiential learning environments based on lifelong learning principles. Current instructional design models effectively integrate actual work experience learning both within the curriculum and through extracurricular activities. This process helps learners gain practical experience, supporting the development of both soft and hard skills for graduates entering the job market and succeeding in the workplace (Radović, Hummel, & Vermeulen, 2023; Makhathini, 2016; Moalosi et al., 2022).

WEL integrates theoretical learning and practical training by combining formal education with hands-on experiences. This approach allows students to study in higher education institutions while simultaneously gaining real-world experience in workplaces through productive work (MHESRI, 2023; Cooper, Orrell, & Bowden, 2010). The characteristics of WEL (Mayombe, 2023; MHESRI, 2023; Seow, Pan, & Koh, 2019; Makhathini, 2016) include:

University and Workplace Collaboration: This collaboration aims to produce graduates with competencies that are ready for the workforce. The partnership ensures alignment with current and future job market demands. Additionally, workplaces actively participate in designing university curricula, ensuring that the education provided is relevant and practical.

Competency-based Education: This approach focuses on developing specific skills and abilities, emphasizing problem-solving. It includes systematic assessment and evaluation of competency levels, with students being evaluated based on their ability to demonstrate the required competencies effectively.

Work Experiential Learning: This involves gaining real-world work experience and assessing actual work performance. It includes creating learning processes within the workplace, allowing students to acquire practical knowledge and skills directly related to their field of study.

Project-based Learning: This approach integrates theoretical knowledge with practical application, addressing organizational challenges in relevant areas. Universities and workplaces collaborate to provide guidance and jointly assess the teaching and learning outcomes based on students' competencies and the learning outcomes achieved.

Type of work experience learning

WEL takes various forms, including research studies, internships, cooperative education, community service work, employment in enterprises, or professional experience training (Kramer & Usher, 2011). WEL is designed by higher education institutions to ensure alignment between workplace experiences and the academic curriculum. This alignment is crucial for producing graduates who are well-equipped with both theoretical knowledge and practical skills, enhancing their readiness for the future job market.

The Announcement of the Higher Education Standards Committee on Criteria and Guidelines to Promote Cooperative and Work-Integrated Education Programs, 2022 outlines guidelines for promoting cooperative education and work-integrated education (CWIE) programs. These guidelines are part of the CWIE platform and are included in higher education plans for producing and developing the nation's workforce for 2021–2027. Experiential learning can take many forms and occur both inside and outside the classroom. Types of work experiential learning students may encounter include (Dewi & Velasquez, 2023; MHESRI, 2023):

1. Apprenticeships are a mixed approach that combines academic instruction at higher education institutions with hands-on training in a real workplace setting. Students spend part of their time learning theoretical concepts at their university and the other part applying those concepts in an industrial environment.
2. Cooperative education organizes learning in a separate manner. Students complete their theoretical studies at the higher education institution according to the prescribed curriculum. After finishing their academic requirements, they then proceed to work in a business or industrial setting for a specified period, gaining practical experience.
3. Internships and traineeships are structured as parallel learning experiences. This approach allows students to simultaneously engage in academic studies at their higher education institution while also working in a professional setting throughout the duration of their program. This concurrent learning model ensures that students gain continuous practical experience alongside their academic education.
4. Service-learning is service learning that is distinguished by being mutually beneficial for both students and the community. Service-learning is growing rapidly and is considered a part of experiential education by its very nature of learning, performing a job within the community, and serious reflection by the student. Service-learning involves
5. Professional work placements provide students with practical experience in professional environments like libraries, museums, and similar institutions. These opportunities enable students to apply their academic knowledge in real-world contexts, enhancing their skills and expertise in their specific fields through direct practice and professional involvement.

Benefits of WEL

There are many benefits of WEL, which we outline below before exploring how they can be integrated into the learning experience (Sonia, Campbell, & Zegwaard, 2014; Cooper, Orrell, & Bowden, 2010):

Institutional Benefits

- Alignment with Labor Market Demands: Educational institutions can adapt their educational and experiential learning frameworks to align with current labor market demands, particularly in fields like Library and Information Science.
- Industry-Relevant Graduates: This adaptation ensures that graduates are equipped with practical skills and knowledge that meet industry needs.
- Demonstrable Learning Outcomes: Institutions deliver learning outcomes that are valuable for advanced education or certification in higher educational institutions.

Student Benefits

- Personal Development: Students undergo personal growth by acquiring knowledge and skills, fostering a well-rounded personality.
- Professional Development: They gain specialized knowledge and practical skills, preparing them for their chosen careers.
- Employability Skills: Institutions equip students with skills that enhance their employability, making them competitive candidates in the job market.

Placement Benefits

- High-Quality Outputs: Graduates are capable of delivering high-quality work that meets industry standards and contributes effectively to organizational goals.
- Fit-for-Purpose Employees: Employers gain access to skilled professionals who possess the exact competencies required for their roles, reducing training costs and enhancing productivity.

As highlighted, WEL and curriculum are intricately linked concepts that play a crucial role in education and professional development. WEL curricula need to explicitly address this expanded agenda and clearly communicate it to all stakeholders (Dali & Caidi, 2022; Fleming & Haigh, 2017). Billett (2024) noted that experiential learning design extends beyond personal employability; it also impacts the viability of organizations and communities, and meets the needs of nations. Additionally, Berndtsson, Dahlborg, and Pennbrant (2020) specify in an integrative literature review that the three most effective strategies for bridging theory and practice are collaboration between academic lecturers and industry supervisors, a variety of teaching modalities, and strong supervisor support. Consequently, Moalosi et al. (2022) emphasize that work experience programs in higher education institutions should focus on global experience, aligning teaching and learning with future job skills and work readiness competencies.

A recent study of WEL plays a crucial role in information science education, bridging the gap between theoretical knowledge and practical application. The idea

of Gadagin (2012) suggested the role that workplace learning plays in the continuing education of LIS professionals, how they should go for workplace learning, what they have to learn, the necessity and the conditions of workplace learning. Based on this article, we discussed the challenges of WEL need more study and research for the information science program as recently added by Dali and Caidi (2022). Additionally, Keating (2020) explored the curriculum design that are being used in the further education and training sector to deliver careers through the work experience module. The findings confirmed that it is not enough to pass on career related information only. A specific career must be delivered by a more knowledgeable person to help the learner develop the skills and abilities needed to construct their own career knowledge when participating in activities and interacting with people. Reflection and discussion need to be part of this process to interpret these experiences and apply their learning to future career decision making. Then, by recognizing the significance of WEL within one's personal curriculum, individuals can better navigate transitions, sustain employability, and enhance their professional capabilities, ultimately contributing to their lifelong education and development.

Research method

This research uses a quantitative method to gain the understanding of management of WEL course in Information Science undergraduate programs in Thailand. The research design primarily adopts a quantitative approach to achieve its objectives.

Participants

According to the National Standards for Undergraduate Curriculum, 2022, five permanent program administrators and lecturers are required to offer the program in the higher institution. This study involved 10 undergraduate programs in information science in Thailand, therefore 50 lecturers (program administrators and lecturers) were selected to be the study participants.

Research tool

The research employed a questionnaire as its primary tool, structured into three main sections: (1) demographic information; (2) WEL course information, and (3) WEL course management. The questionnaire was designed based on the literature review of the management of WEL.

Data collection and analysis

The survey questionnaire was meticulously crafted using the Google Forms platform, ensuring a user-friendly and accessible interface for respondents. The data collection phase spanned in April 2024. As a result, a total of 31 lecturers (62%) valid returned questionnaires were obtained from participants respectively. The dataset was subjected to a thorough analysis utilizing various statistical methodologies. These included the frequencies, enabling a comprehensive examination of the prevalence of different responses within the dataset. Furthermore, key descriptive statistics, such as mean and

standard deviation (S.D.), were calculated to provide a nuanced understanding of the central tendencies and variability of the responses, facilitating a comprehensive and detailed interpretation of the collected data.

Finding and discussion

Demographic information

The demographic data presented in Table 1 illustrates the distribution of teaching experiences and educational backgrounds among the respondents, who constitute 31 (62%) lecturers from Information Science (IS) undergraduate programs in Thailand. The analysis of the respondents' demographics indicates an even distribution across two main categories. Specifically, 35.48% participants reported having more than 15 years of teaching experience, with educational qualifications including a master's degree (16.13%) and doctoral degree (19.35%). Additionally, 25.81% of the participants indicated having between 11 to 15 years of teaching experience, with qualifications ranging from a bachelor's degree (3.23%), master's degree (6.45%), to doctoral degree (16.13%). Similarly, 19.35% reported having between 1 to 5 years of teaching experience, with master's degree (9.68%) and doctoral degree (9.68%) qualifications, as well as 6 to 10 years of teaching experience, where doctoral degree holders accounted for 19.35%. This balanced distribution suggests a representation of both early-career and mid-career educators among the respondents. In terms of educational attainment, the majority of respondents hold doctoral degrees (64.52%), followed by master's degrees (32.26%).

Table 1. Demographic information of the respondents: Teaching experiences and educational degree

Teaching experiences	Education degree			Total
	Bachelor's	Master's	Doctoral	
1-5 years	-	-	6 (19.35%)	6 (19.35%)
6 -10 years	-	3 (9.68%)	3 (9.68%)	6 (19.35%)
11 – 15 years	1 (3.23%)	2 (6.45%)	5 (16.13%)	8 (25.81%)
>15 years	-	5 (16.13%)	6 (19.35%)	11 (35.48%)
Total	1 (3.23%)	10 (32.26 %)	20 (64.52%)	31 (100.00%)

In Table 2, the survey included a series of closed questions aimed at gathering demographic data about roles and experiences of the respondents in WEL course involvement. The breakdown of roles and experience representation among the respondents shows that lecturers alone constitute the largest group, with ten individuals (32.26%). Among them, 19.35% have 1-5 years of experience, and 12.90% have over 10 years of experience. Emerging roles such as program lecturers and WEL course lecturers are also well-represented, totaling nine individuals (29.03%), with significant experience spread across 1-5 years (12.90%), 6-10 years (12.90%), and over 10 years (3.23%). Furthermore, the table highlights a substantial representation among those combining roles as program administrators, lecturers, and WEL course lecturers, totaling seven individuals (22.58%). This group includes individuals with less than 1 year (6.45%), 1-5 years (6.45%), and over 10 years (9.68%) of experience, respectively.

Overall, the distribution of experience levels among staff involved in WEL courses is as follows: individuals with less than 1 year of experience account for 6.45%, those with 1-5 years constitute 29.03%, individuals with 6-10 years make up 22.58%, and those with over 10 years of experience comprise 29.03%. This balanced mix ensures a diverse range of perspectives and expertise among those responsible for managing WEL courses.

Table 2. Demographic information of the respondents: Roles & experiences of the respondents in WEL course

Roles in WEL course	Experience in WEL course (years)				
	<1	1 – 5	6 – 10	>10	Total
Program administrator and lecturer	-	-	1 (3.23%)	-	1 (3.23%)
Program administrator, lecturer, and WEL course lecturer	2 (6.45%)	2 (6.45%)	-	3 (9.68%)	7 (22.58%)
Program administrator and WEL course lecturer	-	-	1 (3.23%)	-	1 (3.23%)
Program lecturer	-	1 (3.23%)	1 (3.23%)	1 (3.23%)	3 (9.68%)
Program lecturer and WEL course lecturer	-	4 (12.90%)	4 (12.90%)	1 (3.23%)	9 (29.03%)
WEL course lecturer	-	6 (19.35%)	-	4 (12.90%)	10 (32.26%)
Total	2 (6.45%)	13 (29.03%)	7 (22.58%)	9 (29.03%)	31 (100.00%)

WEL course information

This study focuses on the WEL course in the IS undergraduate programs in Thailand, with a specific emphasis on shaping fieldwork experiences. Table 3 shows the WEL course information found in the IS undergraduate programs which includes course title, course credits, course learning outcomes defining, study system, and type of WEL applications.

The titles of WEL courses vary, including "Professional Practicum" (22.58%), "Work Integrated Learning" (25.81%), "Cooperative Education for the Professions" (22.58%), and “Professional Practical Experiences (9.68%). Course credits range from 3 credits (16.13%), 6 credits (51.61%), 12 credits (6.45%) and 18 credits (16.13%), adhering to the Standards for Undergraduate Studies Program, B.E. 2565 (CHES, 2022), which requires at least 3-6 credits for fieldwork experiences. Notably, some programs emphasize work experience learning significantly, requiring 18 credits for the course.

Regarding the definition of WEL course learning outcomes, 70.96% of respondents indicated that these are defined according to the educational plan for work-integrated learning experiences that align with accreditation standards in the program or discipline. Additionally, 61.29% stated that outcomes are defined according to Program Learning Outcomes (PLO), covering Knowledge (K), Skills (S), and Attitudes (A) based on a competency-based approach.

The study system for WEL courses is conducted under a semester system (35.48%), which is the regular format for most universities in Thailand, a dual system (29.03%)—combining university and workplace learning during the study period—an innovative approach, a modular system with a practical package comprised of multiset of skills (25.81%), and a blocked course like an intensive training program (12.90%).

Finally, the types of WEL include Apprenticeships/Industrial Training (29.03%), Cooperative Education (29.03%), Internships/Traineeships (35.48%), and Professional Work Placements (45.16%).

The findings presented in this section emphasize the design of WEL course tailored for undergraduate students in Information Science. The data highlights various course tiles and defines objectives or learning outcomes aligned with educational plans for work-integrated learning. These outcomes adhere to accreditation standards in the program or discipline and are specified based on program learning outcomes (PLO), covering knowledge (K), skills (S), and personal attitudes (A) using a competency-based approach. The findings have similar results found in Khampirat (2021) which expressed the relationships among work-integrated learning, learning strategies, institutional commitments, skill self-efficacy, career expectations, lifelong learning skills, achievement goal orientation, and learning outcomes.

Table 3. WEL course information in IS undergraduate programs in Thailand

WEL course information		Responses (Total N = 31)
1.	***Course title***	
1.1	Professional Practicum	7 (22.58%)
1.2	Work Integrated Learning	8 (25.81%)
1.3	Cooperative Education for Information Professions	7 (22.58%)
1.4	Professional Practical Experiences	3 (9.68%)
2	***Course credits (Number)***	
2.1	3 credits	5 (16.13%)
2.2	6 credits	16 (51.61%)
2.3	12 credits	2 (6.45%)
2.4	18 credits	5 (16.13%)
3.	***Learning outcomes defining***	
3.1	Define according to the PLO (Program Learning Outcomes) covering K: Knowledge, S: Skill, A: Attitude based on the Competency-based approach	19 (61.29%)
3.2	Defined according to the educational plan for work-integrated learning experience that aligns with the accreditation standards in the program/discipline of the curriculum	22 (70.96%)
4.	***Study system/mode***	
4.1	Semester system	11 (35.48%)
4.2	Dual system (University + Workplace)	9 (29.03%)
4.3	Modular system	8 (25.81%)
4.4	Blocked course	4 (12.90%)

5.	*Type of WEL applications*	
5.1	Apprenticeships (Industrial Training)	9 (29.03%)
5.2	Cooperative education	9 (29.03%)
5.3	Internships/ Traineeship	11 (35.48%)
5.4	Professional Work Placements	14 (45.16%)

WEL course management

The study on the management of WEL courses in the IS undergraduate program encompassed several key aspects: workplace selection, types of workplaces, student preparation, roles and responsibilities of students and lecturers, workplace support, and student evaluation. Respondents were asked to rate their level of management or practice in each aspect using a five-point Likert scale, ranging from 5 (very high level) to 1 (very low level). The analysis of the data, including mean and standard deviation, is presented in Table 4.

Data analysis indicates that the management of WEL courses is conducted at a high level (mean above 3.50) for nearly all items. Regarding workplaces for WEL, it was found that most programs allow students to select their WEL workplaces based on their own interests under the program's criteria ($\bar{x}$=4.54), or from a list of networks or partners provided by the programs ($\bar{x}$=4.48). The selection of WEL workplaces by the program itself is conducted at moderate level ($\bar{x}$=2.87). Interestingly, the types of WEL workplaces tend to be private organizations with key functions in data or information management ($\bar{x}$=4.35), followed by academic libraries, both public and private ($\bar{x}$=3.90). This reflects a shift in IS programs in Thailand towards preparing IS professionals for the private sector, while the prevalence of library-based organizations is decreasing. Studies on the job market and career opportunities for information professionals also highlight the challenges of employability in other sectors, such as publishing, private companies, and non-library organizations, as potential future workplaces, as well as job positions beyond librarians (Australian Library and Information Association, 2014; Dukic, 2017; Khajuria & Kumari, 2023).

In the WEL program, students take all roles at a high level, including practice in the workplace as if she/her were an employee, in a position that matches his/her knowledge and skills ($\bar{x}$=4.70), follow the rules and regulations of the workplace and the guidelines of the educational institution ($\bar{x}$=4.77), take responsibility for regular duties as well as assigned tasks that are appropriate to his/her knowledge and skills ($\bar{x}$=4.74), and prepare project report/training report and share report in a course final seminar ($\bar{x}$=4.96). Only the role on development a project in collaboration with the workplace trainers is found at moderate level ($\bar{x}$=4.35). In order take such the roles, students are prepared to have essential knowledge and skills before going out to the workplace. The student preparations include develop students' knowledge and skills necessary for practical work training before they begin their training ($\bar{x}$=4.70), promoting the development of social skills (soft skills) throughout the program for students from their first year ($\bar{x}$=4.51), preparing manuals and pre-training preparation documents for students before they

begin practical work training ($\bar{x}$=4.58), providing training for students on preparation guidelines before starting practical work training, such as the use of necessary tools for work, preparation of documents required for training applications (Resume, CV, Portfolio), and personality development training ($\bar{x}$=4.80), and surveying/evaluating the training sites and job positions before approving students' participation in the training ($\bar{x}$=4.54).

The lecturer's roles include the following aspects: serve as an advisor for practical training and project work ($\bar{x}$=4.61), provide guidance and supervision to students under their responsibility ($\bar{x}$=4.87), provide general consultation and advice to students on various topics, such as matters related to their personal life, professional etiquette during the practicum, and other relevant issues as requested by the students ($\bar{x}$=4.83), and provide guidance to students about procedures for the work experience learning practice, including monitoring their progress and assisting with the necessary documentation, in accordance with the regulations and guidelines set by the program or the university ($\bar{x}$=4.83). This finding is supported by Martin et al (2019) who explained that supervisors and mentors can establish clear expectations, offer guidance, and prioritize professional development in management, communication, and leadership. Then, students can prepare by being receptive to feedback, showing initiative in their work, and demonstrating a willingness to learn and grow during the work experience. The benefit from lecturer's guidance creating an enabling environment for learning, gaining confidence, and building relationships for the students with supervisors (Khan, Qayyum, & Mahony, 2022).

Fostering a collaborative climate between labor market stakeholders and educational institutions is essential and should focus on long-term initiatives related to educational partnerships in general and work integrated learning in particular (Snis et al., 2023). In this study it was found that collaboration between the study program and the workplace is important and conducted at a high to very high level. This includes the following aspects: maintaining good interactions with organizations that provide work experience learning for students, both at the institutional level and the interpersonal level ($\bar{x}$=4.41), encouraging student and organization participation in managing work experience learning throughout the course, including before, during, and after the work experience ($\bar{x}$=4.09), preparing manuals and guidelines for managing student work experience learning for employers/mentors/agencies that host students ($\bar{x}$=4.09), and promoting formal collaborations, such as MOUs or agreements, between universities/ faculties/ departments and employers/agencies that accept students ($\bar{x}$=3.70). According to Snis et al. (2023), in addition to the above findings, the issues of integration of theory and practice, reflection and meeting places, quality development, relationship support in contact with collaboration partners, involving both student-centered and business-integrated learning, process-oriented and activity-driven are also important.

Finally, the evaluation of the WEL course in different dimensions by all stakeholders was also found very important and conducted at a very high level,

including evaluation of student training by the program committee and the workplaces ($\bar{x}$=4.87), evaluation of student behavior by the advisor and the workplace (trainers) ($\bar{x}$=4.70), and evaluation of the students' projects by the advisors and the workplace (trainers) ($\bar{x}$=4.54). The following evaluation processes are conducted at a high level: evaluation of the workplaces by the program committee and the students ($\bar{x}$=4.45), and evaluation of the WEL program by the workplaces and the students ($\bar{x}$=4.41). The study of Venville, Lynch, and Santhanan (2018) also suggested that a systematic approach by using a survey instrument can effectively receive feedback from students on worked integrated learning program. In some cases, the workplace supervisors are expected to hold regular one on one meetings to provide general feedback and provide a variety of projects/position responsibilities to ensure an enriching experience and exposure to a range of areas. (Stirling, et al, 2016; Stevenson & Hannaford, 2019)

The results presented in this section provide insight into the management of WEL courses specifically tailored for undergraduate students in information science. The data shows higher average scores across all aspects. The findings highlight WEL procedures focusing on the organizational aspect, where students select work experience locations within the WEL program's network or partnerships, particularly in the private sector, to work on data, information, and knowledge-related projects. The management procedures of stakeholders and workplace promotion within WEL programs emphasize positive interactions with businesses that offer work experience opportunities for students at both the agency and individual levels. Students are prepared with the necessary skills and knowledge for practical work experience. Additionally, lecturers provide guidance and supervision, including site visits to monitor progress. The frequency of supervision depends on the type of practical experience. The program committee, lecturers, and workplaces evaluate student training through project reports and assignments from companies. According to Kligyte et al. (2023) and Arquero-Avilés, Marco-Cuenca, & Siso-Calvo (2019), students experienced a variety of information tasks during their work experience projects. The program is designed to enhance their personal and professional competencies, thus improving the employability of library science students. Students characterized job market needs based on their professional experiences, noting that work experience program design enhances student engagement through authentic industry practices and positively impacts student retention rates in higher education.

Table 4. Management WEL course in the IS undergraduate programs in Thailand

	WEL course management	$\bar{x}$	S.D.
1	Workplaces for WEL		
1.1	Workplace selection		
1.1.1	Students select the workplace on their own interests under the program criteria.	4.54	0.567
1.1.2	Students select the workplace from the list of networks or partners of the program.	4.48	0.889

1.1.3	The program selects the workplace for students.	2.87	1.408
2	Types of workplaces		
2.1	Academic public or private libraries.	3.90	1.398
2.2	Private organizations with have key functions on data or information management.	4.35	1.170
2.3	Public organizations with have key functions on data or information management.	3.67	1.423
2.4	State enterprises with have key functions on data or information management.	3.48	1.434
3.	Roles of students		
3.1	Practice in the workplace as if she/her were an employee, in a position that matches his/her knowledge and skills.	4.70	0.461
3.2	Follow the rules and regulations of the workplace and the guidelines of the educational institution.	4.77	0.425
3.3	Take responsibility for regular duties as well as assigned tasks that are appropriate to his/her knowledge and skills.	4.74	0.444
3.4	Develop a project in collaboration with the workplace trainers.	4.35	0.914
3.5	Prepare project report/training report and share report in a course final seminar.	4.96	0.179
4.	Student preparation		
4.1	Develop students' knowledge and skills necessary for practical work training before they begin their training.	4.70	0.588
4.2	Promote the development of social skills (soft skills) throughout the program for students from their first year.	4.51	0.724
4.3	Prepare manuals and pre-training preparation documents for students before they begin practical work training.	4.58	0.958
4.4	Provide training for students on preparation guidelines before starting practical work training, such as the use of necessary tools for work, preparation of documents required for training applications (Resume, CV, Portfolio), and personality development training.	4.80	0.401
4.5	Survey/evaluate training sites and job positions before approving students' participation in the training.	4.54	0.675
5.	Roles of Lecturers		
5.1	Serve as an advisor for practical training and project work.	4.61	0.954
5.2	Provide guidance and supervision to students under their responsibility	4.87	0.340
5.3	Provide general consultation and advice to students on various topics, such as matters related to their personal life, professional etiquette during the practicum, and other relevant issues as requested by the students	4.83	0.454
5.4	Provide guidance to students about procedures for the work experience learning practice, including monitoring their progress and assisting with the necessary documentation, in accordance with the regulations and guidelines set by the program or the university.	4.83	0.373
6.	Study program and the workplace collaborations		

6.1	Maintain good interactions with organizations that provide work experience learning for students, both at the institutional level (Macro) and the interpersonal level (Micro).	4.41	0.672
6.2	Encourage student and organization participation in managing work experience learning throughout the course, including before, during, and after the work experience.	4.09	1.247
6.3	Support the collection of data to survey the needs and satisfaction of students before and after the work experience within the course.	3.08	1.376
6.4	Ensure that the study program and organizations are involved in developing and designing the work experience curriculum.	3.08	1.249
6.5	Promote formal collaborations, such as MOUs or agreements, between universities/faculties/departments and employers/ agencies that accept students.	3.70	1.657
6.6	Prepare manuals and guidelines for managing student work experience learning for employers/mentors/agencies that host students.	4.09	1.578
7.	Evaluation of WEL program		
7.1	Evaluate the workplaces by the program committee and the students.	4.45	0.888
7.2	Evaluate the WEL program by the workplaces and the students.	4.41	1.057
7.3	Evaluation of student training by the program committee and the workplaces.	4.87	0.340
7.4	Evaluate the students' projects by the advisors and the workplace (trainers).	4.54	1.090
7.5	Evaluate student behavior by the advisor and the workplace (trainers).	4.70	0.972

Conclusion

This paper initially focuses on the WEL course offering and managing for undergraduate students in Information Science, Information Studies, or Library and Information Science programs at universities in Thailand, with a specific emphasis on shaping fieldwork experiences. The development of WEL programs in the information science curriculum involves creating valuable learning opportunities for students by bridging academia and the technology industry, emphasizing real-world experiences and practical projects. The data highlights the course information and management procedures for WEL programs, helping to align academic objectives with stakeholder expectations. This alignment enables program and curriculum committees to effectively map skills for reskilling and upskilling new graduates as they enter the job market.

The paper emphasizes that universal soft skills are essential for all employers, regardless of the candidates' study program. The results highlight WEL placements that focus on data, information, and knowledge management, where students select opportunities within the network or partnerships provided by the university program. Additionally, this research offers valuable insights for managing WEL in undergraduate Information Science programs. Future research is essential to further develop WEL instructional design and management that align with labor market demands and enhance

effectiveness. Moreover, it is important to study perspectives from all stakeholders who are involved with WEL program including the workplace employers and trainers, students, lectures, and program administrators on the other aspects, such as teaching and learning approaches, and factors influences the success of WEL program management..

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MASSIVE OPEN ONLINE COURSES (MOOCS) AND LIBRARIES: OPPORTUNITIES OR PERSISTING CHALLENGES FOR SURVIVAL

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Introduction

Although remote learning and online learning have been around for a while, a lot of experts concur that Massive Open Online Courses, or MOOCs, have been crucial in changing higher education by offering new and creative ways to learn (Zhang et al., 2019). The European Association of Distance Teaching Institutions (EADTU) released a research in 2017 (Jansen & Konings) states that while the number of higher education institutions offering MOOCs is continuously rising, the proportion of students choosing to enroll in these courses in Europe is far greater than in the US. Similar to MOOCs with a western focus, Asian nations like China and India have demonstrated a strong interest in this technology in recent years. 'SWAYAM' and 'Xuetang X' might be the best examples. Millions of students are studying on the 'SWAYAM' MOOC platform in India, while 'Xuetang X', a Chinese platform, has grown to become one of the biggest MOOC platforms globally. According to global class central estimates, 110 million people participated in MOOCs globally in 2019 (Shah, 2019). 'SWAYAM' courses are selected twice a year (2019) by 1000 colleges in India, and all of them offer credit for the next term. (Mendez, 2019).

Without a doubt, MOOC's widespread visibility aided in the democratization of education; in a nation like India, the MOOC culture has greatly increased optimism for the underprivileged community that lacks access to formal education. The influence of MOOCs is increasingly being contrasted with traditional face-to-face education due to their prevalence and relevance in the massification of higher education. While traditional education does not address these issues comprehensively, it is generally prepared to address issues like employability and soft skills. In contrast, MOOCs have not yet made a significant impact on the skills gap, student acquisition tendencies, retention rates, and mismatch in graduation skills. The advent of MOOCs means change not only for the ways universities operate, but also the function of other stake holders like academic libraries.

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Academic libraries and MOOCs have yet to be examined together in the literature. The majority of published papers on this subject, according to the literature study, have focused on problems with copyright and licencing, open educational resources (OERs), creating new courses, and legislative challenges. Advances in information and technology have led to increased rivalry for academic libraries. They are exerting more effort to maintain their standing as a reliable source of information in academic societies (Iwu-James et al., 2020). The top leadership of universities no longer sees academic libraries as the hub of the institution because academic and research materials can be obtained elsewhere (Cox, 2018). Osman and Ahlijah's 2021 study examined the importance of university libraries in the contemporary day. They found that users' expectations of academic libraries have changed and that libraries' traditional roles need to change to meet users' new ways of learning.

It is essential to comprehend the implications of MOOCs for academic libraries. If MOOCs are to transform higher education, they will undoubtedly have a significant impact on libraries' operations and role in the future of learning. The paper will try to find out the gap among MOOCs and academic libraries. The paper will also highlight the most recent developments in MOOCs along with its unique benefits and features, as well as the opportunities and challenges they present for academic libraries.

Literature Review on MOOCs

MOOCs are large-scale online courses that are accessible to everyone with an Internet connection from anywhere, are available to all individuals without entry requirements, and provide a full online course experience at no cost (Mulder & Jansen, 2015). It all began in 2011 when a few highly regarded Stanford academics made their courses available online for free. Their goal was to provide everyone with access to high-quality education wherever they were. With the launch of numerous websites like Coursera and EdX, 2012 was dubbed the New York Times MOOCs year due to the immense hype surrounding them supported by major academic institutions worldwide. Patru & Balaji (2016) state that MOOCs differ from regular online courses in four ways: (1) they are extremely scalable and intended for an infinite number of users; (2) they are free to access; (3) they don't require any prior knowledge; and (4) the complete course is available online. Due to their ability to lessen the strain on university infrastructure, increase enrollments, improve the quality of education, and create opportunities with equal access through digital means, MOOCs have gained importance in emerging economies such as China (Zhang et al., 2019), India (Mahanta, 2020), Malaysia (Albelbisi, 2020), Africa (Rambe & Moeti, 2017), etc. (Badi & Ali, 2016).

The MOOC market was estimated to be worth US$ 14.75 billion in 2022, and from 2023 to 2029, total revenue is projected to increase at a rate of 39.20%, or close to US$ 149.42 billion. (“MOOC Market - Global Industry Analysis and Forecast (2023-2029),” n.d.)

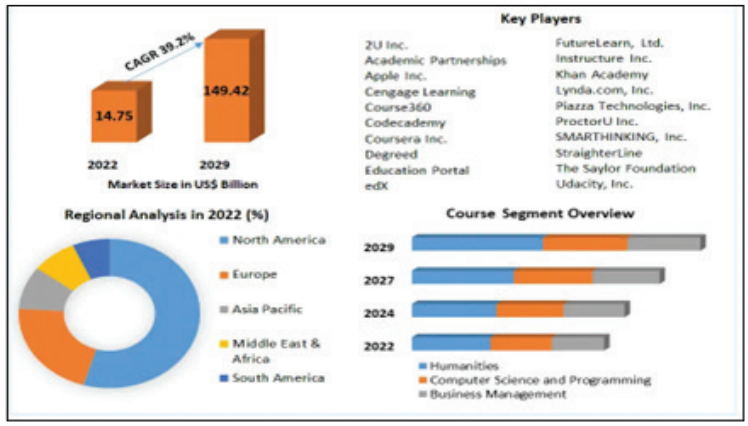


Figure 1: MOOC Market- Global Industry Analysis and Forecast

A recent analysis by Class Central indicates that one-third of all learners who have signed up for a MOOC did so the previous year. With a 387 percent increase from 8 million to 31 million registered users in 2022, Coursera, the largest MOOC provider, has nearly quadrupled its user base. There are 76 million users on the platform Coursera. With 10 million users by 2022, edX, the most popular MOOC network, has more than tripled its user base from 5 million in 2022. Asia-Pacific massive open online courses (MOOCs) market is expected to gain market growth in the forecast period of 2020 to 2027. Data Bridge Market Research analyses (Asia-Pacific Massive Open Online Courses (MOOCS) Market Size By 2029, 2022) stated that the massive open online courses (MOOCs) market was valued at USD 1.92 billion and is expected to reach the value of USD 24.82 billion by 2029, at a CAGR of 37.7% during the forecast period. According to Janssen, Schuwer, Teixeira, and Aydin (2015), higher education institutions are tasked with increasing student recruitment, establishing flexible learning opportunities for new students, enhancing institutional visibility and reputation, utilising MOOCs as areas of innovation, and meeting the needs of learners and societies.

Since almost the very beginning of MOOCs' popularity, concerns have been voiced about things like high dropout rates, the absence of a clear commercial plan, and the ambiguous educational framework that supports MOOCs. The low completion rates of MOOCs are one of the main causes for concern. Despite the fact that there are typically thousands of students enrolled, the dropout rate is typically very high, with less than 10% of registered students ever finishing the course. The financial feasibility of MOOCs has also under criticism because significant financial inputs are required for meagre returns. The scholarly literature is reflecting the growing worries about high dropout rates or the absence of a financial model, with studies gradually shifting away from the revolutionary characteristics of MOOCs and towards the less appealing but more useful features (Kaushik, 2018). The literature has reflected other concerns like course outcomes and the employability of the users. The pedagogical mixture is also putting education in anxiety towards adaptability of various different kind of students.

Academic librarians have a potential to influence academics and students more through MOOCs. According to Wu (2013), academic libraries can participate in MOOCs in a variety of ways. These include the more conventional responsibilities of information, instruction, and reference services, as well as more advanced services like content creation, copyright checking, open educational resources, policy frameworks, and guidelines. With MOOCs, libraries have the chance to take the lead and offer direction to teachers and students on topics like copyright, open access, open educational resources (OER), and other licensing models in higher education. A successful approach to enticing consumers to participate in open access and MOOCs, as well as demonstrating how librarians and libraries can assist the MOOC movement, may be found in the experience of an open access micro-MOOC. Libraries can serve as advisors and encourage academic members to participate in MOOCs related to their fields of expertise. In this advisory role, librarians can offer support and knowledge in certain areas related to MOOC production, including evaluating copyright regulations, choosing and supplying open source materials for MOOCs, and developing open educational resources Santos (2018). Reaching MOOC participants more effectively can involve offering suitable citation (Mahraj, 2012), information literacy training, and self-assessment resources. Academic librarians should assist students enrolled in MOOCs in learning and developing information literacy skills in order to ensure appropriate resource utilization (Mahraj, 2012).

Challenges and concerns about Libraries under MOOCs

Libraries face a myriad of concerns and challenges in the context of MOOCs, which, while offering vast educational opportunities, also present complexities in integration and support.

The changing function of libraries in the digital age is one of the main causes for concern, especially when it comes to integrating digital resources and services with physical ones (Joshi, 2020). Given MOOCs' focus on online learning, libraries' holdings, access guidelines, and user assistance systems must all be reevaluated in order to properly meet the changing demands of their patrons. Libraries face challenges in the areas of credentialing, certification, and recognition of MOOCs since different companies and educational institutions may place different values on online diplomas and their legitimacy. Libraries also struggle with MOOC sustainability because of the fluidity of online learning environments and the unpredictability of financing and organizational support (Santos-Hermosa, 2018). For libraries in the digital age, striking a balance between these worries and maximizing MOOCs' promise to improve information access and lifelong learning is still a major problem.

Some challenges and concerns for libraries are as follows:

- Limited participation: Few players are creating MOOCs for large number of users. Integration of libraries becomes difficult as the players are creating contents on their own. The other concern would be that the quantity of libraries that may be included in content productions would be very little and other academic, public and special libraries cannot take part in the process.

- Limited Customization: MOOCs are typically designed as self-paced, one-size-fits-all courses, which may not align with the specific curriculum or learning objectives of academic programs thus academic libraries may face challenges in integrating themselves into course syllabi or supporting faculty in adapting course content to meet their students' needs.
- Access to Supplementary Materials: Academic libraries may still need to purchase extra materials, such as textbooks, journal articles, or supplemental readings, to enhance student learning, even if MOOCs frequently offer course materials online. It can be difficult to guarantee access to certain resources, particularly if they are not publicly available or can only be accessed through subscription.
- Equity and Accessibility: While MOOCs offer opportunities for lifelong learning, they may also exacerbate existing inequalities in access to education, particularly for underserved populations or those with limited digital literacy skills. It will be difficult for academic libraries to address issues of equity and accessibility of resources to all in fulfilling the outcomes of MOOCs.
- Pedagogical Considerations: MOOCs may not always align with best practices in pedagogy or instructional design, leading to concerns about the quality and effectiveness of online learning experiences. Academic libraries integration may require to provide guidance and support to faculty in evaluating and selecting resources to engage participants in MOOCs.
- Integration with Library Services: Integrating MOOCs into library services requires coordination and collaboration among library staff, educators, and technology specialists. Libraries may need to invest in staff training and professional development to effectively incorporate MOOCs into their programming and support services.
- Licensing and Copyright Issues: MOOC materials may be subject to licensing agreements and copyright restrictions, which can affect how libraries provide access to course content and related resources. Libraries may need to navigate legal and ethical considerations to ensure compliance with copyright laws while facilitating access to MOOCs for their patrons and this could not be possible for all libraries.
- Sustainability: MOOC platforms may undergo changes in business models, course offerings, or accessibility over time, which can impact the sustainability and availability of online learning resources for libraries and their patrons.

There is need of collaboration and partnership among academic libraries, faculty, administrators, and MOOC providers to ensure that MOOCs are effectively integrated into academic programs and support services in ways that enhance student learning and success.

Discussion

The integration of libraries into MOOCs holds promise for enriching the online learning experience and expanding access to educational resources. Libraries serve as vital hubs for information access and support, offering a range of services and expertise that can enhance the effectiveness of MOOCs. Through collaboration with MOOC providers, libraries can curate collections of recommended courses, facilitate access

to course materials, and provide guidance on navigating online learning platforms. Librarians play a pivotal role in assisting learners with research, information literacy, and digital skills development, ensuring that participants can effectively engage with course content and resources (Gore, 2014). Additionally, libraries can host study groups, workshops, and community events related to MOOCs, fostering collaboration, peer learning, and networking among participants. By integrating libraries into MOOCs, educational institutions and MOOC providers can leverage the expertise and resources of libraries to enhance the accessibility, quality, and impact of online education for learners worldwide.

Institutions of higher learning, governmental authorities, and professional associations are examples of parental bodies that can push for laws that acknowledge the contribution libraries make to MOOCs and encourage cooperation between libraries and MOOC providers. Partnerships between libraries and MOOC providers, educational institutions, or other stakeholders can be facilitated by parental bodies. Investments in technology infrastructure, staff training, collection development, or outreach initiatives targeted at marketing MOOCs to library patrons should be promoted by creating a collaborative and coordinated environment among these institutions. Including libraries in financing campaigns, policy frameworks, or strategic strategies helps increase access to MOOCs and other online learning materials. Through the creation of government laws and improved agreements, libraries should have access to materials integrated into multiple MOOCS.

Conclusion

The goal of the study was to determine how academic libraries and self-content MOOCs relate to one another. The MOOC has started to show a shift in thinking about new tools and methods for teaching and learning. Many topics related to MOOCs require discussion, such as employability, skill level, prospectus consideration, and opportunities in the true sense. The courses are still in their early stages, so while some parts of the stream have been seen, the potential results are still being verified. MOOCs offered by colleges and universities continues to grow, academic libraries need to be prepared to be involved and supportive in both the development and implementation phases with the support of parental bodies. The function of academic libraries in connection to MOOCs is an issue that appears frequently in the literature. The retrieval of resources themselves, promotion of MOOCs during library training sessions, production of MOOCs on information literacy and long-term preservation of MOOCs are all ways that academic libraries can contribute to the creation of MOOCs. Libraries are likewise beset by financial, infrastructural and technological issues. Even for experts in library science, developing a MOOC may not be too tough, but the primary worry is whether libraries would become obsolete in to other streams under MOOCs.

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Digital Literacy Practices and E-Government Services: Role of the Libraries

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Introduction

E-government requires people to have a particular level of digital skills. Digital training initiatives aimed at enhancing digital competence and reducing the digital divide in emerging nations through the effectiveness of e-government services. Around the new digital age, many budgets are going into digital literacy and e-government projects in numerous emerging countries. Libraries provide digital literacy training and e-government initiatives that enhance citizen accessibility and facilitate efficient and direct government connection. Libraries play a important role in developing digital literacy by providing users with the required skills to navigate increasingly in vast digital world. Libraries have transformed from being mere book storage facilities to become vibrant centres for digital education and accessibility. Libraries play a crucial role in narrowing the gap between those who have advance skills in digital tools and information technology and those who haven't been in modern society.

According to **(Chohan & Hu, 2022)** there is a lack of evidence about the usefulness of information and communications technology (ICT) training programs in increasing the adoption of electronic government services. The utilization of electronic government services is not yet global across all sectors of society, even though they are becoming increasingly available. However, these groups of vulnerable people are not using them even if they are available. Reasons for this include low levels of information and communication technology (ICT) literacy, difficulties in accessing digital platforms, and discrimination brought on by the digital divide **(Van Deursen & Van Dijk, 2009).** Citizens that are digitally literate are more accomplished when it comes to utilizing technology and navigating online platforms. As a result, individuals are likely to find that the services and portals offered by the government to be easier to use.

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Literature review

The literature examines the digital literacy practices on the usage of e-government services, specifically focusing on the role of libraries. Authors have used bibliographic databases such as Google, SCOPUS, WOS, and Emerald to search for recent studies and relevant research articles.

Digital literacy

According to Eshet-Alkalai (2004) a conceptual model for digital literacy places an emphasis on the requirement for cognitive and social-emotional skills in addition to technical talents, such as the ability to use software or function digital devices. These are the abilities that are required in order to carry out tasks and find solutions to problems in digital environments.

Its basic knowledge that digital literacy encompasses the capabilities and skills necessary to acquire access to technology as it becomes available. In addition, digital literacy extends to the comprehension of language, hardware, and software, as well as the capability to utilize the technology themselves(Alomari et al., 2012; Jaeger et al., 2012).

Digital technology, which includes several tools including - internet, computers, smartphones, social media, and video streaming services, has a vital function in modern society (Hilbert, 2020).

While several older people have had challenge in accessing and adopting technology into their daily lives, many others have successfully bridged the digital gap by embracing and utilizing a range of digital technologies, just like individuals from other age demographics. Whether for socializing, achieving goals, or obtaining information (Szabo et al., 2019)

E-government

Despite the global interest in eGovernment, there is still a lack of actions taken in this area, even if Information and Communication Technology (ICT) which has been recognized for its potential in promoting the sustainable development of such an endeavour. This specific issue is easier to spot in underdeveloped nations. Electronic-government is defined as "the use of the Internet by government agencies to provide information and transaction services to citizens" (West, 2004)

Digital literacy involves a set of abilities and knowledge that enable people to safely and adequately implement and further develop digital technologies. It comprises a range of abilities, expertise, and perspectives that are necessary for collecting, evaluating and using digital information. Citizens with an excellent level of digital literacy are more probable to trust and adopt electronic-government services, which are largely available through digital platforms.(Abdulkareem & Ramli, 2021).

AbdulKareem and Oladimeji, (2024) discusses the several dimensions of digital literacy and its influence on using e-government services. Digital literacy is crucial to access and use digital services. Individuals who are using the internet, computers and smartphones, are more likely to familiar with e-government platforms. They can use websites, filling online forms, and interact with e-government programmes. Education on accessing digital technology will improve the use and the trust in the electronic-government system.

Digital literacy and e-government, Libraries

In many countries, the digital gap is prevalent in rural areas, where people generally have lower levels of information literacy than their urban counterparts in many nations. In contrast to the widespread adoption of information technology in urban regions, the use of ICT is less common in rural communities. (Gerpott and Ahmadi, 2015).

Public libraries are currently promoting the development of technology skills in rural community available, community institutions, libraries serve as vital source of semi-structured or informal learning where through the course of everyday life, people develop new skills to better serve their own lives. (Decoda Literacy solution 2016).

According to Mihai et al., (2022) Digital technologies affect the quality, efficiency and transparency of public services. The Electronic-government initiatives will save time and efforts of citizens by enabling governance through paperless administration. Electronic-government refers to the government's use of technology and information improve services for residents and businesses. It will increase the participation of citizens to engage actively in democratic institutions and political practises. Ebbers et al., (2016) highlights how the digital divide affects e-government because, those who are illiterate to digital literacy will be driven out from accessing government services.

According to (Taylor et al., 2014) At first, when e-government emerged as a feasible method for accessing government information, experts anticipated that implementing direct government-to-citizen (G2C) services would enhance transparency in government services, encourage more people participation, and provide more services to common citizens. However, in due course of time, it realised that certain users did not receive the specific information, guidance, or services, leading to the necessity for an intermediary. It is in this context that public libraries became important in delivering digital literacy.

Over the years, the public library has been the main and sometimes the only place where people may access government-to-citizen services, receive training, and get help in communities all over the country **(Bertot, 2009).** In some cases, serving as guarantor of G2C access and training is a natural extension of the recognized general public roles of the public library.

"The public library is a place that's culturally ingrained as a trusted source of free and open information access and exchange"According to Lee et al. (2020) found that digital skills have a substantial impact on the acceptance of e-government online services.

Role of Libraries in Promoting Digital Literacy

Libraries promote digital literacy by providing users with required skills which navigate an increasingly vast digital world. Libraries are crucial in narrowing the gap between those with advanced skills in digital tools and information technology and those without modern society. They provide complimentary access to technology, internet connectivity, awareness programs, and training designed for individuals with varying degrees of expertise. Libraries empower citizens by offering support and accessing opportunities that enable them to build essential digital literacy skills which is important for success in today's society. Libraries promote digital inclusion and digital participation of citizens, serving as critical pillars to ensure that everyone has the necessary resources to succeed in an ever-growing digital society.

Access to technology and the internet is still seen as a benefit rather than a right in many places. Libraries fill this need by giving people free access to internet and public Wi-Fi. Libraries serve as vibrant community hubs, fostering online communities through social media forums, and virtual events. By curating digital content that reflects their community's interest, they create space for engagement, knowledge sharing, and meaningful discussions, fostering a sense of belonging and collective empowerment. Libraries have always supported lifelong learning, and in the digital era, this dedication continues to increase. The organization enables individuals of all age groups to cultivate crucial digital literacy skills through a wide range of programs, workshops, and training sessions. In addition to fundamental digital skills, libraries also have a vital role in encouraging digital citizenship. Digital citizenship refers to the practice of exhibiting ethical conduct, engaging in responsible interactions on the internet.

E-government services access through libraries

Libraries are public institutions that offer complimentary use of computers and the Internet, granting individuals access to e-government services. They also offer training to citizens in information and communication technology (ICT), aid in citizens' interactions with government agencies, offer guidance on utilizing e-services, and assist elderly individuals and those facing challenges in navigating e-government services. (Jaeger, 2008). Public libraries have initiated the task of educating their clients on the methods of accessing and utilizing e-government information (Jaeger and Bertot, 2009). The 2020 UN E-Government Survey

Report provides valuable insights into how libraries may contribute to the development of inclusive and efficient e-governments.

Major Challenges and Recommendations

Libraries have difficulty with limited funding and rapidly evolving technology; today, libraries promote digital literacy and different skills from the traditional culture to the new digital culture. Regular training and professional development for library staff are essential to keep up with technological advancements and emerging e-government services.

Conclusion

The study is based on existing evidence and information from studies such as digital literacy and e-government; an exclusive review of the relevant literature was conducted to determine the library's role in developing digital literacy, establishing trust in electronic government, and resolving security problems. Libraries provide digital literacy training and e-government initiatives that enhance citizen accessibility and facilitate efficient and direct government connection. The utilization of electronic government services is not yet global across all sectors of society, even though they are becoming increasingly available.

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AWARENESS OF DIGITAL INFORMATION LITERACY AMONG PG STUDENTS AND RESEARCH SCHOLARS OF KUMAUN UNIVERSITY, UTTARAKHAND: A STUDY

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Introduction

With the advent of information communication technology, information has been changed into explosion of information and it is found in different formats. After coming the ICT society has been changed in every field like education, medical, shopping and marketing as well. In this time, we can see that computer technology is using in every field and in every department. This is the time, where we cannot imagine any moment and any work without the computer technology. Now computer technology has become the most important part of our life. In education field, computer has played an important role in teaching and learning platform. Specially in pandemic time we all have seen the role of computer in education and in another sector also. With the help of ICT, teachers can use various types of platforms and option to teach and learn. There is a bundle of resources in front of faculty members to prepare themselves from which they have to consult to plan for teaching their students, as students and learners are most aware and more responsible. Now faculty members are more aware and technology, teaching trends, searching and learnings trends more than the students.

Digital Literacy

The American Library Association (ALA) states that, "To be Information Literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information". Glister (1997) defines digital literacy as, "a set of skills to access the Internet; find, manage and edit digital information; join in communications;

Literature Review

Elango B (2010), surveyed about "Digital Information Literacy of IFET engineering college faculty members in Villupuram" and it was suggested that there is a need of orientation programme to develop the skills in e-resources and internet research tools to the faculty members of IFET College of Engineering, Villupuram.

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Meenambika & Maidhili (2015), discussed the basic "Digital Information Literacy skills among RRASE Engineering College in Chennai" and it was found that most of the students are skilled in internet and computer literacy but they were not aware of digital library resources, emotional and ethical literacy. and it was suggested that online orientation programme should be organized in library for digital Information Literacy.(Meenambika & Maidhili, n.d.)

Kumari et al. (2017), studied "Digital Information Literacy of the faculty members of the Sahyadri College of engineering and Management, Mangalore" and found their strength and weaknesses. This study highlighted the different types of information sources used by the faculty members and how were they familiar with the resources. (Kumari et al., n.d.)

Objectives

- To Know the awareness about digital literacy among PG students and Research Scholars.
- To check the purpose of using digital information.
- To know the awareness about e-resources.
- To know about the level of awareness about e-databases.

Scope and Limitations of The Study

The study considered the digital information literacy skills by the PG Students and Research Scholars of Universities. Geographically the study covers Kumaon University of Kumaon Region and HNB University of Garhwal Region, Uttarakhand.

Methodology

The present study was based on questionnaire methods. Here I took two categories of students like PG students and Research Scholars. Questionnaires were distributed among the PG students and Research scholars in Kumaun University to check their attitudes toward the digital literacy. Total 250 questionnaire were distributed and received 161 questionnaires from the respondents.

Result and Discuss

Gender Wise Pecentage of Respondents In Kumaun University

- MALE 52 32.20%
- FEMALE 109 67.80%

Table -1 Distribution of Questionnaires among PG students and Research Scholars

S. No.	Nature of Respondents	Total Number of questionnaires distributed	Total No. of Questionnaire Received
1	PG Students	150 (60%)	100 (62.12%)
2	Research Scholars	100 (40%)	61 (37.88%)
3	Total	250 (100%)	161 (64.4%)

The above table no. 1 showed that a total of 250 questionnaires were distributed among postgraduate students and Research Scholars of Kumaon University covering four disciplines (Physics, Chemistry, Economics and sociology) and 161 filled questionnaires were received. The response rate is 64.4%.

Table-2: Gender wise distribution of the Respondents

S. No.	Nature of Respondents	No. of Respondents	Percentage
1	Male	52	32.29
2	Female	109	67.71
3	Total	161	100.00

Here, Table-2 reveals that out of a total of 161 respondents' majority of the respondents 52 (32.29%) were male, followed by 109 (67.71%) of the respondents were female. It shows that majority of the respondents were female.

Knowledge on Digital Information Literacy

In questionnaire a research question has put to the respondents about the knowledge on Digital Information Literacy. The respondent's opinions were discussed in the below.

Table-3: Knowledge on Digital Information Literacy

S. NO.	Nature of Respondents	"Yes"	"No"
1	PG Students	32 (19.87%)	68 (42.23%)
2	Research Scholars	50 (31.05%)	11 (6.83 %)
3	Total	82 (50.93%)	79 (49.06%)

Here, Table-3 indicate that, out of 161 respondent's majority of Research Scholars 50 (31.05%) know about the "Digital Information Literacy" and only 32 (19.87%) post graduate students have the knowledge about "digital Information Literacy". Overall majority of respondents are aware about the "Digital Information Literacy".

Table -4: Purpose of Using Digital Information

S. No.	Purpose of using digital information	PG Students	Research Scholars
1	To support Research	15 (9.31)	49 (30.43)
2	Project Work	22 (13.66)	25 (15.52)
3	Writing Research paper	04 (02.48)	45 (27.95)
4	Research	15 (09.31)	54 (33.54)
5	Case Study	19 (11.80)	20 (12.42)
6	General Knowledge	40 (24.84)	14 (08.69)

Table-4 presents that majority of Research scholars are using digital information for the purpose of "Research work" and "To Support Research". On other side majority of post graduate students are using digital information for the purpose of "General Knowledge" only.

Table-5: Types of Devices or Gadgets are Using for Digital Information

S. No.	Devices & Gadgets	PG Students	Research Scholars
1	Computer/Laptop	26 (16.14)	59 (36.64)
2	Cell phone with internet	06 (03.72)	54 (33.54)
3	Cell phone without internet	02 (01.24)	04 (02.48)
4	Tablet (Ipad)	01 (0.621)	12 (07.45)
5	Total	35 (21.73)	129 (80.12)

This table presents that majority of Research scholars 129 (80.12) are using electronic devices or gadgets and only 35 (21.73) post graduate students are using electronic devices or gadgets.

Table-6: Knowledge About E-Resources

S. NO.	PG Students	Research Scholars	Percentage
1	80	61	141 (87.57)

Table-6 reveals the out of 161 respondents, 141(87.57) students having the knowledge about e-resources.

Table-7: Awareness About E-Databases

S. NO.	e-databases	PG Students	Research Scholars	Percentage
1	Scopus	52	60	112 (69.56)
2	Web of Science	24	42	68 (42.23)
3	Google Scholar	63	61	124 (77.01)
4	Ebsco	02	28	30 (18.63)
5	Proquest	12	48	60 (37.26)
6	Inspec	08	25	33 (20.49)
7	Elsevier	02	26	28 (17.39)
8	Springer	24	52	76 (47.20)

Table -7: shows that majority of students are aware and using the "Google Scholar" database and "Scopus" database. and it also shows that as comparison to post graduate students "Research Scholars" are more aware about e-databases.

Conclusion

In conclusion, the study on digital information literacy among postgraduate students and research scholars in Kumaun University has provided valuable insights into the current landscape of digital literacy within this academic community. The findings reveal both strengths and areas for improvement, emphasizing the significance of digital information literacy in contemporary higher education. Postgraduate students and research scholars in Kumaun University exhibit a commendable level of awareness of digital literacy; however, certain gaps exist, particularly in advanced digital research skills and critical evaluation of online information. This study indicates the need for targeted interventions and educational initiatives to address specific areas of improvement identified in the research. Recommendations include the integration of digital literacy modules into the curriculum, fostering a culture of continuous learning through workshops and training programs, and enhancing collaboration between academic departments and the university library to provide tailored support for digital research.

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EXAMINING THE UTILIZATION OF CHATGPT AMONG STUDENTS AT SRI VENKATESWARA UNIVERSITY, TIRUPATI: A STUDY

Dr. M. Prasantha Kumari[1]

Introduction

Students in higher education institutions normalize their educational and personal lives in a technology-enhanced environment, mainly based on Artificial Intelligence (AI). For example, as a part of Artificial Intelligence, Natural Language Processing (NLP) has led to the creation of state-of-the-art virtual assistance and chatbot understanding and generating human language. Students can personalize their learning experiences with the guidance, support, and assistance of artificial intelligence. With more and more writing tools powered by artificial intelligence available to them, students can now edit their writing more easily and receive immediate feedback on their grammar, punctuation, and expression. In addition, these tools assist them in improving the overall caliber of their writing by rewriting the sentence structure, word choice, and tone. These tools also include chatbots that offer recommendations for self-study, allowing users to approach information, find answers to their queries, and access AI-enabled solutions for problem-solving.

OpenAI created ChatGPT, an advanced AI language model. It is intended to converse with users in a natural and meaningful way, providing help, knowledge, and amusement on a variety of subjects. ChatGPT is a versatile tool that may be used as a virtual assistant, creative partner, instructional aid, and much more due to its capacity to understand context, infer meaning, and produce coherent writing. Enhancing human-machine interactions and offering helpful support in negotiating the details of language and communication are its two main objectives.

Review of the Literature

Tianyu Wu et.al (2023)[1] aimed to give readers a basic understanding of ChatGPT by summarizing its background, current state, and possible future developments. In particular, the authors derived the fundamental methods of ChatGPT from the restricted number of publicly available resources. These methods primarily comprise large-scale language models, in-context learning, reinforcement learning from human feedback,

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and the essential technical procedures for creating Chat-GPT. The authors reconsidered ChatGPT's duality in multiple sectors and conduct a more thorough analysis of its benefits and drawbacks.

Firaina & Sulisworo (2023) [2]conducted a study to obtain a greater knowledge of the perspectives and rationale of lecturers in using it for learning. Teachers were interviewed for this project, and they asked to offer their perspectives and experiences. To learn more about how using ChatGPT impacts learning and the factors that influence lecturers' decisions to use or not utilize the technology, the data gathered were critically examined and interpreted. The interview findings indicated that ChatGPT assists users in locating concepts and information, interpreting texts. and providing alternative questions to deepen the understanding of the material. It is important to consider and verify information with more reliable and accurate sources. The use of ChatGPT in learning can be an interesting and effective alternative, but users also need to remain critical and selective in utilizing it. In further research, more interviews and case studies need to be conducted to obtain a more comprehensive understanding of the use of ChatGPT in learning. Although ChatGPT has limitations, respondents consider its use to improve productivity and learning efficiency. Therefore, the use of ChatGPT can be considered as an attractive alternative in learning, while maintaining a critical approach in utilizing it and verifying the information provided.

Rezwan &et.al (2023) [3]stated that the most well-known platform for contemporary natural language processing technology was created by OpenAI and is called ChatGPT. Its foundation is the GPT-3.5 architecture, which is an expansion of the GPT-3 model that has undergone further optimization for efficiency and performance. The model's goal is to analyze natural language inputs and produce responses that resemble those of a human. It was trained using a substantial amount of text data from many sources, such as books, journals, and websites. In unsupervised learning approaches, the model is trained to recognize natural language structure and patterns. All things considered, ChatGPT represents a significant breakthrough in natural language processing and has the power to fundamentally alter how humans interact with computers. It's possible that ChatGPT will be applied in a variety of businesses in more advanced ways.

Dinesh &et.al (2023) [4]discussed with the application of cutting-edge artificial intelligence algorithms, ChatGPT is a ground-breaking technology that can produce natural language responses to input or prompts. It has applications in many different domains, including content production, customer support, and natural language processing. The history, operation, and influence of ChatGPT on several academic disciplines are all examined in this investigation and analysis. It looks into ChatGPT's capabilities and limits in addition to its benefits and drawbacks. Along with its possible uses for researchers and scholars, it also covers ChatGPT's effects on jobs, cyber security, customer service, software development, and academia.

Faycal & et.al (2023) [5]examined ChatGPT usage among students in the United Arab Emirates (UAE), their views, concerns, and perceived ethics. The data was gathered

from 388 students from two universities in Al Ain city using Yamane's formula. Findings showed that students consider ChatGPT a revolutionary technology that helps students in many ways. Finally, the findings also indicated the validation of the final hypothesis, showing the significant effect of ChatGPT Usage on the Perceived Ethics among the students in the UAE. Therefore, this study concluded that using ChatGPT in education has useful and concerning effects on educational integrity.

Objectives of the Study

- To know the awareness of respondents on ChatGPT
- To identify the persons, who motivated the respondents to use ChatGPT
- **T**o study the opinions of respondents on their purpose of using ChatGPT
- To examine the opinions of respondents on advantages of ChatGPT
- To study the impact of ChatGPT on respondents' study

Methodology

Survey method was used for the collection of primary data. An online questionnaire was designed for this purpose and circulated to 230 students of S.V University College of Arts, 197 responses received out of 230 total. The overall user response rate 85.65%.%. The information is presented in the form of tables and evaluated using a basic measurement process.

Scope and Limitation of the Study

The current study investigated the "Examining the Utilization of ChatGPT Among Students at Sri Venkateswara University, Tirupati: A Study".

Data Analysis and Interpretation

Table 1: Distribution of respondents according to Gender

Gender	Respondents	Percentage
Male	121	61.42
Female	76	38.57
Total	197	100

Table 1 depicts that 121(61.42%) are male respondents and 76(38.57%) are female respondents.

Table 2: Distribution of respondents according to their awareness on ChatGPT

Awareness on ChatGPT	Respondents	Percentage
Yes	121	61.42
No	76	38.57
Total	197	100

It is evident by table 2 that 100% respondents are aware of ChatGPT

Table 3: Distribution of respondents according to the persons who motivated to use ChatGPT

Motivated Persons	Respondents	Percentage
Teachers	21	10.65
Friends	134	68.02
Social media	42	21.31
Total	197	100

It is evident by table 3 that 134(68.02%) are motivated by their friends to use ChatGPT followed by 42(21.31%) are motivated by social media and 21(10.65%) are motivated by teachers to use ChatGPT

Table 4: Distribution of respondents according to their frequency of using ChatGPT

Frequency	Respondents	Percentage
Daily	19	9.64
Once in a Week	125	63.45
Fortnightly	32	16.24
Monthly	21	10.65
Total	197	100

It is evident by table 4 125(63.45%) respondents are using ChatGPT once in a week; followed by 32(16.24%) fortnightly, 21(10.65%) by monthly and 19(9.64%) are using daily.

Table 5: Distribution of respondents according to the type of Device

Type of Device	Respondents	Percentage
Smart Phone	113	57.36
Laptop	25	12.69
Desktop	14	7.10
All the above	45	22.84
Total	197	100

It is evident from table 5 that 113(57.36%) respondents are using ChatGPT on their smart phones; followed by 45(22.84%) are using all the mentioned devices; 25(12.69%) respondents are using laptops and 14(7.10%) respondents are using desktop devices for using ChatGPT.

Table 6: Distribution of respondents according to the purpose

Purpose	Respondents	Percentage
Preparation for Exams	45	22.84
Assignments	76	38.57

Dissertation/Project work	52	26.39
Language Learning	11	5.58
All the above	13	6.59
Total	197	100

It is evident from table 6 that 76(38.57%) respondents are using ChatGPT for the completion of assignment works; followed by 52(26.39%) respondents are using for the dissertation/project work; 45(22.84%) respondents are using for the preparation for exams and 13(6.59%) are using all the above-mentioned purposes; 13(6.59%) are using for all the above-mentioned purposes and11 (5.58%) are using for learning a language.

Table 7: Distribution of respondents according to the advantages

Advantages	Respondents	Percentage
24/7 availability	14	7.10
Personalized learning	05	2.53
Instant Feedback	38	19.28
Accessible all resources	47	23.85
Enhanced problem-solving skills	13	6.59
All the above	80	40.61
Total	197	100

It is evident from table 7 that 80(40.61%) respondents opined that ChatGPT has all the above-mentioned advantages; rest of the respondents are opined with other advantages.

Table 8: Distribution of respondents according to the challenges

Challenges	Respondents	Percentage
Understanding context	62	31.47
Generating logical responses	05	2.53
Ethical use and Misuse	28	14.21
Privacy and Security concerns	47	23.85
Language and Cultural Sensitivity	43	21.82
All the above	12	6.09
Total	197	100

It is evident from the above table that 62(31.47%) respondents are accepted that they faced challenge with ChatGPT in understanding the context; followed by 47(23.85%) privacy and security concerns; 43(21.82%) language and cultural sensitivity; 28(14.21%) ethical use and misuse, 12(6.09%) faced all the above mentioned challenges and least amount of respondents 05(2.53) are faced with the challenge of generating logical responses.

Table 9: Distribution of respondents according to satisfaction

Satisfaction	Respondents	Percentage
Yes	192	97.46
No	05	2.53
Total	197	100

It is evident from the above table that 192(97.46%) respondents stated that they are satisfied with the ChatGPT whereas 05(2.53%) respondents are didn't satisfy with the performance of the ChatGPT.

Table 10: Distribution of respondents on the Impact of ChatGPT on their study

Impact	Respondents	Percentage
Yes	192	97.46
No	05	2.53
Total	197	100

It is evident from the above table that 192(97.46%) respondents stated that there is an impact of ChatGPT on their study; followed by 5(2.53%) respondents stated that there is no impact of ChatGPT on their study.

Conclusion

According to the findings of his study, most of the respondents are aware of ChatGPT and using in their study. The students know the advantages as well as challenges of ChatGPT. One should keep in mind that updating with technical knowledge is necessary but also should keep in view the ethics by avoiding confidential information like personal data with ChatGPT. Students should verify the accuracy and reliability of information provided by ChatGPT. By adhering to these ethical guidelines, students can use ChatGPT responsibly and contribute to creating a positive and beneficial AI-powered environment.

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IMPACT OF TRAINEESHIP PROGRAM ON PROFESSIONAL AND PERSONAL DEVELOPMENT OF LIS STUDENTS

Arunima Baiju[1] & Dr. Rekha R V[2]

Introduction

Traineeship is one of the experiential learning forms which has a long history in almost all academic fields. It is said to be a socio-economic way of strengthening the labour market. Traineeship programs mainly intend to equip people with adequate knowledge and skills to achieve work efficiency in a short span of time and instil high career aspirations and self-esteem. It plays a key role in mitigating the complexity of the changes of life stages from a student to a professional. "By integrating conceptual knowledge and training through academic traineeship programs, students can be facilitated to better implement their concepts at the workplace" (Tynjälä, 2008). It is a bridge between theory and practice through supervised and scheduled work which guarantees extensive experience of practical work. Library and Information Science is one among many academic fields which offers and demands traineeship to provide practical work experience to ensure required skill and practical knowledge. It generates valuable employees and competent job applicants through traineeship programs conducted by different libraries across the country. In this field, traineeship can either be a part of the curriculum or it can be done separately and independently after the completion of the post-graduation. Even though it is not compulsory to undergo traineeship in the field of library science, it has created significant improvement in those who have opted for it. Traineeship is always a better alternative for students who have been through inappropriate teaching methodologies in colleges or universities. The main aim of this study is to analyse the impact of traineeship programs on the professional and personal development of LIS students in India. Pre and post traineeship scenarios have been considered for the study to get a better understanding of the overview of the traineeship programs.

Related Studies

Traineeship is considered as a tool to verify students' attitudes to university studies and their future work.(Kozera-Kowalska,, &Uglis, 2018).Internships and traineeships serve as crucial opportunities for individuals to evaluate or even reconsider

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their future career paths, enabling students to develop professional skills and gain self-awareness and self-responsibility in shaping their life trajectories.(Del Bianco,,et.al 2021) The major focus of formal classes is on what students' know, while internship focuses on what students do[8]. Internship opportunities enable students to secure high-quality job offers and it marks significant impacts on professional and personal growth. (Anjum, S. 2020). Social integration with peers is one of the most important objectives of traineeship programs.(Del Bianco,,et.al 2021).The study by Giannopoulou et.al explored that traineeships are useful in the work environment and it adds value for the acquired profession through the achieved learning outcomes.(Giannopoulou,, et.al 2020) Linguistic and cultural learning are the most significant factors that impact on the participants' identities(Mocanu,& Quevedo,. 2024).According to Massé et.al, in transformative medical education, traineeship create greater awareness of beliefs, assumptions and biases through understanding one's own limitations, power and privileges and it strengthens professional identity and future practice orientation.(Massé,, et.al 2020)

Methodology

The main aim of the study is to evaluate the impact of traineeship programs on the professional and personal development and skills of LIS students in India. The study analyzes both the pre- and post-traineeship periods to understand the growth in the students. Data was collected from post graduate MLIS students' who have completed traineeship from different institutions across the country through a questionnaire using Google form during May 2024.The Google form contains questions related to Demographic information, Reasons of participation in traineeship, Assessment of information regarding professional and personal growth and skill improvement. A total of 50 questionnaires were distributed, out of which 20 duly filled questionnaires were received back. The objectives of the study are:

- To determine the background and motivation of engagement of LIS students in traineeship programs.
- To determine the impact of internship programs on professional as well as personal growth and skills of the LIS students in India
- To determine the quality of traineeship programs provided by institutions across the country.
- To identify the strengths and weaknesses of LIS traineeship programs in India

Analysis and Results

The data collected through the Google form was analysed and represented using tables and graphs.

Demographic Details

Analysis indicate that out of 25 respondents, 4 individuals (16%) were aged 25 or younger, while 17 (68%) fell within the 26-29 age bracket, and 4 (16%) were 30 years

old or older. Regarding gender, 17 (68%) were male and 8 (32%) were female. In terms of educational backgrounds, 13 out of 25 students (52%) held a BA degree, 7 (28%) had a BSc degree, 2 (8%) graduated with a B.Com degree, and 1 (4%) had a BTech background. Additionally, 92% of respondents did not pursue a post-graduate degree other than MLIS. Concerning MLIS, 22 (88%) completed a 2-year integrated program, 2 (8%) undertook a 1-year PG program, and 1 (4%) finished a rare 5-year integrated program offered by the University of Calcutta. In terms of traineeship, 18 (72%) trained at Centrally Funded Technical Institutes (CFTIs), 3 (12%) at central universities, 2 (8%) at state universities, and 2 (8%) at private universities. For 92% of the students, traineeship was not integrated into their curriculum; therefore, they pursued it independently after completing MLIS. Among them, 68% undertook traineeships lasting from 6 months to 1 year, while 24% engaged for 1 to 2 years, and 8% completed traineeships lasting less than 6 months.

Table1: Demographic Details

Demographic Details		Frequency	Percentage
Age (Years)	25 or less	4	16
	26-29	17	68
	30 and above	4	16
Gender	Male	17	68
	Female	8	32
Residence	Urban	4	16
	Rural	12	48
	Semi-Urban	9	36
Degree	1 Year PG	2	8
	2-year Integrated Program	22	88
	5 Year Integrated Program	1	4
Traineeship Completion (Year)	2010 – 2015	1	4
	2016-2020	5	20
	2021 and above	19	76
Duration of Traineeship	Below 6 Months	2	8
	6 Months - 1 Year	17	68
	1 Year - 2 Year	6	24
	Above 2 Years	-	-

Source of getting information of Traineeship

The majority of respondents (56%) discovered their traineeship opportunities through job search websites, with 40% learning about them through recommendations from professors, mentors, seniors, or friends, and a small 2% through university programs.

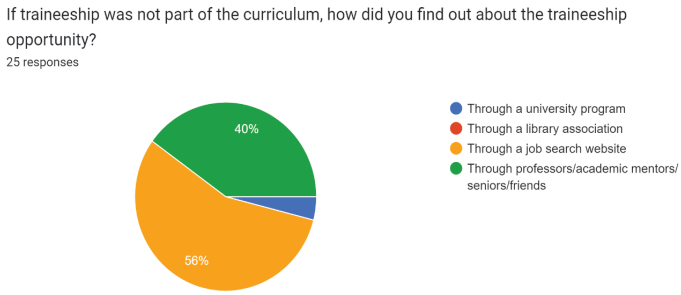


Figure 1: Source of getting information

Factors Considered while Selecting the Institution

The decision to choose the institution for traineeship was primarily influenced by the scope of learning and mentorship quality, cited by 56% of respondents. Reputation and prestige of the institution were important for 52%, while 36% valued institutions using modern technologies. Additionally, 28% considered stipend offers, and 24% made choices based on recommendations from professors, librarians, or academic mentors. Notably, only 16% prioritized the stipend amount, reflecting a strong motivation among graduates to prioritize knowledge acquisition over financial gain.

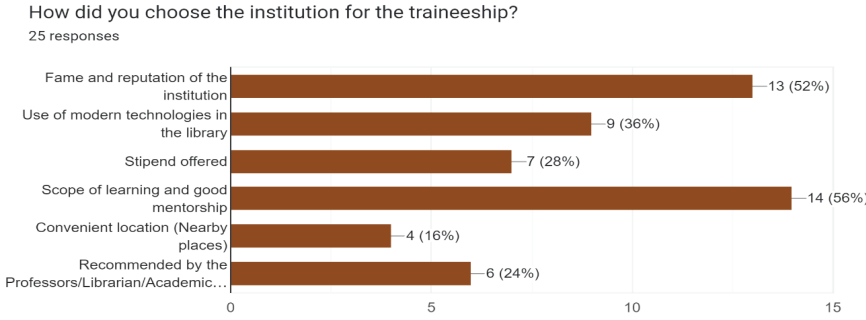


Figure 2: Factors Considered while Selecting the Institution

4.4 Name of the Institution (Traineeship)

In the study, it was noted that the largest proportion of respondents (20%) completed their internship at the Indian Institute of Management, Ahmedabad. Furthermore, the majority (80%) of all respondents undertook their traineeship at Centrally Funded Technical Institutions (CFTIs). Regarding the stipend, approximately 72% of the respondents expressed satisfaction with the amount offered, whereas 28% were dissatisfied, mainly citing high living expenses in their institution's city as the primary reason.

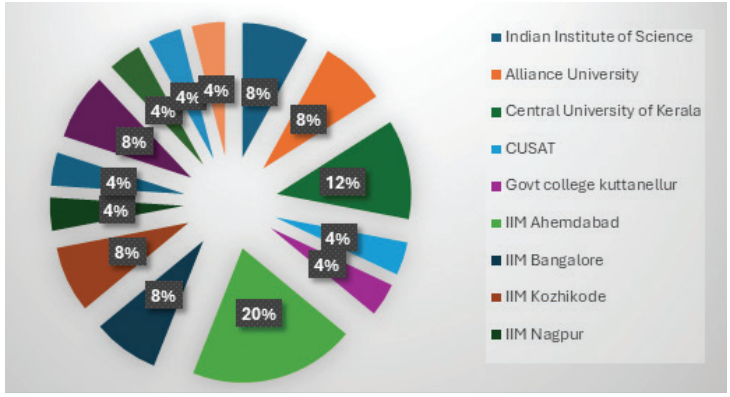


Figure 3: Name of the Institution (Traineeship)

Sections where Respondents got Training

Among the respondents, 60% received training in all sections of the library, including circulation, acquisition, technical processing, serial control, and databases/e-resources. Notably, this 60% primarily consisted of those who completed their traineeships at CFTIs. The training rates of 36% in databases/e-resources and 20% in serial control are notably low considering their significant importance.

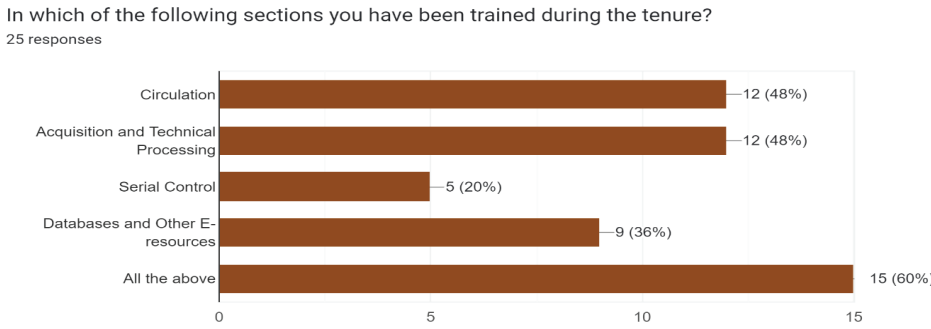


Figure 4: Sections where Respondents got Training

It was found that 76% of the respondents are currently employed after completing their traineeship. The remaining 24% cited various reasons for their unemployment, such as challenges in the job market downturn, institutions' reduced value for graduates who completed their education during the COVID-19 period, opting for PhD programs after qualifying for Junior Research Fellowships (JRF), and some choosing to pursue another traineeship due to dissatisfaction with their initial experience.

Employment after Traineeship

After the traineeship program, among those employed, 38.1% have joined private universities, 23.8% have joined public/government universities, 19% have joined aided/

unaided/private colleges, and 4.8% each have joined CFTIs, corporate companies, aided/ unaided/private schools, and other institutions such as autonomous bodies.

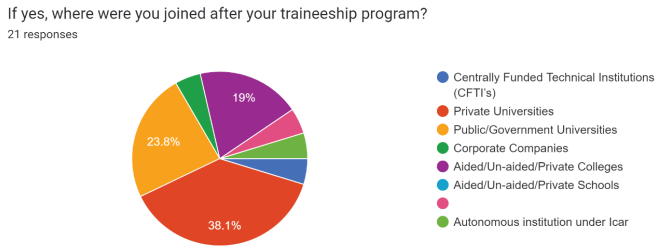


Figure 5: Employment after Traineeship

Candidates underwent various selection processes to secure their first job after completing the traineeship. For 56%, an interview was sufficient to land on their first professional role. For 26%, both an exam and an interview were required. 8% secured their first job solely through an exam, 4% through references, and another 4% based on their MLIS marks.

Anticipated Outcomes of the Traineeship Program

Regarding the anticipated outcomes of the traineeship program, the majority of participants have high expectations. Specifically, 92% are looking forward to gaining practical and technical skills, while 80% anticipate learning about the latest technologies utilized in libraries. Moreover, 64% have hopes for improved career prospects, along with an equal percentage aiming to enhance their knowledge.

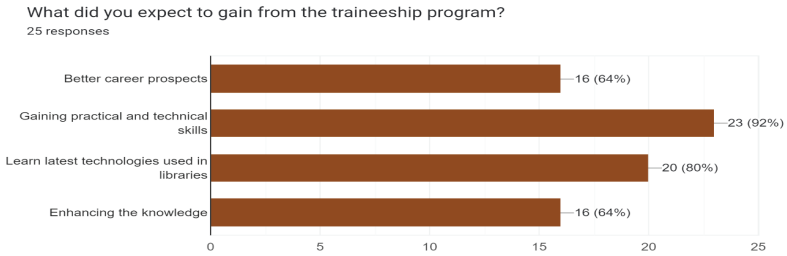


Figure 6: Anticipated Outcomes of the Traineeship Program

From a survey of 25 respondents, a significant portion, 84%, acknowledged that their traineeship significantly contributed to securing a job. Additionally, 72% attribute the reputation of the institution to aiding them in promptly securing their initial job post-traineeship. However, it's noteworthy that only 36% of respondents reported that the traineeship directly led to securing a permanent professional position, indicating that the remaining 64% are currently in either temporary or contractual roles.

Positive Impact of the Traineeship program

All the respondents have acquired various qualities through the traineeship program, despite some disparities in quality of the traineeship provided across institutions. According to the survey, 92% of participants reported gaining knowledge in library-specific skills such as cataloging and classification. Additionally, 84% developed communication and interpersonal skills, as well as enhanced their understanding of library operations and management. The program significantly boosted the confidence of 80% of respondents, while 64% improved their networking opportunities. Furthermore, 80% of participants gained a better understanding of user needs. As a result, 88% of respondents would recommend the traineeship to future MLIS graduates.

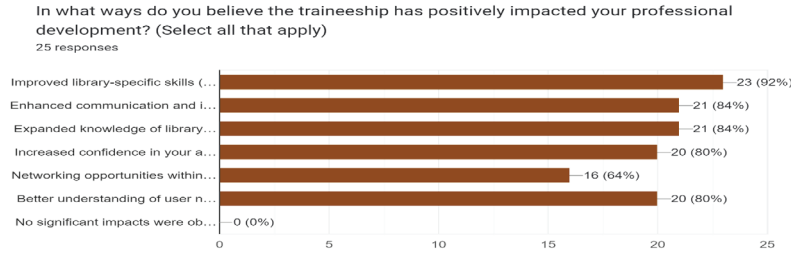


Figure 7: Positive Impact of the Traineeship program

Satisfaction with the Traineeship

Based on their experiences, respondents rated their satisfaction with the traineeship on a scale of 1 to 5, where 1 indicates highly dissatisfied and 5 indicates highly satisfied. The results show that 28% of respondents are highly satisfied, 24% are satisfied, 8% have a neutral satisfaction level, 16% are dissatisfied, and 24% are highly dissatisfied. Graph 1 shows the result.

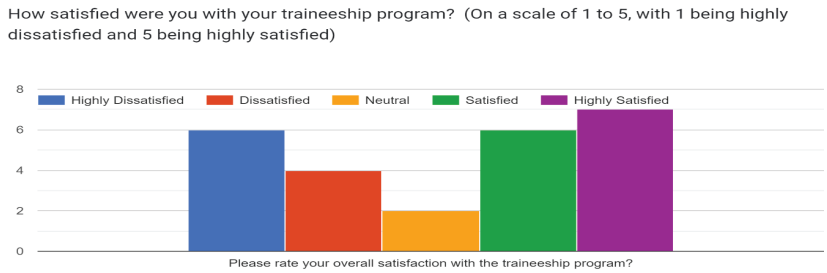


Figure 8: Satisfaction with the Traineeship

Professional and Personal Development

This study aimed to evaluate the professional and personal development experienced by respondents through their traineeship program. Respondents assessed

their experiences using a 5-point Likert scale, ranging from strongly disagree to strongly agree. The findings reveal that 40% agreed that the program enhanced their decision-making, problem-solving, and critical thinking skills to the extent that they felt confident in building a library from scratch. Additionally, 36% strongly agreed that the traineeship brought about significant professional changes, improving their ability to take initiative and enhancing their conscientiousness and ethics.

Regarding personal development, 36% of respondents noted improvements in conscientiousness and ethics, while 40% reported developing habits such as respecting individuals from diverse backgrounds, managing finances and time effectively, and creating networking opportunities for professional advancement. Table 2 presents these findings, detailing the characteristics, frequencies, and percentages observed in the study.

Table 2 Professional and Personal Development

Professional Development	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
"Traineeship program changed me professionally	1 (4%)	-	2 (8%)	7 (28%)	9 (36%)
The Traineeship program made clear my career goals	1 (4%)	-	4 (16%)	8 (32%)	9 (36%)
Traineeship helped me to gain practical work experience in my field of interest	1 (4%)	-	2 (8%)	5 (20%)	11 (44%)
I have applied my classroom knowledge during Traineeship	1 (4%)	1 (4%)	4 (16%)	8 (32%)	5 (20%)
Traineeship helped me to identify the skills needed to get a job in my field of interest	1 (4%)	-	3 (12%)	7 (28%)	8 (32%)
I faced some problems to seek and accept work assignments during Traineeship	1 (4%)	2 (8%)	7 (28%)	6 (24%)	3 (12%)
Traineeship improved my communication and interpersonal team skills	1 (4%)	-	2 (8%)	9 (36%)	7 (28%)
It enhanced my decision-making and problem-solving skills	1 (4%)	-	3 (12%)	10 (40%)	5 (20%)
It improved my skills to work as a team	1 (4%)	-	4 (16%)	7 (28%)	7 (28%)
It enhanced my critical thinking	1 (4%)	1 (4%)	3 (12%)	10 (40%)	4 (16%)
It improved my knowledge in all sectional activities of a Library	1 (4%)	1 (4%)	2 (8%)	7 (28%)	8 (32%)
It improved my skills in the technical areas of Library and Information Science	1 (4%)	-	3 (12%)	9 (36%)	6 (24%)
Traineeship made me confident in building a library from scratch.	1 (4%)	-	3 (12%)	10 (40%)	5 (20%)
Personal Skills					
Traineeship improved my conscientiousness and ethics	1 (4%)	-	4 (16%)	9 (36%)	5 (20%)

It polished my habit to have a respect for people different from myself	1 (4%)	-	3 (12%)	10 (40%)	5 (20%)
It taught me how to learn	1 (4%)	-	2 (8%)	10 (40%)	6 (24%)
It improved my skills to manage my time and money	1 (4%)	-	3 (12%)	8 (32%)	7 (28%)
Traineeship program offered opportunities for networking and professional growth	1 (4%)	-	1 (4%)	10 (40%)	7 (28%)
It enhanced my initiative taking"	1 (4%)	-	3 (12%)	9 (36%)	6 (24%)

Conclusion

The study indicates that traineeship programs significantly influence the professional and personal growth of MLIS graduates, with a majority undergoing 6 months to 1 year of training. It also reveals that the selection of institutions for traineeship was primarily driven by the prospects of learning and quality mentorship. Centrally Funded Technical Institutions (CFTIs) emerged as the primary providers of traineeships, offering experiences across various sections of library arrays. However, only 28% of respondents reported high satisfaction with the traineeship program, suggesting room for improvement. Private universities were the leading providers of job opportunities for graduate trainees. Overall, the study highlights that traineeships positively impact personal development, skills, and capabilities.

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ASSESSMENT OF INFORMATION RESEARCH LITERACY AMONG RESEARCH SCHOLARS IN PONDICHERY UNIVERSITY

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Introduction

In today's information-driven world, research scholars must have information research literacy skills to engage in academic discourse, advance knowledge, and address societal challenges. Assessing information research literacy among research scholars is crucial for preparing them to navigate the complexities of contemporary research. This includes the ability to locate, critically evaluate, ethically use, and effectively communicate information within scholarly inquiry (Beaudry, J. S & Miller, L, 2016). Assessment practices are diverse and multifaceted, including performance-based assessments, research projects and papers, and peer review. These methods help evaluate scholars' proficiency in navigating the research process and offer opportunities for skill development. By utilizing a variety of assessment methods, educators can support the development of proficient scholars and researchers in the academic environment (Sohail, M & Sharma, A, 2023).

Information research literacy is crucial in the digital era for academic investigation, enabling critical thinking, efficient search, in-depth literature reviews, and significant contributions to fields. It also covers ethical issues like citation guidelines and intellectual property rights, ensuring the integrity and legitimacy of research projects. Assessment of information research literacy is crucial for identifying areas of proficiency, promoting critical thinking and analytical skills, promoting ethical information use and academic honesty, and improving the quality of scholarly publications (Bruce, C. S, 2013). It helps educators identify areas where learners need additional support, allowing for targeted interventions. It also helps students evaluate the credibility, reliability, and relevance of information, enabling informed judgments and decisions. Assessing scholars' ability to synthesize information from various sources also contributes to the creation of excellent research papers and presentations.

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Pondicherry University's research scholars must assess information research literacy to navigate and critically analyse material in the modern academic scene, where digital technology and information influence scholarly endeavours. The university must ensure its evaluation techniques align with dynamic research scholar needs and equip them for professional settings. Thus, there is a pressing need to investigate and address these gaps to enhance the assessment practice of information research literacy among research scholars at Pondicherry University.

Objectives of The Study

The objectives of this study are:

1. To examine the different information resources that typically consult for research.
2. To investigate role of events and platforms that used to stay updated on the latest research trends and methodologies.
3. To analyses the awareness and use of Reference Management Tools for organizing citation in research.
4. To examine the factors to determine credibility when evaluating a research paper.
5. To investigate how treat plagiarism when incorporating information into research work.
6. To identify the challenges when conducting information search for scholarly work.

Review of Literature

This study aims to determine the expertise of research researchers in assessing information management competency and identify disparities in information literacy (IL) among academics and genders. Data from researchers at Manonmaniam Sundaranar University in Tamil Nadu was collected through a survey. The findings revealed that most users used simple search instead of the Online Public Access Catalogue, struggled to evaluate material, and library staff's assistance was inadequate. The study also identified issues and provided recommendations (Senthur Selvi, K. & Ganesan, P, 2022).

The current study researchers (Singh, R. & Kumar, S, 2019) evaluate the information use ethics expertise of social science researchers. It found that 79.62 percent of respondents were competent in information literacy, indicating their ability to use information ethically and legally. The majority were from economics, followed by political science, history, sociology, law, and geography. However, 20.38 percent were less competent in information literacy, with a minimum of 1.54% from economics, a maximum of 4.42 percent from law, and 4.04 percent from geography. This indicates that many researchers have only basic or lower information literacy skills, well behind their proficiency level.

In this research (Chanchinmawia, F & Verma, M. K, 2018) assesses the information literacy skills of Mizoram University's research scholars. A structured questionnaire was distributed to 232 researchers, with 75.43% of them completing it. The researchers were found to have sufficient information processing skills for their

basic needs, including library knowledge and access to print and electronic information. However, there is room for improvement in handling information, especially when evaluating electronic sources.

This paper reports a study on information literacy implementation among multidisciplinary PhD students, based on workplace visits and interviews. The study found that integrating information literacy is a cooperative effort involving interactions with concrete items and discussions, embedded in socio-material practices and interdisciplinary researcher perceptions. Activities like attending seminars and conferences facilitate discussions about work-in-progress (Pilerot, O, 2016).

Methodology

To meet the objectives of the present investigation, the main methods employed in data collection were a questionnaire survey among research scholars in Pondicherry University. A stratified random sampling technique is used to evaluate how research scholars at Pondicherry University use information research literacy. A total of 100 questionnaires were distributed online to research scholars in the 10 schools of the Pondicherry University covering the major subject areas. A total of 72 respondents responded to the study. The investigator used online Google form as the tool for data collection. The present study is descriptive research in nature and involves gathering data that describes events and organizes, tabulates, depicts, and describes the data collection.

Data Analysis & Interpetations

A total of 72 respondents responded to the study, In these 38 respondents (52.8%) from male population and 34 respondents (47.2%) from female research scholars.

Types of Resources That Typically Consult for Research

The table 1 presents the resources utilized by respondents for information gathering.

Table 1: Types of resources that typically consult for research

Resources	Frequency	Percentage
Peer- Reviewed Journal	30	41.7
Online databases	33	45.8
Websites	3	4.2
Books & Monographs	6	8.3
Total	72	100

The study found that 45.8% of respondents use online databases for information access, indicating a strong reliance on digital platforms. Peer-reviewed journals were used by 41.7% for scholarly research, while books and monographs were used by 8.3%. Websites were used by 4.2% of respondents, indicating a mix of digital and traditional resources in their information-gathering practices. Overall, the data highlights the diverse range of sources preferred by respondents.

5.2 Confident in Evaluating the Credibility and Reliability of Information Sources

Table 2: Confident in evaluating the credibility and reliability of information sources

Confidence	Frequency	Percentage
Very confident	11	15.2
Confident	35	48.8
Somewhat confident	21	29.1
Not very confident	5	6.9
Not at all confident	0	-
Total	72	100

The data in table 2 shows how research scholar' s confidence levels on the subject resources, with 15.2% feeling "very confident" and 48.8% "confident." 29.1% were "somewhat confident," and 6.9% were "not very confident." No respondents felt "not at all confident." The findings emphasize the need for confidence-building efforts, especially for those feeling less confident.

Critically Analysing and Synthesising Information from Different Resources to Develop Own Arguments

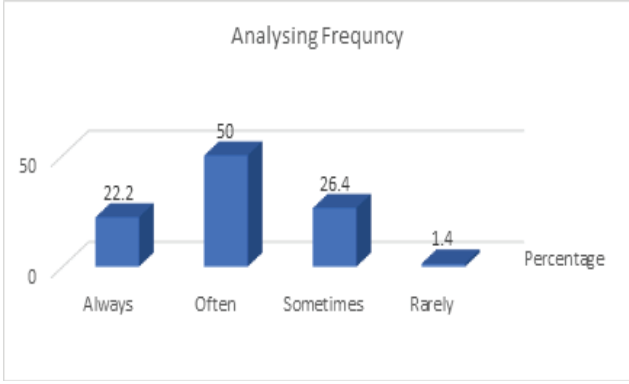


Figure 2: *Critically analysing information from different resources to develop own arguments*

The data from table 3 shows that 22.2% of respondents analyse "Always," 50% do so "Often," 26.4% "Sometimes," and only 1.4% "Rarely." This indicates a common habit of analysis among the surveyed group, indicating a commitment to critical thinking and thorough examination of data. The data emphasizes the importance of analysis in research and decision-making processes.

Events and Platforms That Used to Stay Updated on The Latest Research Trends and Methodologies

Table 4 illustrates the various events and platforms utilized by research scholars for obtaining information or staying updated within their field.

Table 3 Events and platforms that used to stay updated on the latest research trends and methodologies

Events & Platforms	Frequency	Percentage
Attending conference & seminars	26	36.1
Reading scholarly journals	24	33.3
Following academic blogs & forums	10	13.8
Engaging with peers & mentors	11	15.3
Social media	1	1.5
Total	72	100

The data from table 3 reveals that 36.1% of respondents engage in attending conferences and seminars, 33.3% read scholarly journals, 15.3% engage with peers and mentors, 13.8% follow academic blogs and forums, and 1.5% mention social media as a source. These findings highlight the diverse ways in which respondents acquire information, highlighting the importance of staying informed in academic circles.

Awareness and Use of Reference Management Tools in Research

Table 4: Use of reference management tools in research

Usage of Reference Management Tools	Frequency	Percentage
Always	26	36.1
Sometimes	40	55.6
Rarely	5	6.9
Never	1	1.4
Total	72	100

The table shows varying levels of engagement with reference management tools among scholars. 55.6% engage sometimes, 36.1% always, 6.9% rarely, and 1.4% never. The majority engage "Sometimes," indicating periodic involvement, while 36.1% engage "Always," indicating significant but not dominant participation. The findings highlight diverse participation patterns in the activity, with only 1.4% claiming to never engage.

Factors to Determine Credibility When Evaluating a Research Paper

The data presents respondents' perspectives on factors influencing their evaluation of academic content.

Table 5: Factors to determine credibility when evaluating a research paper

Factors	Frequency	Percentage
Author's credentials and affiliation	12	16.7
Publication date and relevance to the topic	11	15.3
Peer review process and journal reputation	9	12.4
All of the above	40	55.6
Total	72	100

According to table 5 majority of respondents (55.6%) believe in a holistic approach to content assessment, considering all factors. However, 16.7% prioritize the author's credentials and affiliation, 15.3% value the publication date and relevance, and 12.4% emphasize the importance of the peer review process and journal reputation. These findings highlight the multifaceted nature of content evaluation, helping content creators and publishers ensure the quality and relevance of academic materials to meet diverse audience needs.

Treatment Plagiarism When Incorporating Information into Research

The data outlines the methods used for treatment of plagiarism when incorporating information into their work.

Table 6: Treatment plagiarism when incorporating information into research

Methods	Frequency	Percentage
Paraphrase the information and cite the source properly	52	72.2
Copy and paste the information directly without citation	11	15.3
Change a few words from the original text and claim it as your own	9	12.5
Skip citing sources altogether	0	-
Total	72	100

The table 6 shows that 72.2% of respondents paraphrase information and cite sources properly, demonstrating commitment to academic integrity and ethical research practices. However, 15.3% admit to copying without citation, and 12.5% change words and claim it as their own. No respondents skipped citing sources, indicating a general awareness of citation importance. The findings suggest a need for increased awareness and education on plagiarism avoidance and ethical sourcing in academic endeavours.

Challenges When Conducting Information Search for Scholarly Work

This data outlines the challenges faced by research scholars in their academic pursuits.

Table 7

Challenges	Frequency	Percentage
Accessing relevant resource	29	40.2
Evaluating source credibility	11	15.3
Managing and organizing citations	11	15.3
Synthesizing information from various source	9	12.5
Understanding complex research methodologies	12	16.7

Table 7 reveals the challenges faced by respondents in their academic pursuits. Accessing relevant resources is the most common challenge, cited by 40.2% of respondents. Evaluating source credibility and managing citations are also significant challenges for 15.3% of respondents. 12.5% struggle with integrating diverse sources into their work, while 16.7% struggle with understanding complex research methodologies. These findings highlight the diverse challenges faced by individuals in the academic landscape and suggest areas where additional support and resources may be beneficial.

Conclusion

The results of the study on the assessment of information research literacy among research scholars of Pondicherry University provide valuable insights into the behaviours, preferences, and challenges faced by this academic community. The study illuminates the diverse information acquisition preferences among research scholars, with a notable preference for online databases and peer-reviewed articles. However, challenges such as accessing relevant resources and evaluating source credibility highlight areas where additional support may be beneficial. Furthermore, the study emphasizes the importance of maintaining academic integrity, with majority of research scholars demonstrating proper citation practices. However, the presence of instances of improper attribution underscores the need for continued awareness and education regarding plagiarism avoidance in academic research.

In conclusion, the study provides valuable insights into the information research literacy practices among research scholars at Pondicherry University. These findings can inform the development of targeted strategies to enhance engagement, support knowledge acquisition, and foster academic integrity within the university community. Moving forward, addressing the identified challenges, and building upon the observed strengths will be instrumental in promoting a culture of effective information research literacy and scholarly excellence among the research scholars at Pondicherry University.

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RESEARCHER PERCEPTION ON USE OF SOCIAL MEDIA AS A RESEARCH COLLABORATIVE TOOLS BY SOCIAL SCIENCE RESEARCH SCHOLARS AT SELECTED UNIVERSITIES of TAMIL NADU

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Introduction

Social media has become an essential tool for research communication, offering various benefits across different academic disciplines. Scholars have highlighted the advantages of social media in research communication, including improved communication with stakeholders, increased opportunities and contacts, enhanced student learning and satisfaction, and increased peer support and communication about content (Chugh et al., 2020; Mahmud et al., 2022). Additionally, social media has been found to be effective in raising awareness of academic research articles, providing links between related research, and increasing citations (Cochrane et al., 2018). Furthermore, it serves as a platform for sharing personal academic interests, creating groups for academic purposes, and improving e-textbook functions by linking students with collective ideas for collaborative work (Boahene et al., 2019). Moreover, academic social media performs literature-related functions such as searching for academic literature, tracking relevant articles, and providing access to publication lists and database entries (Salami et al., 2020). In addition to its role in research communication, social media has also been found to have an impact on students' academic achievements, offering informal means of learning and facilitating communication and collaboration between individuals and groups (Motar et al., 2022; Lim et al., 2021). However, it is important to note that the intensity of social media use may correlate with the level of social anxiety in adolescents, potentially affecting social interaction and causing higher levels of anxiety (Silmi et al., 2020).

Objectives

i. To Identify Popular Social Media Platforms for Academic Collaboration

ii. To Explore the Perceptions and Attitudes of Scholars Toward Social Media Use in Research

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iii. To Evaluate the Role of Social Media in Networking and Knowledge Sharing

Methodology

This study uses quantitative research methods, and the sample size for the study was 623 Ph.D. Social Science Scholars in Selected Universities of Tamil Nadu. An online survey was conducted by the respondents in Tamil Nadu by the researcher using a convenience sampling technique. The research is collecting data from an online questionnaire mode from November 2023 to February 2024 in recruitment social science. This survey was conducted through Google Forms; the link to the online survey was shared through E-Mail and WhatsApp. After collection, it was analyzed using descriptive and statistical analysis methods such as frequency distribution, chi-square analysis, Mean score and rank analysis. used for analyzing the results from SPSS were calculated for the previously described respondents. The statistical analyses were carried out using Microsoft Excel and SPSS 23 version.

Data Analysis and Results

Table - 1: Demographic profiles and descriptive statistics of the surveys

Variables	Components	Count	%
Selected Universities	Alagappa University	73	11.7
	Annamalai University	87	14
	Bharathidasan University	51	8.2
	Bharathiyar University	62	10
	Central University of Tamilnadu	60	9.6
	Gandhigram Rural University	65	10.4
	Madurai Kamaraj University	50	8
	Manonmaiam Sundaranar University	63	10.1
	Periyar University	70	11.2
	University of Madras	42	6.7
	Total	623	100
Gender	Male	323	51.8
	Female	300	48.2
	Total	623	100
Age group	Below 25 years	133	21.3
	26-35 years	409	65.7
	36-45 years	71	11.4
	Above 45 years	10	1.6
	Total	623	100

Research area	Economics	72	11.6
	Education/Physical Education	102	16.4
	Management/ Commerce	148	23.8
	Sociology/ Social Work	56	9
	Library and Information Science	54	8.7
	History/Geography	40	6.4
	Philosophy/Psychology	39	6.3
	Public Administration	2	0.3
	Anthropology/ Criminology	5	0.8
	Journalism and Mass Communication	24	3.9
	Political Science	17	2.7
	Cultural Studies/Women s studies	64	10.3
	Total	623	100
Residing areas	Rural	364	58.4
	Urban	259	41.6
	Total	623	100

Selected Universities: From the analysis, it can be interpreted that among 623 considered respondents; 14% (87) are research scholars from Annamalai University followed by 11.7% (73) are from Alagappa University, 11.2% (70) are from Periyar University, 10.4 (65) are from Gandhigram Rural Institute (Deemed to be University), 10.1% (63) are from Manonmaniam Sundaranar University, 10.0% (62) are research scholars from Bharathiyar University, 9.6% (60) are from Central University of Tamilnadu, 8.2% (51) are from Bharathidasan University research scholar, 8.0% (50) are from Madurai kamaraj University and 6.7% (42) are research scholars participants of University of Madras.

Gender: Majority of respondents Social Science Scholars are male. They contribute more than half 50% Out of (51.8%, 323) of the respondents are male, the remaining half of 40% (48.2%, 300) of the respondents are female.

Age group: Two third of the respondents are aged 26-35 years (71, 65.7%), and one-third of them (133, 21.3%) are aged below 25 years, followed by (71, 11.4%) 36-45 years and the remaining (10, 1.6%) are aged above 45 years.

Research area: A majority of 23.8% (148) respondents are pursuing Management/ Commerce and 16.4% (102) respondents are Education/Physical Education, 11.6% (72) Economics, 10.3% (64) Cultural Studies/Women's Studies, 9% (56) Sociology/ Social Work, 8.7% (54) Library and Information Science, 6.4% (40) History/Geography, 6.3% (39) Philosophy/Psychology, 3.9% (24) Journalism and Mass Communication, 2.7% (17) Political Science, 0.8% (5) Anthropology/ Criminology and 0.3% (2) of them are Public Administration Scholars.

Residing areas: Slightly more than half of the respondents are hailed from rural areas 58.4% (364). About half of the respondents 41.6% (259) of them belongs to Urban areas.

Table 2: Use of General Social Media/Networks by Researcher perception Vs. Gender

General SM/N	Gender				Chi-Square Test		
	Male		Female		$\chi 2$	df	Sig.
Ask.fm	87	26.9	85	28.3	.152	1	.696
Bebo	128	39.6	131	43.7	1.044	1	.307
Dailymotion	127	39.3	141	47.0	3.744	1	.053
Facebook	242	74.9	229	76.3	.168	1	.682
Flickr	120	37.2	122	40.7	.809	1	.368
Foursquare	104	32.2	107	35.7	.835	1	.361
Google Talk	176	54.5	166	55.3	.045	1	.832
Hangouts	121	37.5	124	41.3	.977	1	.323
Hi5	88	27.2	93	31.0	1.064	1	.302
Ibibo	73	22.6	81	27.0	1.618	1	.203
Instagram	249	77.1	228	76.0	.103	1	.748
LinkedIn	288	89.2	247	82.3	5.983	1	.014
Meetme	132	40.9	116	38.7	.314	1	.575
Meetup	99	30.7	91	30.3	.007	1	.932
Metacafe	57	17.6	60	20.0	.565	1	.452
Myspace	122	37.8	118	39.3	.160	1	.689
Ning	85	26.3	69	23.0	.919	1	.338
Picasa	78	24.1	70	23.3	.057	1	.811
Pinterest	141	43.7	137	45.7	.255	1	.613
Plaxor	73	22.6	65	21.7	.079	1	.779
Reddit	72	22.3	65	21.7	.035	1	.851
Shtyle.fm	76	23.5	66	22.0	.207	1	.649
Skype	156	48.3	150	50.0	.180	1	.671
Snapchat	200	61.9	196	65.3	.783	1	.376
Tagged	105	32.5	85	28.3	1.279	1	.258
Telegram	183	56.7	154	51.3	1.775	1	.183
Tumblr	118	36.5	103	34.3	.329	1	.566
Twitter	111	34.4	107	35.7	.116	1	.734
Vine	103	31.9	88	29.3	.478	1	.489
WhatsApp	298	92.3	275	91.7	.074	1	.785
Xing	108	33.4	93	31.0	.423	1	.516
Yahoo!Buzz	85	26.3	83	27.7	.144	1	.704
Yahoo!Pulse	50	15.5	51	17.0	.265	1	.607
Yammer	38	11.8	42	14.0	.694	1	.405
YouTube	267	82.7	235	78.3	1.863	1	.172

Zedge	50	15.5	54	18.0	.710	1	.399
Zoomr	49	15.2	58	19.3	1.895	1	.169
Zorpia	47	14.6	50	16.7	.530	1	.467
Total	323	51.8	300	48.2			

Table 2 shows the web 2.0 tools for obtaining required information on Use of General Social Media/Networks by Researcher perception used by male and female social science scholars to get their sharing research information.

Male Respondents

Majority of the respondents (298, 92.3%) make use of WhatsApp is one of most web 2.0 tools for obtaining required information. More than of the respondents (288, 89.2%) get required information with LinkedIn, (82.7%) of the respondents required information are YouTube, (249, 77.1%) information are Instagram, Facebook required information are (242, 74.9%), Slightly more than half of the respondents (200, 61.9%) get information sharing Snapchat, (183, 56.7%) get required information of Telegram, (176,54.5%) get information of Google Talk, Skype (156, 48.3%), (132, 40.9%) get information from Meetme, (128, 39.6%) Bebo, (127, 39.3%) Dailymotion, Myspace (122, 37.8%), (121, 37.5%) Hangouts, (120, 37.2%) Flickr, (118, 36.5%) Tumblr, (111, 34.4%) Twitter, (108,33.4%) Xing, (105, 32.5%) Tagged, (104, 32.2%) Foursquare, (103, 31.9%) Vine, (99, 30.7%) Meetup, (88, 27.2%) Hi5, (87, 26.9%) Ask.fm, (85, 26.3%) Yahoo!Buzz and Ning, (78, 24.1%) Picasa, (76, 23.5%) Shtyle.fm, (73, 22.6%) Ibibo and Plaxor, (72, 22.3%) Reddit, (57, 17.6%) Metacafe, (50, 15.5%) Yahoo!Pulse and Zedge, (49, 15.2%) Zoomr, (47, 14.6%) Zorpia, The least General Social Media/ Networks platforms among Social Scholars *are* (38, 11.8%) Yammer.

Female Respondents

Majority of the respondents (275, 91.7%) make on using WhatsApp from required information, While (247, 82.3%) required information are LinkedIn, (235, 78.3%) YouTube, (229, 76.3%) Facebook, (228, 76.0%) Instagram, (196, 65.3%) Snapchat, (166, 55.3%) Google Talk (154, 51.3%) Telegram, (150, 50.0%) Skype, (141, 47.0%) Dailymotion, (137, 45.7%) Pinterest, (131, 43.7%) Bebo, (124,41.3%) Hangouts, (122, 40.7%) Flickr, (118, 39.3%) Myspace, (116, 38.7%) Meetme, (107, 35.7%) Foursquare and Twitter, (103, 34.3%) Tumblr, (93, 31.0%) Hi5 and Xing, (91, 30.3%) Meetup, (88, 29.3%) Vine, (85, 28.3%) Ask.fm and Tagged, (83, 27.7%) Yahoo!Buzz,, (81, 27.0%) Ibibo, (70, 23.3%) Picasa, (69,23.0%) Ning, (66, 22.0%) Shtyle.fm, (65, 21.7%) Plaxor and Reddit, (60, 20.0%) Metacafe, (58, 19.3%) Zoomr, (54, 18.0%) Zedge, (51, 17.0%) Yahoo!Pulse, (50, 16.7%) Zorpia, only less number of Social Science scholars make use of (42, 14.0%) Yammer.

Chi-Square Test

To investigate whether there is an association between gender of the respondents and General Social Media/Networks platforms, chi –square statistics test was conducted.

Table 4.9 shows the results of the test and reveals that there is an association between nativity of the respondents and gender of the respondents and General Social Media/ Networks platforms as the p-value is less than the significant level of 0.05 (χ^2 = 5.983, df = 1, p< **.014**). The null hypothesis is rejected and the alternative hypothesis is accepted.

There is no association between gender of the respondents and General Social Media/Networks platforms, as the p-value is more than the significant level of 0.05. There is no association between the variables. Thus, the null hypothesis is accepted.

Table 3: Level of Satisfaction Vs Academic Social Media/Networks Research Tools: Mean score and Rank Analysis

Variables	Weight					Total Weight Score	Mean Score	Rank
	5	4	3	2	1			
	Extremely Satisfied	Very Satisfied	Moderately Satisfied	Slightly Satisfied	Not at all Satisfied			
	Response							
Academia.edu	1285	584	432	104	24	2429	3.90	2
Bharat Students	245	780	411	262	111	1809	2.90	26
Chegg	590	500	621	164	91	1966	3.16	15
Cite ULike	510	596	459	214	112	1891	3.04	19
Classmates	365	504	804	146	83	1902	3.05	18
Docsity	395	604	591	128	132	1850	2.97	21
Emerald Research Connections	370	608	852	68	79	1977	3.17	13
End Note	590	612	645	118	78	2043	3.28	11
Epernicus	345	500	705	166	111	1827	2.93	22
Figshare	345	504	627	214	112	1802	2.89	28
Google Scholar	1225	740	318	90	42	2415	3.88	3
HUB zero	110	772	717	118	110	1819	2.92	23
Mendeley	685	676	555	172	46	2134	3.43	5
Method Space	230	400	948	118	102	1798	2.89	29
My Experiment	220	504	570	322	102	1718	2.76	32
Nano HUB	230	584	792	84	125	1815	2.91	24
Ref works	345	600	684	238	57	1924	3.09	17
Research Gate	1230	612	483	120	3	2448	3.93	1
Researcher ID	815	612	273	368	32	2100	3.37	8
Scholastica	555	580	681	180	50	2046	3.28	10
Scispace	285	584	528	296	96	1789	2.87	30
Sci blogs	270	484	759	194	98	1805	2.90	27

Science2.0	390	392	399	478	75	1734	2.78	31
Science Stage	390	576	486	242	118	1812	2.91	25
Science Daily	470	500	489	322	80	1861	2.99	20
Sci Meet	630	612	474	114	148	1978	3.17	12
Sci topics	850	488	537	140	82	2097	3.37	9
Slide Share	750	676	465	184	57	2132	3.42	6
Study Blue	740	576	333	186	127	1962	3.15	16
Wikio	400	860	465	146	100	1971	3.16	14
Word press	735	696	462	134	81	2108	3.38	7
Zetero	960	884	336	174	11	2365	3.80	4

Weighted score = weight* No. of Respondents. Weighted average rank: Total/sum of weight

The researcher has given weight from the actual score based on an order from (5 weight for factors acquired Extremely satisfied on respondents, 4 weight for factors acquired Very satisfied respondents, 3 weight for factors acquired Moderately satisfied respondents, 2 weight for factors acquired Slightly satisfied respondents, 1 weight for weight for factors acquired Not at all satisfied respondents).

Table 3 shows that Research Gate has got 1st rank in the Academic Social Networks followed by availability of favorite research tools. Academia.edu has got 2nd rank, Google Scholar 3rd rank, Zetero 4th rank, Mendeley is 5th rank, Slide Share is 6th rank, Word press 7th rank, Researcher ID 8th rank, Sci topics 9th rank, Scholastica 10thrank, End Note 11th rank, Sci Meet 12th rank, Emerald Research Connections 13th rank, Wikio 14th rank, Chegg 15th rank, Study Blue 16th rank, Ref works 17th rank, Classmates 18th rank, Cite ULike 19th rank, Science Daily 20th rank, Docsity 21th rank, Epernicus 22 rank, HUB zero 23 rank, Nano HUB 24th rank, Science Stage 25th rank, Bharat Students 26th rank, Sci blogs 27th rank, Figshare 28th rank, Method Space 29th rank, Scispace 30th rank, Science2.0 31th rank and My Experiment 32th rank. The study concludes that social science scholars in selected Tamil Nadu universities are satisfied with the use of academic social networks. It is inferred that scholars need academic research-related tools. It is found that it is based on the wands and satisfactions of scholars. It is suggested that research tools be used on academic social networks. It is found that it is essentially needed by social science scholars. This satisfaction is based on the present academic social network evaluation of alternatives given priority of Research Gate, Academia. edu, Google Scholar, Zetero, and Mendeley.

Association between personal factors of Academic Social Networks for Research Gate

To study the association between personal factors of Academic Social Networks for Research Gate, chi-square test has been applied and the results of the test are given below:

- **H_0:** There is no association between personal factors of Academic Social Networks for Research Gate.
- **H_1:** There is association between personal factors of Academic Social Networks for Research Gate.

Table 4: Association between Personal Factors of Academic Social Networks Vs. The Respondents Highly preference of Research Gate

S. No	Variables	Calculate value	DF	Sig.	Result
1	Selected Universities	23.282	36	.950	Accepted
2	Research area	35.726	44	.808	Accepted
3	Gender	2.029	4	.730	Accepted
4	Age Group	9.899	12	.625	Accepted
5	Residing area	3.861	4	.425	Accepted

(Source: Primary Data)

As the *p* values of all five personal factors are more than 0.05, it is concluded that there is no association between personal factors of Academic Social Networks for Research Gate. The null hypothesis is accepted. Association between personal factors of Academic Social networks for Use of Academia.edu. To study the association between factors of Academic Social networks for Use of Academia.edu, chi-square test has been applied and results of the test are given below:

- **H_0:** There is no association between personal factors of Academic Social networks for Use of Academia.edu
- **H_1:** There is association between personal factors of Academic Social networks for Use of Academia.edu.

Table 5: Association between Personal Factors of Academic Social Networks Vs. The Respondents Highly preference of Use of Academia.edu.

S. No	Variables	Calculate value	DF	.Sig	Result
1	Selected Universities	23.282	36	950.	Accepted
2	Research area	35.726	44	808.	Accepted
3	Gender	2.029	4	730.	Accepted
4	Age Group	9.899	12	625.	Accepted
5	Residing area	9.233	4	056.	Accepted

(Source: Primary Data)

As the *p* values of one personal factors are more than 0.05, it is conducted that there is no association between personal factors of Academic Social networks for Use of Academia.edu. The null hypothesis is rejected.

Association between personal factors of Academic Social networks for Use of Google Scholar.

To study the association between personal factors of Academic Social networks for Use of Google Scholar, chi-square test has been applied and results of the test are given below.

- **H_0:** There is no association between personal factors of Academic Social networks for Use of Google Scholar
- **H_1:** There is an association between personal factors of Academic Social networks for Use of Google Scholar.

Table 6: Association between Personal Factors of Academic Social Networks Vs. The Respondents Highly preference of Use of Google Scholar.

S. No	Variables	Calculate value	DF	Sig.	Result
1	Selected Universities	503.288	36	.000	Rejected
2	Research area	126.026	44	.000	Rejected
3	Gender	9.500	4	.050	Rejected
4	Age Group	19.282	12	.082	Accepted
5	Residing area	.328	4	.988	Accepted

(Source: Primary Data)

As the *p* values of three personal factors are less than 0.05, it is concluded that there is no association between the personal factors of Academic Social networks for Use of Google Scholar. The null hypothesis is rejected. As the *p* values of two personal factors are more than 0.05, it is concluded that there is an association between the personal factors of Academic Social networks for Use of Google Scholar. The null hypothesis is accepted.

Findings

- It provided can be interpreted that among 623 considered respondents; most participants' contributions of 14% (87) are research scholars from Annamalai University.
- Majority of respondents Social Science Scholars are male. They contribute more than half 50% Out of (51.8%, 323) of the respondents are male.
- Two third of the respondents are aged 26-35 years (71, 65.7%)
- A majority of 23.8% (148) respondents are pursuing Management/ Commerce.
- Slightly more than half of the respondents are hailed from rural areas 58.4% (364).
- Majority of the male respondents (298, 92.3%) make use of WhatsApp is one of most web 2.0 tools for obtaining required information. More than of the respondents (288, 89.2%) get required information with LinkedIn, (82.7%) of the respondents required information are YouTube, (249, 77.1%) information is Instagram, Facebook required information are (242, 74.9%).
- Majority of the female respondents (275, 91.7%) make on using WhatsApp from required information, While (247, 82.3%) required information are LinkedIn, (235, 78.3%) YouTube, (229, 76.3%) Facebook required information are (228, 76.0%).

- It is provided classified into thirdy two variables in Academic Social Media and Networks for Research Gate has got 1st rank (Mean Score: 3.93) followed by availability of favorite research tools. Academia.edu has got 2nd rank (Mean Score: 3.90) and Google Scholar 3rd rank (Mean Score: 3.88).

Conclusion

The researcher's perception of social media as a collaborative tool in academic research among social science scholars in Tamil Nadu is highlighted in this study. The study found that 62% of participants contributed to it, with 92.0% preferring WhatsApp, 85.9% preferring LinkedIn, and 80.6% preferring YouTube for general social media and networks. Among academic social networks, Research Gate, Academia.edu, and Google Scholar were the most preferred. By leveraging the benefits of these social media tools, scholars and institutions can harness their full potential as a collaborative tool in academic research. These studies give social science scholars the ability to use social media platforms collaboratively to enhance their research performance. The study demonstrated a strong relationship between integrated collaborative theory and the use of social media for research purposes.

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SECTION - IX
INFORMATION SEEKING BEHAVIOUR AND USER STUDIES

USAGE PATTERNS OF LIBRARY RESOURCES & SERVICES AMONG PG STUDENTS IN VIGNAN GROUP OF INSTITUTIONS IN GUNTUR: A SURVEY

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Introduction

Now a days, libraries can be seen as busy data centers, displaying data in various formats for the benefit of users. The value of the library collection is not solely determined by the number of knowledge sources, but also by how they are presented and decoded for the users. In library activities, terms like cataloging, classification, charging, and discharging are not common to users; University libraries serve as a primary resource to support instruction, learning, and analysis, in accordance with the institution's mission and objectives. The services that correlate positively are inter-library loans and help from library staff in searching online databases and services. The University Libraries provide ample scope and opportunity for the students and staff to read and learn a lot from a wide variety of newspapers and magazines, online journals, databases, books etc.. available in the Library.

Definition of Library Resources & Services

Library Resources means any form of written, printed, or graphic matter on or in which information is written, recorded, stored, displayed, or reproduced, including manuscripts, typescripts, books, newspapers, periodicals, pamphlets, maps, microforms, music sheets, photographs, cinematograph films, phono records, video and audio recordings and other recordings on paper, film or other materials

Library services encompass a range of resources, facilities, and support provided by libraries to meet the informational, educational, and recreational needs of their users. These services aim to facilitate access to information, support learning and research, and foster community engagement

Importance of Library Resources & Services

- Libraries keep history and, more importantly, facts.
- Libraries offer free educational & academic resources.
- Libraries are transparent in all the services they provide.

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- Libraries provide a variety of resources that are accessible to all.
- Libraries help promote education.
- Libraries provide access to technology.
- Libraries are a great place to find jobs and career advice.

Objectives

1. Investigating the purpose of a library visit.
2. Identify and evaluate library resources, facilities, and services.
3. Examine the satisfaction level of library users with the library's resources and services.

Hypotheses: The following hypotheses were formulated for testing

- There would not be any significant differences in the use of library serives and rsources sties among post graduate students and female male students.
- There would not be any significant differences in the time spent on library services and resources among and post graduate students and female male students.

Methodology

The methodology used in the present study is delineated in the following paragraphs.

Sample Selection

The study deals with examining users' expectations, perceptions, and exploitations of library infrastructure and services in select Vignan Group of Institutions in the Guntur District of the state of Andhra Pradesh in India. There are 27 Departments in the peripheral limits of Guntur District. Out of 5 Institutes, Vignan is the best and provides quality academic programs, training activities, research facilities, and opportunities. The Central library at Vignan's University, inaugurated in the year of 2005. It is an air conditioned, aesthetically designed facility with plenty of indoor greenery, modern furniture and reprographic conveniences. The NTR library stack more than 1,12,633 volumes, which include competitive exam resources for UPSC, IES etc, and plenty of audio-visual learning materials. Also, 261 national and international referred journals are available. the researchers have selected library services and resources from this university as the sample in the first instance.

There are different types of users such as UG students, PG students, faculty fembers, research scholars and supporting staff are using this library, the researcher selected the postgraduate students from M.Tech, M.B.A., M.C.A, and M.Pharmacy courses as sample in the second instance. At present, there are 1050 PG Student users in the selected five Vignan Group of Institutions in the Guntur District. Since the population is too large to study, hence, given time and cost involved, a sample of 210 (20% of the population) users have been drawn from the total population by simple random method. However, the researcher received responses from 691 (65.78% of the sample) users only.

Analysis of The Data

The awareness of resources, frequency of use, time spent on online sites, preference for online resources, purpose of using, and problems identified while using the library services and online resources by the Postgraduate students were discussed in the following paragraphs.

Awareness of Resources

The distribution of Postgraduate students according to their awareness of library services and online resources, programs, and gender is shown in Table 1.

Table 1: Distribution of engineering students according to their awareness of resources and services (in percentage)

Response	PG				Gender		Total
	Engineering	SCIENCES	Pharmacy	Mgt	Male	Female	
Yes	655	175	22	198	510	540	1050
No	--	--	--	--	--	--	--
Total	655 (100.00)	175 (100.00)	22 (100.00)	198 (100.00)	510 (100.00)	540 (100.00)	1050 (100.00)

It is found that all the Postgraduate students are aware of the library resources. It indicates that in the present time library resources play a very important role in communicating with peers, friends, or relatives and also in circulating information as the easiest way between them (Table 1).

Frequency of use of Services.

The distribution of Postgraduate students according to their frequency of use, program and gender is shown in Table 2. 55.04 percent of the Postgraduate students are using library resources cited daily, 33.01 percent weekly, 7.79 percent monthly and 4.16 percent rarely (Table 2).

There is no significant difference in the frequency of library services use between postgraduates different streams and female and male students. The chi-square values with three degrees of freedom are not significant at 0.05 level (Table 2).

Table 2: The distribution of engineering students according to their frequency of use

Frequency	PG				PG		PG
	Engineering	SCIENCES	Pharmacy	Mgt	Male	Female	
Daily	360 (55.00)	97 (55.29)	12 (55.00)	109 (55.29)	281 (55.06)	297 (55.04)	578 (55.04)
Weekly	217 (33.02)	58 (32.94)	7 (33.02)	65 (32.94)	167 (32.81)	179 (33.14)	347 (33.01)

Monthly	52 (8.02)	19 (6.47)	2 (8.02)	13 (6.47)	36 (7.19)	44 (8.18)	80 (7.79)
Rarely	26 (3.96)	16 (5.30)	1 (3.96)	10 (5.30)	25 (4.94)	20 (3.64)	45 (4.16)
Total	655 (100.00)	175 (100.00)	22 (100.00)	198 (100.00)	510 (100.00)	540 (100.00)	1050 (100.00)

Time spent

The distribution of postgraduate students according to their time spent on online resources, program and gender is shown in Table 3. Table 3: Distribution of postgraduate students according to their time spent on Library Services and Online resources (in percentage)

Time spent	PG				PG		PG
	Engineering	SCIENCES	Pharmacy	Mgt	Female	Male	
One hour	253 (38.65)	66 (37.65)	8 (37.65)	75 (37.65)	161 (31.69)	231 (42.92)	392 (38.49)
Two hours	242 (36.98)	65 (37.06)	8 (37.06)	73 (37.06)	165 (32.36)	216 (40.00)	381 (36.99)
Three hours	86 (13.12)	22 (12.94)	3 (12.94)	24 (12.94)	83 (16.18)	60 (11.09)	143 (13.10)
More than three hours	74 (11.25)	22 (12.95)	3 (12.95)	26 (12.95)	101 (19.77)	32 (5.99)	142 (11.42)
Total	655 (100.00)	175 (100.00)	22 (100.00)	198 (100.00)	510 (100.00)	540 (100.00)	1050 (100.00)

38.49 percent of the PG students spend one hour on online resources, 36.99 percent two hours, 13.10 percent three hours, and 11.42 percent are spending more than three hours. It may concluded that the majority of the PG students spend 1-2 hours on library services and resources (Table 3).

There is no significant difference in the time spent on Library services and resources between the students of postgraduate. However, there is a significant difference in this regard between female and male students. That means male students are spent more time on online resource sites than female students. (Table 3).

Preference for online resources

The distribution of Postgraduate students according to their preference of online resources, program and gender is shown in Table 4.

88.28 percent of the students preferred 'IEEE', 86 percent prefer 'SPRINGER', 82.95 percent preferred 'ASME', 58.19 percent 'ASCE', 46.95 percent preferred 'EBSCO', and 36.00 percent preferred 'JSTOR'. It may be concluded that a majority of the engineering students are preferred 'IEEE' and 'SPRINGER' (Table 4).

Table 4: Distribution of postgraduate students according to their preference of library online resources (in percentage)

Type of social media	PG				PG		PG
	Engineering	SCIENCES	Pharmacy	Mgt	Female	Male	
IEEE (IEL)	497 (83.02)	230 (76.42)	62 (83.02)	138 (83.02)	359 (80.67)	568 (82.92)	927 (88.28)
SPRINGER	566 (79.79)	138 (81.18)	54 (79.79)	146 (79.79)	356 (80.00	548 (80.00)	904 (86.00)
ASME	735 (76.98)	60 (77.65)	31 (76.98)	45 (76.98)	337 (75.73)	534 (77.96)	871 (82.95)
ASCE	508 (54.06)	46 (54.12)	26 (54.06)	31 (54.06)	243 (54.61)	368 (53.72)	611 (58.19)
EBSCO	105 (43.54)	75 (44.12)	45 (43.54)	268 (43.54)	195 (43.82)	298 (43.50)	493 (46.95)
JSTOR	148 (43.54)	76 (44.12)	65 (43.54)	89 (43.54)	183 (43.82)	195 (43.50)	378 (36.00)

(multiple answers were permitted)

Problems in use of Library services and Resouces: It is observed from the study that there are some problems faced by the engineering students while using SNSs and the same has been displayed in Table 6.

Table 6: Problems/Issues in use of Library services and Resouces

Problems	Responses		Total
	Yes	No	
Budget constraints	294 (28.05)	756 (71.95)	1050 (100.00)
The website is difficult to understand and use	115 (10.97)	935 (89.03)	1050 (100.00)
Available information is not sufficient	441 (42.04)	609 (57.96)	1050 (100.00)
People can search for whatever they want	504 (48.05)	545 (51.95)	1050 (100.00)
Lack of knowledge on how to use it	356 (33.98)	693 (66.02)	1050 (100.00)
Low interest in learning and utilizing online resources	283 (26.99)	767 (73.01)	1050 (100.00)
Staff difficulty	315 (27.88)	757 (72.12)	1050 (100.00)
Slow speed of the internet	293 (34.07)	692 (65.93)	1050 (100.00)
Difficult to search and find information	283 (26.99)	767 (73.01)	1050 (100.00)
Non-availability of proper consultancy service for automation	410 (39.03)	640 (60.97)	1050 (100.00)
Lack of advanced IT skills	263 (25.04)	787 (74.96)	1050 (100.00)

48.05 percent of postgraduate students, people can search for whatever they want is the main problem in using services and resources. Further 42.04 percent of the students have reported that available information is not authentic is the problem they are facing in using the services and resources. It has been observed that, for the majority of the respondents (89.03%), 'website is difficult to understand and use' was not the problem in using services and resources (Table 6).

Findings and Suggestions: Based on the analysis of the study, the significant findings as follows

- It is found that all the PG students are aware of the Library services/Resources.
- A Majority of the PG students (55.04%) are using the Online resources daily.
- There are no significant differences in the level of frequency use of Library services and resources between the students of undergraduate and post graduate, and female and male students.
- A majority of PG students spend 1-2 hours on online resources.
- There is no significant difference in the time spent on Library services and resources the PG students.
- Male students spend more time on online resources than female students.
- A majority of t PG students prefer to use the 'IEEE' and 'Springer' tools.
- The PG students are facing the main problems are 'People can search for whatever they want' and 'available information is not authentic' while using online resources.
- There is a need to encourage PG students to use Library services and resources in their professional activities from their workplace.
- Library authorities should explore possibilities to provide other library services to the users through online resources and services.
- Library authorities should make remedies to overcome all barriers in resources and services for libraries in connection to the use of full versions and facilities of services in libraries and for their professional growth.

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EXPLORING THE READER'S REALM: UNDERSTANDING USER FEEDBACK AND SATISFACTION IN THE DEPARTMENTAL LIBRARY OF MAHATMA GANDHI UNIVERSITY, KOTTAYAM

Aswathy Ajayan[1], Dr. S. Thanuskodi[2] & Saritha. R[3]

Introduction

In the GenAI era, users are the first priority, so things are made up based on the needs of users. The way academic libraries operate has been increasingly reshaped by developmental changes to provide better library and information services to academic communities. But rather than viewing the rise of information and the way technologies have changed to provide library and information services in the twenty-first century as obstacles, academic libraries and librarians should welcome all the overwhelming technological changes for the benefit of users (Obiano et al., 2023). However, it is as important as to seek the needs of users with changing technology. So, the study is detailing the user satisfaction of the departmental library in the School of Letters, an esteemed department at Mahatma Gandhi University, which possesses a good library in terms of collection and service. Library has a collection of 22000 Books and other documentary resources. It's an academic library; users are mainly students, researchers, faculty, alumni and visitors from other colleges. The inquiry is conducted to identify the needs of users and to measure the overall performance in the School of Letters Library.

There have been many studies conducted earlier in terms of user satisfaction, user awareness, and performance analysis. Saloi (2021) stated that users are more related to the physical infrastructure of the library, along with the technological aspects. The management should encourage the librarians to expel best out of them by giving training and participating in several academic programs. On the other hand librarians should focus on user needs and make statistics for the future references (khasim et al., 2017). Continues assessment is an essential requirement to evaluate the performance of library, findings from these studies are useful for the formulation of new measuring techniques to evaluate the performance (Moses et al., 2016).

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Objectives

- To rate the availability, quality of study space and availability of technology in the School of Letters Library
- To find out the users experience on library services and resources, convenience of users in the timing of School of Letters Library

Methodology

The study employed user survey to understand and analyse users experience on School of Letters Library. There are 60 Students, 44 Research Scholars and 8 faculties in the department. From those 30 students, 21 research scholars and 4 faculties are selected by using Simple random selection. From the total population of 112 respondents 55 were taken as the sample. SPSS were preferred to perform mean, median and mode and frequency of variables are tested find the average response for each variable.

Result and Findings

Total population of School of Letters is 60 students, 44 Research Scholars and 8 faculty, from those 30 students, 21 Research scholars and four faculty were selected as sample. Data were analysed via SPSS software.

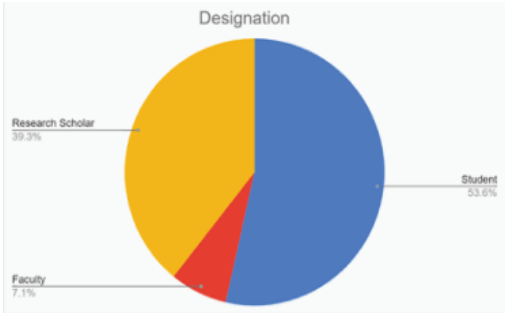


Figure. 1

Availability, Quality of Study Space and Availability of Technology in the School of Letters Library in the View of Users

Availability, quality of study spaces and technology were measured through the opinion of users in the school of letters library. Mean, median is performed to find actual satisfaction level of users. Frequency also measured via SPSS to find the average of opinion.

Availability and Quality of Study Spaces and Technology			
	Availability of study spaces	Quality of study spaces	Availability of Technology
N	Valid	55	55
	Missing	0	0

Mean	3.16	3.15	2.71
Median	3.00	3.00	3.00
Std. Deviation	.877	.756	1.012
Very Poor	0	0	10.9%
Poor	20%	14.5%	29.1%
Good	54.5%	63.6%	45.5%
Very Good	14.5%	14.5%	7.3%
Excellent	10.9%	7.3%	7.3%

Table. 1

Total 55 respondents answered the data. The disquisition Rated the variables on the basis of Very Poor is equal to 1, Poor is equal to 2, Good is equal to 3, Very Good is equal to 4 and excellent is equal to 5. Out of the total respondents 20 % answered availability of study spaces is poor, 54.5% users said it as Good, 14. 5% answered as Very good and 10.9% users tells excellent. Respondents of 14.5% argued that Quality of study space is poor and 63.6 % respondents argued that it was good, 14.5% users feel very good and 7.3% as excellent. None of them answered as the availability and quality of study space is 'very poor'. Availability of technology is very poor by 10.9%, Poor by 29.1% good by 45.5% very good by 7.3% and excellent by 7.3 % respondents. Median we got in the test is '3' in all cases so the majority ensure that availability of study spaces, quality of study spaces and availability of technology in the school of letters library are 'Good'.

Experience of Users on the Library Services and Resources and Convenience of Users in the Timing of the Library

Experience on library services and resources and convenience of users in the timing of library are tested through the mean median and mode to find level of satisfaction among the users. Frequency tested to find the average of each variable. Variables are rated on the basis of 1 is equal to Highly dissatisfied, 2 is equal to Dissatisfied, 3 is equal to neither satisfied or dissatisfied in the case of experience on Library service and resources.

Rate the Experience of Users			
Measurement	Experience on Library Services and Resources	Measurement	Convenience of users in the Timing of the Library
Mean	4.24	Mean	3.53
Median	4.00	Median	4.00
Mode	5	Mode	4
Std. Deviation	.962	Std. Deviation	.604

Highly dissatisfied	3.6%	No. Not at all convenient	0%
Dissatisfied	3.6%	No, not very convenient	5.5%
Neither satisfied or dissatisfied	3.6%	Yes, somewhat convenient	36.4%
Satisfied	43.6%	Yes, very convenient	58.2%
Highly Satisfied	45.5%		

Table.2

Experience on Library resources and services are measured on the basis of mean, median, mode. From the total population, 3.6% are Highly dissatisfied, 3.6% are dissatisfied, 3.6% users neither satisfied or dissatisfied, 43.6 % are satisfied and 45.5% are highly satisfied. From the result we got Median as 4 which means most of the users are 'satisfied' in library resources and services. 58. 2% are said that the timing of library is 'very convenient' to them, by the median of 4(Yes, very convenient).

Conclusion

School of Letters Library is one of the eminent departments of Mahatma Gandhi University, Kottayam. Readers are usually from with in the university, but allow reference to outside readers from other university and they are not allowed to lend the book. Registered users are obviously the students, faculty and research scholar of the particular department. Samples are collected from the students, research scholars and faculty and analysed using SPSS software. The study found that the median of the availability of study space is three and frequency of 54.5% which means good, Quality of study space is good for the users by the frequency of 63.6% and Availability of technology is also good from the view of users. Users of 43.6% are satisfied on Library services, and Resources by the median of four which means satisfied. Timing of school of letters library is very convenient for the users of around 58.2% respondents . Users learning environment influences their reading behavior. So, it's a need to seek their opinion on a regular time bases to understand their realm.

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THE GAP BETWEEN USER EXPECTATIONS AND PERCEPTIONS OF ENGINEERING STUDENTS: A CASE STUDY ON NAAC ACCREDITED ENGINEERING COLLEGE LIBRARIES IN GUNTUR DISTRICT OF ANDHRA PRADESH

Dr. Ch. Madhavi[1] & Dr. K.Kusumakumari[2]

Introduction

A college or university's academic library is integral to the effective functioning of the academic programs offered by it. As a valuable section, it directly provides materials, both print and digital, to user communities, comprising students and faculty. Its main goal is to make value additions in teaching, learning, research, and other areas. Unlike a user remaining distant in a manufacturing company, the user is physically present in a service organization like a college or university library. The user is always a member of the academic community rather than an outsider. However, over the years, due to much technological advancement, we are witnessing rapid transformations in the field of librarianship and the roles and responsibilities of library professionals. Due to developing technology, users are getting more and more comfortable with IT and having higher expectation from the libraries. They want to rapidly and effectively fulfil their informational and research demands. The function of libraries and librarians has altered as a result of information technology. These technologies alter not just the way that information is created, but also how it is distributed to users. Libraries must make every effort to address such pertinent user issues and meet their expectations and desires for better library services.

It is important to review library services in order to raise their level of quality. The primary goal of an educational institution's library is to fulfil the material needs of researchers, faculty, and students. Because of ICTs, users nowadays have increased expectations for library services. Librarians and other information workers have a duty to recognize how users' information demands are evolving and to meet those needs.

A number of issues, particularly in science and technology, limit the actions of the academic libraries in fulfilling the real objectives. The researcher has conducted this study on users' expectations and perceptions of access to information in NAAC Accredited Engineering College Libraries in the Guntur District of Andhra Pradesh,

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although there are existing studies on individual colleges/universities from various geographical regions on users' satisfaction.

Objectives

The objectives of the present study are:

1. To assess expectations and perceptions among engineering students with regard to collection, access to information services, library infrastructural facilities, library as a place and staff services;
2. To determine the ranking of collection, access to information services, library infrastructural facilities, library as a place and staff services as per engineering students' expectations and perceptions levels; and
3. To find out the gap between the engineering students' expectations and perceptions of collection, access to information services, library infrastructural facilities, library as a place and staff services.

Methodology

The methodology used in the present study is clearly delineated in the following paragraphs.

Sample Selection

The study examines user expectations, perceptions and uses of library infrastructure and services in select NAAC accredited engineering college libraries in Guntur District of the state of Andhra Pradesh in India. There are 53 engineering colleges within the peripheral limits of Guntur District. Out of 53 engineering colleges, 11 colleges have been accredited by NAAC. Hence, the researchers have selected users from these eleven colleges as the sample in the first instance.

Though there are different user types such as B.Tech, M.Tech, M.B.A., M.C.A, Faculty and Supporting staff in these engineering college libraries, the researcher has selected undergraduate and postgraduate engineering students only as the sample in the second instance.

At present, there are 9046 (7740 UG students + 1306 PG Students) users in the selected eleven NAAC accredited engineering colleges in Guntur District. Since the population is too large to study, a sample of 1800 (20% of the population) users have been drawn from a total population by simple random method in order to save time and cost. However, the researcher received responses from 1130 users (62.78%) only.

Data Analysis

To know the expectation and perception levels among engineering students on library resources and facilities provided by NAAC accredited engineering college libraries in Guntur District of Andhra Pradesh, the results of the survey are presented in the following tables.

Comprehensive collection

Table 1 shows the gap between the expectations and perceptions levels on library comprehensive collection as indicated by engineering students.

Table 1: The gap between students' expectations and perceptions on comprehensive collection

Collection	Expectations Mean Score (E)	Rank (E)	Perceptions Mean Score (P)	Rank (P)	Gap (E-P)	Rank (E-P)
Printed books	3.98	1	3.62	2	0.36	1
Printed journals	3.55	3	3.39	3	0.16	2
Electronic resources	3.67	2	3.89	1	-0.22	3

Engineering students indicates the overall comparisons made at the outset, between the expectations and perceptions levels with regard to library collection. The study revealed that the gap was that there were not adequacy print books and journals in sample engineering college libraries in Guntur District of Andhra Pradesh (Table 1).

Access to Information

Table 2 shows the gap between the expectations and perceptions levels on access to information as indicated by engineering students.

Table 2: The gap between user expectations and perceptions on access to information

Access to information	Expectations Mean Score (E)	Rank (E)	Perceptions Mean Score (P)	Rank (P)	Gap (E-P)	Rank (E-P)
Prompt re-shelving of journals	4.08	3	3.08	5	1.00	1
Prompt re-shelving of books	3.93	4	3.21	4	0.72	2
Prompt interlibrary loan (loan from other libraries) service	3.64	6	2.99	7	0.65	3
Prompt corrective action regarding missing books and journals	3.63	7	3.01	6	0.62	4
Catalogue having clear and useful information	4.18	2	3.71	3	0.47	5
Easy access to available electronic databases	4.23	1	3.91	1	0.32	6
A webpage having clear and useful information	3.92	5	3.88	2	0.04	7

On an overall evaluation of the study, it is observed that, among all the statements on access to information services, no statement has fully fulfilled the user expectations and revealed that there is a considerable discontentment in their satisfaction levels. Hence, it is suggested to the authorities of the NAAC accredited engineering colleges in Guntur District of Andhra Pradesh to enormously improve the quality of access to information services to desired levels (Table 2).

Library infrastructural facilities

Table 3 shows the gap between the expectations and perceptions levels on library infrastructural facilities as indicated by engineering students.

Table 3: The gap between users' expectations and perceptions on infrastructural facilities

Infrastructural facilities	Expectations Mean Score (E)	Rank (E)	Perceptions Mean Score (P)	Rank (P)	Gap (E-P)	Rank (E-P)
Adequacy of the availability of computer workstations	4.42	1	2.56	5	0.86	1
Adequacy of the availability of furniture and space for reading	3.22	5	2.58	4	0.64	2
Adequacy of the satisfaction towards the proper functioning of computers	3.58	4	2.96	3	0.62	3
Adequacy of the availability of printing facilities	3.68	3	3.24	2	0.44	4
Adequacy of the availability of photocopying facilities	3.82	2	3.51	1	0.31	5

On an overall evaluation of the study, it is observed that, among all the statements on infrastructural facilities, no statement has fully fulfilled the user expectations and revealed that there is a considerable discontentment in their satisfaction levels. Hence, it is suggested to the authorities of the NAAC accredited engineering colleges in Guntur District of Andhra Pradesh to enormously improve the infrastructural facilities to desired levels (Table 3).

Library staff services

Table 4 shows the gap between the expectations and perceptions levels on library staff services as indicated by engineering students.

Table 4: The gap between users' expectations and perceptions on staff services

Staff Services	Expectations Mean Score (E)	Rank (E)	Perceptions Mean Score (P)	Rank (P)	Gap (E-P)	Rank (E-P)
Information skills for study	3.89	4	3.62	7	0.27	1
Knowledgeable staff	3.85	5	3.64	6	0.21	2
Understand service needs	3.93	2	3.75	4	0.18	3
Friendly staff	4.06	1	3.92	1	0.14	4
Instill confidence in users	3.85	5	3.74	5	0.11	5
Readily available	3.92	3	3.82	3	0.10	6
Willing to help	3.93	2	3.90	2	0.03	7

It is evident from Table 4 that that there is a major gap reading to who do not provide users with information skills need for their work or study compared to other staff services. It is followed by knowledgeable staff, understand users' service needs, friendly staff, instill confidence in users, readily available and willing to help.

Library as a place

Table 5 shows the gap between the expectations and perceptions levels on library as a place as indicated by engineering students.

Table 5: The gap between users' expectations and perceptions of library as a place

Library as a Place	Expectations Mean Score (E)	Rank (E)	Perceptions Mean Score (P)	Rank (P)	Gap (E-P)	Rank (E-P)
A quiet library environment	3.88	4	3.43	4	0.45	1
A library space for group learning and group study	3.68	5	3.38	5	0.30	2
Library space that inspires my own study and learning	4.00	1	3.74	3	0.26	3
A safe and a secure place for study	3.99	2	3.81	2	0.18	4
A library environment that has sufficient lighting	3.89	3	3.90	1	-0.01	5

It is evident from Table 5 that that there is a main gap reading that 'a quiet library environment' compared to other statements. It is followed by "a library space for group learning and group study, library space that inspires my own study and learning, and a safe and a secure place for study". It is also evident from table that the students have good perception regarding to the library environment that has sufficient lighting (-0.01).

Academic and research fields

Table 6 shows the gap between the expectations and perceptions levels with regard to the services concerning research and academic fields as indicated by engineering students.

Table 6: The gap between users' expectations and perceptions with regard to the services concerning research and academic fields

Research and academic fields	Expectations Mean Score (E)	Rank (E)	Perceptions Mean Score (P)	Rank (P)	Gap (E-P)	Rank (E-P)
Helps me to advance in my academic field	3.94	2	3.49	2	0.45	1
Helps me with my research needs	4.09	1	3.67	1	0.42	2
Helps me stay abreast of developments in my field(s) of interest	3.85	3	3.48	3	0.37	3

It is evident from Table 6 that that there is a major gap reading to the service concerning research and academic fields that the library helping the students advance in

their academic filed, followed by helping students with their research needs and library helping the students' stay abreast of any developments in their field of interest.

Conclusions

Based on the findings of this research, it is evident that there is a significant gap between the users' expectations and perceptions of library resources and services at the NAAC accredited engineering college libraries in Guntur District of Andhra Pradesh. According to the survey, several services just weren't performing as they ought to be, which had a detrimental effect on how consumers perceived their experiences. The following services had issues: well-functioning computers; an acceptable number of computer work stations; re-shelving of print materials (books and journals); short loan services; printing facilities; a quiet library environment; assistance from the library in helping students advance their academic work. The research also identified the library's strengths and shortcomings with regard to the level of user service provided and proposed areas for improvement as well as the inclusion of new proposed services.

The library users expressed great desire to have many facilities and provisions such as extensive collections, information access, staff services, the library as a location, and general services, were subject to high expectations from library users. But frequently their views were different from what they had anticipated. When compared to their expectations, the students' perceptions of the services and resources offered by NAAC-accredited engineering college libraries were lower.

Users' expectations

Amongst the main objectives of the survey, the research work seeks to find out what engineering students anticipate in terms of service quality. The survey found that engineering students have high standards for the quality of library services. A library that assists students with their research requirements, a library setting with enough lighting, conveniently accessible printed books, access to electronic databases, staff who are pleasant and quickly available to answer questions, employees who are promptly available to react to enquiries.

Users additionally expected a library catalogue which was simple and had valuable information, as well as a homepage having clarity, besides having relevant information. Engineering students had high expectations for the library personnel in terms of their ability to give users with the information skills they need for employment or study, as well as their willingness to assist, know how to answer inquiries, and create confidence in users. The learners anticipated a secure and protected learning atmosphere at the library as a venue. About extensive collection, the learners anticipated the availability of sufficient electronic journals. Other requirements included a library that aids users in advancing their academic careers and one that helps students keep up with changes in their subjects of interest. The engineering students essentially anticipated top-notch services and amenities to meet their demands for reading, learning, and performing research.

Users' perceptions

Understanding how postgraduate learners feel about the library's materials and services was the second objective. According to the survey, users of the NAAC-accredited engineering college library had positive impressions of some services but negative perceptions of others. Ample electronic resources for their work, Immediate access to available electronic databases, a webpage having clear and helpful information, a library atmosphere with enough lighting, library staff who are willing to help, staff who really are cordial to users, easy access to accessible electronic databases, and library staff who recognize users' library requirements were the services with fairly high perceptions. In contrast, services with low perceptions include having an acceptable quantity of computer workstations and functioning computers, taking timely remedial action when books and journals go missing, providing effective short-term loans, promptly reshelving journals, etc.

A vast proportion of real time users expressed great dissatisfaction with the services and the furnishings of the libraries. The learners didn't think that the library had enough computer workstations, reliable computers, sufficient printing and photocopying equipment, or that it was a peaceful place to study.

In each area, the survey indicated that the majority of student perceptions fell short of expectations. The categories of comprehensive collection on the service of suitable e - journals for their job and studies and the category of access to information where the service of the website being clear and having valuable information had better perceptions than expectations. It may be argued that because engineering students do not view the NAAC-accredited engineering college libraries as a location for reading, studying, and doing research, the other services that were researched have greater expectations than perceptions.

Gap between user expectations and perceptions

In this study, establishing if there was a discrepancy between users' expectations and views of the library services and resources provided at the NAAC recognized engineering college libraries was the third aim. The study discovered that practically all of the services offered by the sample engineering college libraries were lacking. For instance, the major deficiency in the complete collection was the lack of sufficient print periodicals and print books. The fast re-shelving of books and journals and the library's ineffective short lending service were the two main gaps in information availability.

In comparison to every other library service, the survey found that the segment of library infrastructure facilities encountered the most significant shortages. The survey indicated that there were significant gaps in the availability of functional computers and computer workstations. According to the survey, there is a significant shortage of qualified personnel who are able to give users with the information skills they need for employment or education as well as professionals who are aware of their demands for services. The study concluded that there are three main deficiencies with the library

as a location: the library lacks a calm setting, the library lacks enough space for group learning and group study, and the library does not stimulate people to learn and study. The research concluded that the study had two significant gaps in the services provided by libraries for research and academic fields, which were in having students advance in their academic fields, assisting students with their future research, and assisting students in keeping up with any advancements in their subject areas.

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MOBILE TECHNOLOGY AND LEARNING BEHAVIOUR OF UNIVERSITY FACULTY MEMBERS IN CHENNAI CITY – A STUDY

Prof. V. Kasirao[1] & K. Dilli Babu[2]

Introduction

The innovative concept, Knowledge Access and Sharing Information for Resources Approach Objectives plays a vital role and impact in mobile phone technology for Knowledge connectivity to the University faculty members in a multidisciplinary way for learning, teaching and research and handling classes in the class rooms to the student's community towards socio economic and cultural development perspectives. Current trends predominantly occupy the mobile applications are being used by faculty members and academic researchers, and there is scope for better support of mobile application use for higher education teaching and universe of knowledge research activities in the present digital technology Era.

Sample Size

21 Universities have identified in order to study the application of mobile phone technology in the learning behaviour of University faculty members in Chennai city. A total number of 2030 questionnaires were administered randomly to the faculty members. Out of which 1511 dully filled in questionnaires collected from faculties. The response rate is 74.43% under study.

Statement of The Research Study

The information that are being created and disseminated for access to library user community like the scholars, teachers on information seeking behavior aspects. In view of this, the present study examined in relation to the innovative concept on Knowledge Access and Knowledge Sharing Information for Resources Approach Objectives in the application of mobile phone technology and learning behavior of the University faculty members in Chennai city.

Scope and Objectives

- The research study, the considered the main focus objectives are**:**

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- To know the level of awareness of mobile technology and using Smartphone for information access among the University faculty members in Chennai city.
- To know the e- learning behavior of the University faculty members in Chennai city.
- To assess the use of smartphone access on e- knowledge resources towards academic research and development perspectives.

Limitations

The research study covers only (21) Universities and disciplines, science & technology, humanities and social sciences in Chennai city and the remaining Universities and other educational institutions are not covered in this research study.

Review of Literature

Many studies have been done in the field of information and communication technology (**ICT)** and in this literature review reveals the recent studies in the application of mobile phone technology in learning behavior of University faculty members towards the use of smartphone information access on e- knowledge resources for research purpose under study in a clear way.

Mobile Technology: Definitional Analysis

The mobile technology can be defined as "the network knowledge connectivity for the knowledge management, knowledge access, knowledge disseminations **(K3s)** to the e-learning scientific community for social inclusive development.

Implications of Mobile Technology

The e-learning in the world scenario is considered as a new dimension to create wider access to the information user communities on learning behaviour and teaching through the application of mobile technology for academic research and development.

The Results and Discussion

Distribution of the respondents according to universities

The primary characteristic of the respondent is location classification on the basis of the application of mobile phone technology in learning behaviour of university faculty members' in Chennai city in which respondents were identified in all the Universities.

Table No. 9.1: Demographic of Distributions of Universities Vs Designation

S. No	Name of the University	AP	Asso.P	P	Total
1	Anna University	60 (4.0)	36 (2.4)	14 (0.9)	110 (7.3)
2	Hindustan Institute of Technology and Science-Deemed University	37 (2.4)	24 (1.6)	25 (1.7)	86 (5.7)
3	B.S.Abdur Rahman Crescent Institute of Science and Technology-Deemed University	45 (3.0)	8 (0.5)	22 (1.5)	75 (5.0)

4	Vels Institute of Science, Technology & Advanced Studies – University	29 (1.9)	32 (2.1)	29 (1.9)	90 (6.0)
5	Sathyabama Institute of Science and Technology-Deemed to be University	28 (1.9)	23 (1.5)	19 (1.3)	70 (4.6)
6	St. Peter's Institute of Higher Education and Research-Deemed University	40 (2.6)	15 (1.0)	24 (1.6)	79 (5.2)
7	SRM Institute of Science and Technology University	38 (2.5)	44 (2.9)	45 (3.0)	127 (8.4)
8	Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology- Deemed University	31 (2.1)	23 (1.5)	36 (2.4)	90 (6.0)
9	Vellore Institute of Technology-Deemed University	29 (1.9)	22 (1.5)	18 (1.2)	69 (4.6)
10	Dr.M.G.R Educational and Research Institute University	27 (1.8)	36 (2.4)	29 (1.9)	92 (6.1)
11	TamilNadu Veterinary and Annimal Sciences University	7 (0.5)	22 (1.5)	11 (0.7)	40 (2.6)
12	Tamil Nadu Dr. Ambedkar Law University	6 (0.4)	7 (0.5)	22 (1.5)	35 (2.3)
13	University of Madras	22 (1.5)	37 (2.4)	25 (1.7)	84 (5.6)
14	Bharath Institute of Higher Education and Research -Deemed University	13 (0.9)	23 (1.5)	20 (1.3)	56 (3.7)
15	Hindustan Institute of Technology and Science - HITS-University	31 (2.1)	21 (1.4)	29 (1.9)	81 (5.4)
16	Saveetha Institute of Medical and Technical Sciences-Deemed University	29 (1.9)	19 (1.3)	15 (1.0)	63 (4.2)
17	Meenakshi Academy of Higher Education and Research -Deemed University	23 (1.5)	29 (1.9)	19 (1.3)	71 (4.7)
18	Tamil Nadu Teachers Education University – TNTEU	10 (0.7)	13 (0.9)	14 (0.9)	37 (2.4)
19	Tamil Nadu Physical Education and Sports University – TNPESU	9 (0.6)	21 (1.4)	12 (0.8)	42 (2.8)
20	Shiv Nadar University –Chennai	19 (1.3)	8 (0.5)	14 (0.9)	41 (2.7)
21	Academy of Maritime Education and Training (AMET) Deemed University	21 (1.4)	34 (2.3)	18 (1.2)	73 (4.8)
	Total	554 (36.7)	497 (32.9)	460 (30.4)	1511 (100)

(Figures in parenthesis indicates %), Response rate is =74.43%

It is seen from the **Table 9.1**, that the mobile technology and learning behavior of faculty members are more from SRM Institute of Science and Technology University, 127 (8.4%)and stand at number one ranking and followed by Anna University, 110 (7.3%) and Dr.M.G.R Educational and Research Institute University, 92 (6.1%) respectively.

Table 9. 2. : Discipline Vs Designation

S. No	Discipline	Assistant Professors	Associate Professors	Professors	Total
1	Science & Technology	201 (13.3)	172 (11.4)	148 (9.8)	521 (34.5)
2	Humanities	234 (15.5)	207 (13.7)	198 (13.1)	639 (42.3)
3	Social Sciences	119 (7.9)	118 (7.8)	114 (7.5)	351 (23.2)
	Total	554 (36.7)	497 (32.9)	460 (30.4)	1511 (100)

(Figures in parenthesis indicates %)

Table 9.2 demographic of the faculty members in the categories of discipline and designation wise the research study infers that it could be noted the respondents out of 1511, 521 (34.5%) of them from science and technology discipline with 639 (42.3%) of them from humanities and remaining 351 (23.2%) of them from social sciences respectively.

Table 9.3: Using the mobile app for access Vs Designation and Gender

S. No	Mobile App	Assis-tant Profes-sors	Asso-ciate Profes-sors	Profes-sors	Total	Male	Female	Total
1	Smartphone	160 (10.6)	174 (11.5)	174 (11.5)	508 (33.6)	318 (21.0)	190 (12.6)	508 (33.6)
2	Android tablet	164 (10.9)	160 (10.6)	114 (7.5)	438 (29.0)	295 (19.5)	143 (9.5)	438 (29.0)
3	iPad	121 (8.0)	99 (6.6)	88 (5.8)	308 (20.4)	207 (13.7)	101 (6.7)	308 (20.4)
4	E-book Readers	109 (7.2)	64 (4.2)	84 (5.6)	257 (17.0)	194 (12.8)	63 (4.2)	257 (17.0)
Total		554 (36.7)	497 (32.9)	460 (30.4)	1511 (100.0)	1014 (67.1)	497 (32.9)	1511 (100)
χ^2 19.759		Val-ue	df	Asymp. Sig. ((2-sided		Value	df	Asymp. Sig. ((2-sided
		6	0.003		12.867	3	0.005	

(Figures in parenthesis indicates %)

The table 9.3 revealed that using the mobile app for access by faculties 508 (33.6%) of using the smartphone and followed by 438 (29.0%) of the android tablet, 308 (20.4%) of iPad and remaining 257 (17.0%) of e-book reader. and monitored the categories of gender access the mobile application male 318 (21.0%) of used the smartphones, 295 (19.5%) of the android tablet, 207 (13.7%) of iPad, 194 (12.8%) of e-book reader, and

persistent the female category 190 (12.6%) of used smartphones, 143 (9.5%) of the android tablet, 101 (6.7%) of iPad, 63 (4.2%) of e-book readers respectively.

Table 9.4: Purpose of using mobile devices Vs Gender

S. No	Purpose of using a mobile device	Male	Female	Total
1	For daily information needs and entertainment	333 (22.0)	155 (10.3)	488 (32.3)
2	For academic information	287 (19.0)	105 (6.9)	392 (25.9)
3	For related research work	147 (9.7)	109 (7.2)	256 (16.9)
4	For only communication	141 (9.3)	69 (4.6)	210 (13.9)
5	For related coursework	106 (7.0)	59 (3.9)	165 (10.9)
Total		1014 (67.1)	497 (32.9)	1511 (100)
χ^2		Value	df	Asymp. Sig. (2-sided)
18.399		4	0.001	

(Figures in parenthesis indicates %)

Table 9.4 shows the purpose of using mobile devices by the faculty members in gender wise and also this study's five parameters measured. Out of 1511 respondents, 1014 (67.1) male respondents have used it for daily information needs and entertainment, for academic information, for related research work, for only communication, and for related coursework. and 497 (32.9) of female respondents used mobile devices respectively.

Table 9.5: Satisfaction level and quality in the use of mobile technology in academic research work Vs Designation

S. No	Mobile technology academic research work	Assistant Professors	**Associate Professors**	**Professors**	**Total**
1	Very Dissatisfied	34 (2.3)	13 (0.9)	26 (1.7)	73 (4.8)
2	Dissatisfied	45 (3.0)	42 (2.8)	30 (2.0)	117 (7.7)
3	Neutral	208 (13.8)	230 (15.2)	183 (12.1)	621 (41.1)
4	Satisfied	140 (9.3)	129 (8.5)	137 (9.1)	406 (26.9)
5	Very Satisfied	127 (8.4)	83 (5.5)	84 (5.6)	294 (19.5)

Total	554 (36.7)	497 (32.9)	460 (30.4)	1511 (100.0)
χ^2	Value	df	Asymp. Sig. (2-sided)	
21.934	8	0.005		

(Figures in parenthesis indicates %)

Table 9.5 Summaries the results of the level of satisfaction on using mobile technology in academic research work, the research study has a five-point scale was used, the research infers that the 294 (19.5%) per cent of respondents is very satisfied, followed by 406 (26.9%) per cent of respondents satisfied, 621(41.1%) per cent of respondents neutral, 117 (7.7%) per cent of respondents dissatisfied and residual 73 (4.8%) respondents is very low per cent in this study.

Table 9.6: Problems faced while using mobile devices Vs Designation

S. No	Problems faced	Assistant Professors	Associate Professors	Profes-sors	Total
1	Poor Internet connectivity	77 (5.1)	65 (4.3)	58 (3.8)	200 (13.2)
2	Lack of High Speed	58 (3.8)	77 (5.1)	58 (3.8)	193 (12.8)
3	Authentication of e-recourses	73 (4.8)	90 (6.0)	66 (4.4)	229 (15.2)
4	Difficult reading content format	91 (6.0)	89 (5.9)	83 (5.5)	263 (17.4)
5	Data Security	122 (8.1)	77 (5.1)	66 (4.4)	265 (17.5)
6	Lack of Training/ Support	52 (3.4)	39 (2.6)	55 (3.6)	146 (9.7)
7	Lack of knowledge	37 (2.4)	40 (2.6)	39 (2.6)	116 (7.7)
8	Technological Constraints	44 (2.9)	20 (1.3)	35 (2.3)	99 (6.6)
Total		554 (36.7)	497 (32.9)	460 (30.4)	1511 (100)
χ^2 33.402		Value	df	Asymp. Sig. (2-sided)	
		14	0.003		

(Figures in parenthesis indicates %)

There are number of barriers associated with using mobile devices like any other technology. These risks vary from poor network coverage to in large amount charging

plans and slow load time to small screen size .Table 5.49 revealed that the problems faced by the faculty members. This research study infers that makes to understand the problems, which is users face with mobile devices network coverage is the biggest barrier to using mobile devices. Out of 1511 respondents, 200 (13.2) per cent respondents faced poor internet connectivity, 193 (12.8) per cent of respondents faced a lack of high speed, 229 (15.2) per cent of respondents authentication of e-resources, 263 (17.4) per cent of respondents faced difficult reading content format, 265 (17.5) per cent of respondents data security, 146 (9.7) per cent of respondents lacks of training/ support, 116 (7.7) per cent of respondents lacks of knowledge, and finally, 99 (6.6) per cent of respondents technological constraints respectively. The chi-square calculates a value of 33.402 with 14-degree freedoms and a table value of 23.685 at 5 per cent of the level of significance. Therefore, the null hypothesis is rejected. This means that there is a close relationship between the problems faced using mobile devices and by faculty members.

Table 9.7: Problems faced while using mobile devices Vs Gender

S. No	Problems faced	Male	Female	Total
1	Poor Internet connectivity	144 (9.5)	56 (3.7)	200 (13.2)
2	Lack of High Speed	133 (8.8)	60 (4.0)	193 (12.8)
3	Authentication of e-recourses	168 (11.1)	61 (4.0)	229 (15.2)
4	Difficult reading content format	181 (12.0)	82 (5.4)	263 (17.4)
5	Data Security	174 (11.5)	91 (6.0)	265 (17.5)
6	Lack of Training/ Support	93 (6.2)	53 (3.5)	146 (9.7)
7	Lack of knowledge	62 (4.1)	54 (3.6)	116 (7.7)
8	Technological Constraints	59 (3.9)	40 (2.6)	99 (6.6)
Total		1014 (67.1)	497 (32.9)	1511 (100)
χ^2 20.218		Value	df	Asymp. Sig. (2-sided)
		7	0.005	

(Figures in parenthesis indicates %)

Table 9.7 shows the problems faced while using mobile devices by gender, According to the collected data, male faculty members 1014 (67.1), and the remaining 497 (32.9) were females. The majority of the male respondents faced difficulty in reading content format 181 (12.0), and 144 (9.5) of poor internet connectivity, 133 (8.8) of lack of high speed, 168 (11.1) of authentication of e-recourses, 174 (11.5) of data security, 93 (6.2) of lack of training/ support, 62 (4.1) of lack of knowledge and remaining 59 (3.9) of technological constraints and Out of 497 (32.9) of females respondents faced

problems is 56 (3.7) of poor internet connectivity, 60 (4.0) of lack of high speed, 61 (4.0) of authentication of e-recourses,82 (5.4) of difficult reading content format, 91 (6.0) of data security, 53 (3.5) of lack of training/support, 54 (3.6) of lack of knowledge, 40 (2.6) of technological constraints respectively. The chi- square calculates value 20.218 with 7 degree freedoms and table value14.067 at 5 percent of level of significant. Therefore null hypotheses are rejected. This means that there is no association between level of the problems faced uses the mobile devices and

Conclusion

Presently, the communications media is an essential for information access and dissemination in present digital technology scenario. The mobile devices are playing dynamic role in academics, research and development. The university faculty members are more fascinated to use mobile devices to search the required information articles for their habitual research studies. The mobile devices provide a platform to access with mobile applications to scientific research community for academic and Research Development perspectives.

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HEALTHCARE INFORMATION SEEKING BEHAVIOUR OF STUDENTS OF CENTRAL UNIVERSITY OF TAMIL NADU: A SURVEY

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Introduction

Information is an essential commodity that no individual on Earth can do without. When information ceases to exist in a society, that society gradually disappears, often without realisation. There is a saying that 'information rules the world,' and it's no wonder(Okolo 2021) compared it to a key that can open doors without restriction. Health information concerns individuals' physical and mental health, disease, nutrition, and overall well-being. Health information-seeking behaviour (HISB) involves individuals taking various actions to obtain, clarify, or understand health-related knowledge, evaluate health risks, and prevent diseases, particularly toward a particular event or situation (Manafo &Wong, 2012). Access to health information is an enduring human need that becomes increasingly important to a population, especially in a significant health event. The ability of individuals to acquire information related to their health is an essential aspect of taking better care of themselves. Health information-seeking behaviours play a major role in gathering and processing health-related information, enabling individuals to make informed decisions about their health. It is an essential life skill foundation for society's well-being.

Background

Understanding Health Information-Seeking Behavior (HISB) is crucial for grasping how individuals access health-related information and can guide efforts to enhance public health (Mukherjee, A., & Bawden, D., 2012; Pesala, S. et al., 2017). With the rapid advancement of technology, people now have unprecedented access to a plethora of health information (Bratucu R. et al., 2014). Formerly limited to scant resources, research indicates that Internet usage significantly shapes HISB (Chen, Y., Li, C., Liang, J., & Tsai, C., 2018). Internet users have reached 3.9 billion (Social media usage statistics,2024). By April 2024, 5.44 billion individuals, constituting 67.1% of the global population, were online, with 5.07 billion, or 62.6%, engaging in social media (Social media usage statistics, 2024). Unsurprisingly, people turn to these platforms for health-related information. HISB practitioners can access a vast array of readily available and

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easily accessible information. With the abundance of health resources, individuals are increasingly taking charge of their health concerns, seeking information for themselves and others, particularly in situations where access to healthcare is limited (Bhandari, N., Shi, Y., & Jung, K., 2014; Bratucu, R. et al., 2014). HISB is integral to personal health awareness and responsibility (Fergie, G., Hilton, S., & Hunt, K., 2016). However, despite the significance of understanding HISB, there is a shortage of studies focusing on college students. This pivotal subgroup is transitioning to making their own healthcare decisions and is in an independent phase. Understanding how individuals, particularly students, are more inclined than other demographics to seek health-related information and navigate information-seeking presents an opportunity to furnish resources for enhancing lifestyles and averting potential health risks among this demographic. The primary objective of this study is to assess the health information-seeking behaviour (HISB) among students at the Central University of Tamil Nadu.

Need for the Study

Conducting a study to measure healthcare information-seeking behaviour (HISB) among Central University students in Tamil Nadu is crucial for improving healthcare Information. Surveys, interviews, or focus groups can be utilised to gather data on students' attitudes and practices related to HISB, probing their sources of information and perceived barriers. Educational interventions, including awareness campaigns on hygiene and dietary habits, can address gaps in HISB. Platforms like workshops and social media can effectively engage students in enhancing healthcare information. Understanding the current awareness level and addressing underlying factors can foster proactive healthcare management, leading to better health outcomes.

Aim and Objectives

The following are the specific objectives of the study.

1. To assess the health care information needs of the students;
2. To examine their awareness and satisfaction concerning health services and programmes available inside the University
3. To know the channels through which the information relating to health is obtained;
4. To identify the barriers which affect students to follow good health practices;

Scope and Limitations

The present study evaluated knowledge-seeking behaviour and determined students' Health information needs. The study will help understand students' Health information-seeking behaviour and how it will affect the community and surrounding population. The scope is limited to students undergoing various PG Programmes, Intergrteades PG Programmes and PhD programmes in the University of Tamil Nadu 104 students from 10 major schools were involved in getting an idea about the overall Health information-seeking behaviour of Central University of Tamil Nadu Students.

Literature Review

Kalankesh et al. (2019) analysed information-seeking behaviours, highlighting students' inclination towards health inquiries. Targeting youngsters with accessible resources could enhance well-being. The study employed simple random sampling, revealing students' interests in illness prevention (47.8%), health knowledge (45.1%), and addressing health concerns (60.2%). Many actively seek nutrition, exercise, and health advice, influencing medical decisions (68.2%). Aldousari and Al-Muomen (2022) investigated how Kuwait University undergraduates sought health information. Using a semi-structured web-based questionnaire, they found that 68.8% actively searched for health material. The most common topics were bones, joints, and muscles. 34.9% discussed online findings with physicians, influencing doctor-patient relationships. El Kahi et al. (2012) conducted a cross-sectional study on 543 Lebanese students at Saint Joseph University, examining health-seeking behaviour and accessibility challenges. Formal, informal relational, and personal care-seeking behaviours were classified. Students tended to seek unauthorised medical assistance, with formal care almost absent for psychiatric (3.3%), marital (1.8%), and substance use issues (5.1%). Basch et al. (2018) explored college students' health information-seeking behaviour (HISB) and attitudes toward online tools. Surveying 258 students, they found the Internet (74%) as the primary source for health information. Women and non-white students showed higher usage. Understanding HISB motivations is crucial to enhancing e-health literacy among college students.

Research Methodology

Primary data collection was conducted using a survey method. A questionnaire was designed to collect data from Central University of Tamil Nadu students. The questionnaire contains demographic details, health information needs, sources/ channels of receiving health information, and problems in getting health information, all of which are closed-ended questions. The questions were prepared in simple language for the respondents to understand and respond efficiently. The study's target population comprises students from the Central University of Tamil Nadu. Central University of Tamil Nadu consists of various schools of study. Among the total students, 104 were selected as samples by simple random method from various departments, as shown in Table 1.

Data Analysis

All the applicable data, such as Gender, Age Group, education qualification domicile and other responses to various questions, were processed using Microsoft Office and SPSS software. The responses to open-ended questions were categorised into a few broad categories for analysis.

Table -4. 1: Demographic details

Variable	No. of Respondents	% of Respondents
Gender		
Male	56	53.85
Female	48	46.15
Age Group		
18-22	36	34.62
23-27	47	45.19
28-32	14	13.46
33 and above	7	6.73
Educational Qualification		
PG Student	53	50.96
Integrated PG Student	32	30.77
Ph.D. Scholars	19	18.27
School		
Arts	40	38.46
Commerce	8	7.69
Science	56	53.85

Demographic details are given in Table 4.1, in which the majority of the respondents (56.85 %) were male and 46.15% were female respondents. The respondents are 18-22 years old students at 34.62%, 22- 27 years students at 45.19%, 28-32 years old students at 13.46%, and 33 above age are 6.73%. Department-wise, the respondents were education level 50.96% PG Students, 30.77% Integrated PG Students, 18.27 Ph.D. Scholars and discipline-wise, 38.49% are in the Arts, 7.69% are in Commerce, and 53.85 % are in Science.

Table -4.2: Frequency of seeking health information

Frequency of exploring healthcare information	No. of Respondents	% of Respondents
Frequently	29	27.90
Occasionally	29	27.90
Only when I have a health concern	46	44.20
Total	104	100.00

Table 4.2 indicates the frequency of respondent's healthcare information consumption. Most respondents either access healthcare information only when they have a health concern (44.20%) or do so occasionally (27.90%). Anyway, a few students (27.90%)

seek healthcare information frequently.

Information Needed by University Students

Table 4.3 shows the distribution of university students according to the type of healthcare information they would need at their University.

Table - 4. 3: Type of health care information required by the University students

Aspect of Health Information	No. of Respondents	% of Respondents
Tips for physical health (nutrition, exercise)	65	62.50
Mental health guidance (stress management, anxiety tips)	56	53.85
Preventive care details (vaccinations, screenings)	29	27.88
Sexual health information (safe practices, contraceptives)	48	46.15
Substance abuse risks and recovery resources	31	29.81
Basic first-aid knowledge	70	67.31
Healthcare access information	50	48.08
Sleep improvement tips	54	51.92
Chronic condition management	33	31.73
Hygiene	57	54.81
Others	1	0.96

It is evident from Table 3 that most of the majority of respondents (67.31 %) need basic first-aid knowledge, followed by Tips for physical health (nutrition, exercise) 62.50 %, information on hygiene 54.81 %, and mental health guidance (stress management, anxiety tips) 53.85%, sleep improvement tips 51.92 %, healthcare access information 48.08%, sexual health information (safe practices, contraceptives) 46.15 %, chronic condition management 31.73 %, and substance abuse risks and recovery resources 29.81 %.

Table – 4.4 Importance of access to accurate and reliable health information

Access to accurate and reliable health information	No. of Respondents	% of Respondents
Very important	52	50.00
Important	25	24.04
Neutral	17	16.35
Not very important	5	4.81
Not important at all	5	4.81
Total	104	100.00

Table4.4 shows that half of the respondents (50.00%) think access to accurate and reliable health information is very important, (24.04%) think it is important and same (16.35%) of students were neutral in this regard, very few students (4.81%) think it is not very important or not at all important.

Table- 4.5: Awareness about the health services and programmes offered by the university

Response	No. of Respondents	% of Respondents
Yes	51	49.04
No	53	50.96
Total	104	100.00

Table 4.5 shows that while half of the respondents are aware of the health services and programs offered by the university, the remaining half is ignorant about them.

It is evident from Table 4.6 that the majority are very satisfied (17.31%) or satisfied (43.27%) with the services of the university health centre (24.04%) of students are neutral in their opinions, a few students are either somewhat dissatisfied(6.73%) or Very dissatisfied (8.65%) with the services of university health centre. It can be concluded that most students are satisfied with the health services and programmes offered by the university health centre.

Table -4.6: Level of satisfaction with the services of university health centre

Level of Satisfaction	No. of Respondents	% of Respondents
Very satisfied	18	17.31
Satisfied	45	43.27
Neutral	25	24.04
Somewhat dissatisfied	7	6.73
Very dissatisfied	9	8.65
Total	104	100.00

Table – 4.7: Channel and resources used by students in seeking health information

Health information sources	No. of Respondents	% of Respondents
University health centre	69	66.35
University Library	57	54.81
Online sources	70	67.31

Social media	68	65.38
Family and friends	61	58.65
Healthcare professionals outside the University	44	42.31
Other (please specify	4	03.85

Table 4.7 shows that most respondents (67.31%) obtain Health information from Online sources. Followed by university health centre 66.35%, Social media 65.38%, Family and friends 58.65%, it is a notable health care professional outside the university 42.31%, and more than half of the students 54.81% depending on the university library to obtain health information.

Table – 4.8:Opinions about the reliability of sources of health-related information

Level of satisfaction Health information sources	Not at all Reliable	Only Somewhat Reliable,	I'm not Sure	Reliable	Very Reliable
University health centre	7(6.73)	9(8.65)	11(10.58)	36(34.62)	41(39.42)
University Library	13(12.50)	6(5.77)	42(40.38)	29(27.88)	14(13.46)
Online sources (e.g., websites, search engines)	10(9.62)	16(15.38)	26(25.00)	33(31.73)	19(18.27)
Social media	11(10.58)	14(13.46)	28(26.92)	36(34.62)	15(14.42)
Family and friends	10(9.62)	11(10.58)	25(24.04)	30(28.85)	28(26.92)
Healthcare professionals outside the University	13(12.50)	11(10.58)	18(17.31)	34(32.69)	28(26.92)

Table 4.8 shows the cross-tabulation result of respondent's opinions about the reliability of health information sources. It can be seen that the opinion of students at the university health centre (34.62%) is the most relied source of health information and also Social media, followed by Health care professionals outside the university (32.69%), Family and friends (28.85%) Online sources (31.73%), Social media (34.62%) are found to be major sources of health information.

Table-4.9: Barriers faced by university students in adopting good health practices

Health information Barriers	No. of Respondents	% of Respondents
Lack of time	40	38.46
Lack of motivation	67	64.42
Cost of healthy food and activities	77	74.04
Lack of awareness about healthy practices	61	58.65
Difficulty accessing healthcare services	46	44.23
Other (please specify	03	02.88

Table 4.9 shows the barriers university students face in following good health practices. Most of the respondents mentioned the cost of healthy food and activities (74.04%), their Lack of motivation (64.42%), Lack of knowledge about healthy practices (58.65%), difficulty in accessing health care services (44.23%), Lack of time (38.46%) as the barriers to follow as the good health practices.

Table-4.10: Ability to Identify reliable, accurate health information

Confidences level	No. of Respondents	% of Respondents
Very confident	18	17.31
Somewhat confident	30	28.85
Neutral	37	35.58
Not very confident	8	7.69
I am not confident at all	11	10.58
Total	104	100.00

Table 4.10 clearly shows that 46.16% of respondents have the same confidence level regarding their ability to identify reliable and accurate health information. Most of the student, 35.58%, are neutral in this regard, which indicates that they are unsure about their ability to identify reliable and accurate health information.

Opinions of the Respondents

An open-ended questionnaire was employed to gather respondents' opinions, health information needs, suggestions, and advice regarding the health information-seeking process among Central University, Tiruvarur, Tamil Nadu students.

Their answers are as follows

- Ensure regular stock checking for medicines. Paracetamol gives the impression that it is the most commonly available, but there should be a variety of essential medicines in stock.
- Organise healthcare programs in every department to raise awareness about various health-related topics.
- Conduct campaigns and webinars monthly, covering topics such as health, nutrition, and fitness to educate students and staff.
- Improve the surroundings near the health centre as it is surrounded by snakes and insects, which may pose health risks.
- Ensure a clean and safe environment by regularly cleaning the department and hostel with appropriate washing items to prevent the spread of diseases.
- Introduce yoga classes as they can benefit everyone in promoting physical and mental well-being.
- Provide good quality medicines at the health centre to ensure effective treatment for students and staff.

- Ensure medical staff are more approachable and readily available for consultation.
- Ensure a variety of effective medicines are readily available at the health centre to address different health conditions.
- Equip the health centre with additional facilities to handle various health issues effectively.
- Conduct regular health information and services classes for students and staff to promote awareness and understanding of health-related matters.
- Develop programs to educate vendors, shopkeepers, and mess personnel about providing healthy and nutritious food options. Address concerns such as excessive oil usage and the Lack of nutritious food choices.
- Ensure various healthy food options are available, including protein sources like legumes and vegetables/fruits for essential vitamins.
- Provide fully equipped facilities to support healthcare services effectively.
- Establish a comprehensive health information service tailored to the needs of students.
- Provide prescribed medicines directly from the health centre to ensure convenience for students and staff.

Findings

- Majority of the respondents access healthcare information only when they have a health concern (44.20%)
- The majority of respondents (67.31 %) need basic first-aid knowledge following the Tips for physical health (nutrition, exercise) 62.50 %, Information on Hygiene 54.81 %, and Mental health guidance (stress management, anxiety tips) 53.85%, Sleep improvement tips 51.92 %, Healthcare access information 48.08%, Sexual health information (safe practices, contraceptives) 46.15 %, Chronic condition management 31.73 %, and Substance abuse risks and recovery resources 29.81 % Students need health care information.
- Half of the respondents (50.00%) replied to the Student that access to accurate and reliable health information was very important.
- All respondents (49.04%) positively reacted to the health services and programs offered by the university.
- Over one-third of the respondents (43.65%) are satisfied with the services of the university Health centre.
- The majority of respondents (67.31%) of them obtain Health information sources from Online sources (e.g., websites, search engines) and follow University health centres 66.35%, Social media 65.38%, Family and friends 58.65% University Library 54.81, Healthcare professionals outside the University 42.31% and others 03.85% respondents are received in health information.
- One-third of respondents' Level of satisfaction with Health information sources with the University health centre (39.42) is Very Reliable with the University health centre
- The majority of respondents' Level of satisfaction with Health information sources

with the University Library (40.38) of respondents were I'm not sure the University Library,

- One-third of respondents' Level of satisfaction with Health information sources Online sources (e.g., websites, search engines) (31.73%) of respondents are Reliable with Online sources (e.g., websites, search engines),
- One-third of respondents' Level of satisfaction with Health information sources with Social media (34.62) of respondents were Reliable with Social media,
- The respondents' Level of satisfaction with Health information sources with Family and friends (28.85) of respondents are Reliable with Social media,
- The respondents' Level of satisfaction with Health information sources with Healthcare professionals outside the University (32.69) of respondents are Reliable with Healthcare professionals outside the University,
- the barriers university students face in accessing health-related information on Most of the respondents mentioned the cost of healthy food and activities (74.04%), their Lack of motivation (64.42%), Lack of knowledge about healthy practices (58.65%), difficulty in accessing health care services (44.23%), Lack of time (38.46%) others (02.88). There are consumer barriers to using health information, said the students.
- The 46.16% of respondents have the same confidence level regarding identifying reliable and accurate health information. Most of the student, 35.58%, are neutral in this regard, which indicates that they are unsure about their ability to identify reliable and accurate health information.

Recommendations

To bridge the gap between "health information present" and "health information absent", providing the correct health information at the right time to the right consumer to satisfy their doubts is essential. Some initiatives must be taken to ensure the easy access and utilisation of health information for the respondent members to sustain their lives and uplift and improve the new society. For that reason, some essential recommendations are suggested:

1. Design health information mechanisms to efficiently address the health information needs of university students by identifying their specific health information needs and providing easy interaction for health information seekers.
2. Develop comprehensive health information programs in university libraries and the community using formal and informal educational channels. It empowers students to understand better and use health information.
3. Build vital community health information services to meet university students' diverse health information needs. These services should facilitate community development by providing access to essential health resources and information.
4. University authorities should proactively promote various health programs and initiatives targeting students. Conducting health-related programs, workshops and awareness campaigns

5. The University Health Center should ensure that basic infrastructure and resources are readily available to support the health and well-being of every student, regardless of their community background.
6. Encourage close collaboration and communication between University Library staff and the student body. Make efforts to disseminate health information widely.

Implementing these recommendations will reduce the gap in access to health information and promote the well-being of university students, contributing to fostering a healthier society.

Conclusion

This study focuses on the healthcare information-seeking behaviour of Central University students in Tamil Nadu, focusing on health information-seeking attitudes. It emphasises the importance of obtaining reliable medical information by explaining the different information demands. While opinions on university health services vary, addressing disparities and increasing the quality of health care services is critical. It is imperative that students are satisfied with the reliability of healthcare information obtained from different sources. Comprehensive solutions are needed to overcome barriers such as cost and motivation that hinder access to knowledge. Initiatives are essential to identify reliable health information, store health data, and promote student access to health information. Improving health information needs and health service quality and access improves student well-being.

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DIGITAL LEARNING IN MEDICINE: INVESTIGATING ONLINE RESOURCE USE AMONG MANDYA INSTITUTE OF MEDICAL SCIENCES STUDENTS

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Background of the study

Digital learning has become essential in medical education, allowing students access to a wide range of online resources such as textbooks, journals, procedure videos, and virtual patient simulators. This study intends to investigate how Mandya Institute of Medical Sciences students use online resources, with an emphasis on their awareness, preferences, and perceived effects on medical education.

Methodology

The study included undergraduate and postgraduate students and was carried out between December 2023 and February 2024 using a dynamic research technique. A group of three hundred undergraduate students from the MBBS program's second and third years, as well as one hundred fifty postgraduate students from the MD and MS programs' three years each, eagerly took part and contributed insightful remarks. The data analysis process included a thorough review with MS-Excel, the integration of quantitative and qualitative components, and the use of visual elements and gamification to increase participation.

Results

The findings show that 88.75% of participants are aware of online resources. Exam preparation (36.67%) and academic research (34.17%) were the main reasons people used online resources. The most often used resource was e-journals (23.88%), which was followed by e-books (11.04%), e-databases (16.12%), and e-learning with mobile apps (20.60%). Having access to a wide variety of online journals (33%) and librarian support (40%) were two benefits of using online resources. Seventy-one percent of the respondents used the college library's online resources. In addition, an analysis of respondents' satisfaction levels with using the library's e-resources showed that 75.83% were extremely satisfied or satisfied, with a lesser fraction expressing neutral (8.75%) or dissatisfaction (1.67%).

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Introduction

Digital learning has become an integral part of medical education, allowing students to access a wide range of online resources, such as textbooks, journals, procedure videos, and virtual patient recreations (Masters, 2020). Through the use of online platforms and digital tools, students can enhance their understanding of complex medical concepts, stay up-to-date with the latest research developments, and develop critical thinking and problem-solving skills (Cook et al. 2021). This study aims to investigate online resource use among students at the Mandya Institute of Medical Sciences, specifically focusing on their awareness and utilization of digital learning platforms, their preferences for different types of online resources, and the perceived impact of online learning on their overall medical education experience (Smith & Johnson, 2019). Furthermore, various organizations offer no- and low-cost e-learning resources to those working in the field of global health, contributing to the accessibility of e-learning materials for medical education (World Health Organization, 2018). The use of e-learning and electronic resources in medical education is continuously evolving, with the potential to significantly impact the way students access and engage with educational content, both in traditional and resource-constrained settings (Aungst, 2017).

Review of Literature

According to Sadaf et. al (2022) Medical students, particularly in the modern age, show a positive inclination towards utilizing electronic resources like MEDLINE Databases, Science Direct, and other online platforms for their academic and research needs". Sadaf et. al (2022) have indicates that a significant percentage of medical students prefer internet-based resources over traditional printed materials for various purposes such as research, thesis writing, and accessing articles and journals. Additionally, there is a growing emphasis on integrating digital health skills into the medical curriculum to enhance students' understanding and preparedness in utilizing digital health technologies effectively (Jun, 2021).

However, E-learning in medical education has been widely adopted as a teaching and learning approach internationally, including in low- and middle-income countries (LMICs). It is considered a means of improving student learning outcomes and experiences, especially in resource-constrained settings. Moreover, the ability of medical students to evaluate. In summary, research indicates a positive trend towards the use of digital resources by medical students, emphasizing the need for integrating digital health skills into medical education and enhancing students' abilities to evaluate online medical information effectively.

Importance of Digital-Resources

Online resources or electronic resources are of great importance to researchers, students, and faculty members. Here are the key points highlighting their significance:

Easy to Search: E-resources provide the feature of searching for information using different access points, allowing users to search and access a wide range of information from various databases.

Enhanced Competence and Information Access: The use of e-resources enhances users' competence and provides them with various information resources. They also offer instant access to current and up-to-date information, thus overcoming time and space restrictions.

Convenience and Accessibility: E-resources can be used anytime and anywhere, making them highly convenient. They offer a globalized reach, easy storage and dissemination, and easy revision and manipulation of content. They also enable instant and concurrent access for multiple users.

Cost and Space Efficiency: E-resources are less bulky than traditional paper resources, offer speedy delivery, and add value to services. They also lead to cost savings in storage and maintenance, and sometimes, electronic forms are the only alternative for certain resources. Collection Development: E-resources represent an increasingly important component of the collection-building activities of libraries, particularly in academic settings.

Types of Online resources for medical students

Some types of e-resources that may be beneficial for medical students include online textbooks, medical databases, journal articles, virtual simulations, video lectures, and interactive learning modules.These resources can provide up-to-date information, enhance understanding of complex medical concepts, and offer opportunities for interactive learning and skill development.

Table-1 : Types of Online Resources

Types of Online-Resources			
E journals	E Books	E-Thesis and Dissertation	E-Database
PubMed Central	FreeBooks4Doctors	University Repositories	PubMed
PLoS	National Library of Medicine (NLM)	ProQuest Dissertations and Theses Global	The Cochrane Database
BioMed Central	Bookboon	PubMed Central	Embase
Directory of Open Access Journals (DOAJ)	OpenStax	Networked Digital Library of Theses and Dissertations (NDLTD)	Web of Science
Medicine (MDPI):	OnlineFreeEBooks.net		Scopus
The New England Journal of Medicine (NEJM)	Project Gutenberg		

Note: The following list of e-resources has been compiled based on the available documents in the library.Table -1

Scope

Online resources offer a wide range of resources that are particularly beneficial for both undergraduate and postgraduate students. For undergraduate students, mobile apps related to study materials from the library are essential resources. These apps can provide convenient access to study materials, facilitating learning on-the-go. On the other hand, postgraduate students benefit from evidence-based mobile apps like UpToDate and e-journals such as PubMed, Lancet, and The New England Journal of Medicine. These resources support their research endeavors, enhance their learning experience, and provide access to up-to-date information in their respective fields of study. The importance of e-resource awareness and utilization for medical students cannot be overstated. These resources play a crucial role in their academic and professional pursuits. Online resources offer a wealth of information that can aid in their research, deepen their understanding of complex topics, and help them stay updated with the latest advancements in their fields. Therefore, it is imperative for postgraduate students to be aware of and effectively utilize e-resources to maximize their academic and professional growth.

Objectives

- The main aims of this study are as follows:
- To determine the awareness of users about available online sources.
- To study the purpose and use of online resources.
- Determine the advantages of accessing online sources
- To determine the satisfaction level among users regarding e-resources.

Methodology

The present effectively integrating quantitative and qualitative elements and technique, scheduled to take place between December 13, 2023, and February 2024, aimed at exploring the digital environment of postgraduate students at the Mandya Institute of Medical Sciences. A carefully selected sample of 300 undergraduate students from the 2nd and 3rd years of M.B.B.S programs, along with 150 postgraduate students of (M.D and M.S) from all three years, enthusiastically responded to our engaging poll, providing insightful comments on e-resources. From this sample, 240 responses offered in-depth analysis, further enriching our investigation.The insightful data gathered underwent meticulous examination using MS-Excel, enabling a thorough analysis of trends and patterns.

Analysis and Results

Gender-wise classification of respondents: Figure-1 depicts the gender-wise classification of respondents of the 240 respondents, 129 (54.8%) were male, while the remaining 111 (46.%) were female.

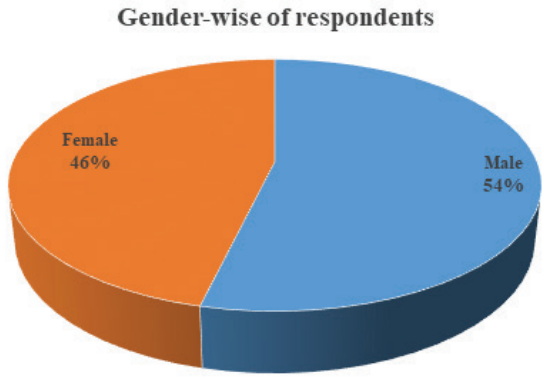


Figure-1

Awareness of e-resources: Table-2 indicates that out of total respondents 87(100%), the maximum number of the respondents i.e. 65 (74.70%) are aware of e-resources and the least number of respondents i.e. 22 (25.30%) are not aware of e-resources.

Aware of Online resources			
Sl.No	Response	Frequency	Percentage
1	Aware	213	88.75%
2	Not Aware	27	11.25%
3	Total	240	100.00%

Table -2

The table-2 shows that a significant percentage of participants 213 people, or 88.75% of the total sample said they were aware of internet resources. On the other hand, a smaller percentage of respondents 27 students in all, or 11.25% of the sample stated that they were unaware of online resources. The data indicates that the students exhibited a noteworthy awareness, as evidenced by the mean awareness rate of 88.75%. These results highlight the significance of online resources and point to the necessity of additional efforts to increase awareness and utilization among those who might not be familiar with these useful resources.

The primary purpose of using Online resources			
Sl.No	Frequency	Total	Percentage
1	Academic research	82	34.17%
2	Exam preparation	88	36.67%
3	Professional development	20	8.33%
4	Personal interest	50	20.83%
5	Total	240	100%

Table-3

The analysis of respondents' usage of online resources reveals that the majority utilize them for exam preparation (36.67%) and academic research (34.17%). A considerable proportion of respondents reported using online resources for personal interest (20.83%). However, a smaller percentage indicated utilizing online resources for professional development (8.33%). These findings suggest that online resources play a significant role in supporting academic pursuits, particularly in research and exam preparation contexts. They also highlight the diverse ways in which individuals engage with online platforms for personal enrichment and professional growth.

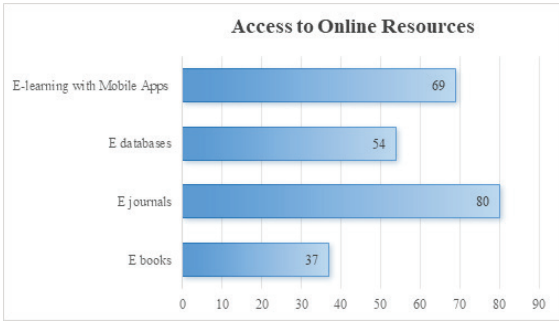


Figure-2

Types of Online resources used: In the Figure-2 most popular resource was found to be e-journals, as reported by 23.88% of medical students who said they relied on academic research and publications. E-learning using mobile apps comes in second, preferred by about 20.60% of students over mobile-based learning platforms. About 16.12% of medical students used e-databases, demonstrating their importance for gaining access to a variety of information sources. Finally, 11.04% of students said they used e-books, suggesting a moderate preference for digital publications.

Advantages of accessing the Online resources: Figure 3 shows the advantage for which the respondents of the medical students of MIMS use online resources. It was found that out of a total of 40% of students who get assistance from the librarian, 33.%, of 21% of students opted for a broad range of online journals that can be accessed and followed by core journals searching with a particular subject.

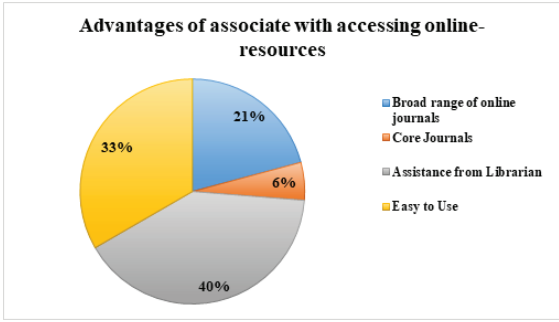


Figure-3

Location of access to Online- resources

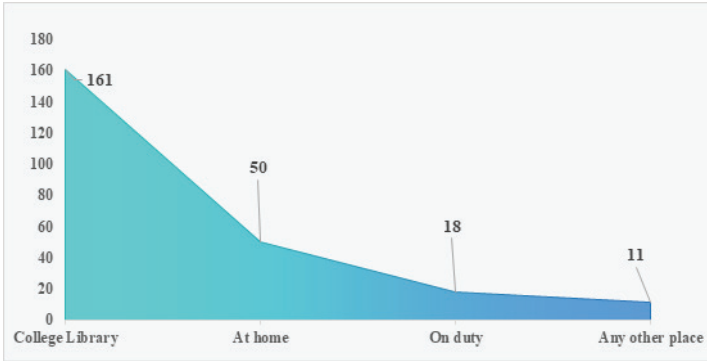


Figure-4

Location for accessing Online resources: Figure-4 indicates the location from which the respondents accessed the Online resources. Out of a total of 87 respondents, about 61(70.10%) of the respondents access to Online resources from College library, followed by 15 (17.20%) of the respondents' access e-resources from the Hostel/ Residential, and the least number of the respondents, i.e., 11 (12.60%) access Online resources from the On duty.

Satisfaction level of accessing online resources in library			
Sl.No	Frequency	Total	Percentage
1	Very satisfied	182	75.83%
2	Satisfied	33	13.75%
3	Neutral	21	8.75%
4	Dissatisfied	4	1.67%
5	Total	240	100%

Table-4

Satisfaction Level of accessing the online resources : Table-4 indicates the satisfaction level of the users with the online resources. (75.83%) of respondents expressed very satisfaction with the library's online resource access. Less of the students (13.75%) stated satisfaction, while fewer people (1.67%) indicated neutrality.

Study findings

- Medical students had a high level of awareness of online resources: 88.75% of participants said they were aware of online resources.
- Online resources are primarily used for academic research (34.17% of students used them for this purpose, while 36.67% used them to prepare for exams), according to the study.
- Preference for particular categories of online resources: According to 23.88% of students, e-journals were the most widely used resource. E-learning through mobile

apps (20.60%), e-databases (16.12%), and e-books (11.04%) came next.

- Benefits of using online resources: Forty percent of participants mentioned getting help from librarians, and (33%) percent mentioned having access to a wide variety of online publications.
- Location of online resource access: The college library having Wi-Fi facility for the library users and tabs connected with electric charger was the point of entry for the majority of respondents (70.10%) for online resources.
- Levels of satisfaction with using e-resources in the library: According to the study, 75.83% of participants expressed high levels of satisfaction or satisfaction with using e-resources in libraries.

Recommendations

- Improving medical students' knowledge and use of internet resources: Conduct programs like tutorials, workshops, and advertising campaigns to help medical students become more aware of and use online resources.
    - Diversifying the sorts of online resources available to meet the various requirements and interests of medical students could result in a more comprehensive selection of resources for professional development, exam preparation, and academic research.
    - Enhancing accessibility and convenience: Make sure that online materials are always easily accessible from a variety of devices by regularly assessing and improving their accessibility and convenience.

Conclusion

The use of online resources among medical students at Mandya Institute of Medical Sciences (MIMS) is widespread, with 100% of the students being aware of online resources and using them for their research work and publications. The college library is the primary location from which respondents access online resources, and they use evidence-based resources for retrieving quick information. However, most of the students are not satisfied with the online resources available on the internet. Medical students need to keep up with the latest research and developments in their field, and online resources provide access to the latest information and research materials. The challenges reported include limited access to full-text content, inadequate search skills, insufficient training on online resources use, and poor internet connectivity. To address these challenges, the library should focus on augmenting its collection, organizing training sessions, scheduling programs and workshops, providing Wi-Fi-enabled infrastructure, developing user-friendly mobile apps, continuously subscribing to and updating e-resources, investing in infrastructure facilities, and providing accessible and reliable internet facilities.

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USE OF E-JOURNALS AMONG THE RESEARCH SCHOLARS OF MAR IVANIOS COLLEGE (AUTONOMOUS) TRIVANDRUM

Akarsh R[1]

Introduction

Universal access to information has become an essential requirement for users worldwide in the digital era. In addition to traditional print media, the emergence of technological and digital advances has attracted the interest of those seeking knowledge in the realm of electronic resources. Electronic resources encompass various materials that are accessible in the form of e-books, e-journals, e-newspapers, e-magazines, e-databases, e-conference proceedings, e-reports, and more in several formats and with a range of features. The efficient use of electronic resources in higher education and research has encouraged academic and research communities to advance in the increasing realms of knowledge in the contemporary day.

Researchers always depend upon journal articles as the primary and most dependable source of scientific research output. Also, a researcher's success and efficiency are mostly evaluated based on the quantity and quality of their publications. E-journals are the most crucial source of information among periodicals, providing the most up-to-date and current information on specific subject fields. They have become increasingly popular and preferable due to their advantages over traditional print journals in today's fast-paced modern society. E-journals play a crucial role in academia by serving as a communication tool and a lasting archive (Rallison, 2015). Moreover, they offer advantages over traditional print journals such as immediate availability, remote access, space efficiency, enhanced search features, multiple access, diverse search options, and digital portability, etc. The various capabilities provided a competitive advantage for e-journals, leading to their rising usage and popularity among the research community.

Examining the e-journal usage among the research scholars of Mar Ivanios College aids in comprehending their current statistics and facilitates the implementation of measures to enhance its utilization. Considering the status of the college as one of the state's leading higher education institutions with multiple research departments, it is crucial to determine the extent of e-journal utilization in the institution and evaluate the

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outcomes. It will raise awareness about the significance and influence of e-journals in research and their essential role in research investigations.

Review of Literature

Paswan and Kumar (2022) found that the users in the field of Social Sciences at Lalit Narayan Mithila University of Bihar, India are well aware of the availability of e-journals in their respective areas of interest and also feel extremely beneficial with the latest information being conveyed through e-journals. Ali (2021) in his investigation on awareness and use of e-journals among research scholars and faculty members in the Department of Political Science of Aligarh University, majority of the research scholars and faculty members are aware of e-journals. They searched articles through search engines however slow speed, internet connectivity, and lack of training were found to be the major problems faced. Balakrishnan and Pandeeswaran (2021) in their study on the utilization of e-journals among the research scholars and students of Madurai Kamaraj University revealed that 73.8% of the respondents need printed e-journals apart from using electronic e-journals, 53.3% of the respondents search the articles in e-journals by using keywords, 49.5% of respondents revealed that the main purpose of using e-journals is for writing articles/books, 39.3% of the respondents spend less than one hour for accessing e-journals and 37.4% of the respondent's opinion about the level of satisfaction of the e-journals is good. Illias and Devi (2021) confirmed through their study on the use of e-journals among faculty members and research scholars of the University of Kerala that the majority of the respondents use the internet daily for more than one hour and most of them in the University of Kerala prefer direct subscriptions of e-journals. Nearly forty percent of respondents are 'satisfied,' and more than forty percent are only 'somewhat satisfied' revealing the importance of some improvement in collecting e-journals and online databases of e-journals in the Kerala University Library System. They suggested that the universities in Kerala have to provide more and more access to e-resources, especially e-journals, and academics have to utilize electronic resources for their academic and professional development. Iqbal and Shahzad (2021) revealed that the majority of the faculty members at five diverse universities in Lahore, Pakistan use online e-journals rather than printed ones. Most of the respondents used research papers for teaching purposes, also for writing articles, and theses, supervising researchers, and keeping updates in the field and many of them were not familiar with advanced searching techniques.

Objectives

To identify the use of e-journals by the research scholars of Mar Ivanios College, (Autonomous), Trivandrum.

- To understand what features of e-journals influenced researchers to prefer them as their source of information.
- To find out the purpose of using e-journals among the researchers.
- To assess the overall satisfaction of researchers with the e-journals available in the college library.

- To determine the various problems faced by the research scholars while accessing e-journals.

Methodology

The study adopted a survey method of research and data was collected using a structured questionnaire comprising both open and closed-ended questions. The questionnaire was formulated and distributed among the total 35 full-time research scholars of six various departments (Physics, Chemistry, Mathematics, Zoology, English, and Commerce) of the Mar Ivanios College (Autonomous), Trivandrum to investigate their e-journal usage. Among that, 30 questionnaires were duly filled and returned with a response rate of 85.71%. The collected data were analyzed using percentage analysis and interpreted as tables and graphs. The study also used observation and interview methods to collect accurate and necessary subsidiary information.

Results

Table 1 Use of e-journals

Sl. No.	Whether used e-journals	Number of responses	Percentage
1	Have used	30	100
2	Have not used	0	0.00

Table 1 indicates that all the 30 researchers who participated in the study (100%) had used e-journals.

Table 2 Frequency of use

Sl. No.	Frequency	Number of responses	Percentage
1	Daily	12	40.00
2	2-3 times a week	9	30.00
3	Once in a week	4	13.33
4	2-3 times in a month	4	13.33
5	Occasionally	1	3.33

From Table 2, it is evident that 40% of the respondents are daily users of e-journals whereas 30% use 2-3 times in a week. However, 13.33% indicated that they use e-journals weekly and 2-3 times in a month. Only 3.33% responded that they use e-journals occasionally.

Table 3 Source of knowledge about e-journals

Sl. No.	Source	Number of responses	Percentage
1	Library	9	30.00

2	Research guides	16	53.33
3	Internet	20	66.67
4	Peer groups	15	50.00
5	Co-scholars	19	63.33

(Multiple answers were permitted)

Table 3 indicates that the Internet was a significant source for 66.67% of researchers to gain knowledge about e-journals, whereas 63.33% of researchers learned from their Co-scholars. 53.33% of respondents acquire knowledge from Research guides, 50% from Peer groups, and 30% learn from the library.

Table 4 Use of Search Strategy

Sl. No.	Search Strategy	Frequency	Percentage
1	Keywords	10	33.33
2	Author	12	40.00
3	Title	20	66.67
4	Boolean Operators (AND, OR, NOT), Truncation search, Wild card characters, etc.	1	3.33

(Multiple answers were permitted)

From Table 4, the majority of respondents 66.67% use the title as their search term followed by 40.00% using author and 33.33% using keywords. Only 3.33% use specific search strategies such as Boolean operators, truncation search, wild card characters, and others.

Table 5 Features of e-journals

Sl. No.	Features	Number of responses	Percentage
1	Up to date information	22	73.33
2	Authenticity	10	33.33
3	Relevance	19	63.33
4	Subject specialization	21	70.00
5	Peer review	11	36.67

(Multiple answers were permitted)

From table 5, most of the researchers' 73.33% responded that up to date information as the most influential feature of e-journals that attracted them for its use. Also, 70% of them indicated subject specialization as the key feature followed by 63.33% as relevance. 36.67% responded as peer review and 33.33% as authenticity of the given information in the e-journals.

Table 6 Purpose of using e-journals

Sl. No.	Purpose	Number of responses	Percentage of responses

1	For research work	29	96.67
2	For teaching	8	26.67
3	For literature search/ review	17	56.67
4	For updating knowledge	18	60.00
5	For publishing articles	18	60.00

(Multiple answers were permitted)

From Table 6, the majority of the respondents 96.67% responded that the purpose of using e-journals is for research work. 60% of them indicated that their purpose is for updating knowledge and for publishing articles. Also 56.67% responded that they use e-journals for literature search/ review and only 26.67% of them use it for teaching purposes.

Table 7 Satisfaction with available e-journals

Sl. No.	Extent of satisfaction	Number of responses	Percentage
1	Very satisfied	3	10.00
2	Satisfied	4	13.33
3	Partially satisfied	17	56.67
4	Dissatisfied	4	20.00
5	Very dissatisfied	2	6.67

From Table 7, 56.67% indicated that the satisfaction of researchers with available e-journals is partial. The other responses imply that 20% are dissatisfied, 13.33% are satisfied and 10% are highly satisfied. Only, 6.67% responded that e-journals available in the library are not at all satisfactory according to the researcher's requirement.

Table 8 Problems faced

Sl. No.	Problems	Number of responses	Percentage
1	e-journals are not adequately available in my discipline	9	30.00
2	Lack of guidance and training	8	26.67
3	Lack of familiarity in searching	10	33.33
4	Inadequate computer system	12	40.00
5	Slow internet connectivity	3	10.00
6	Restricted access to e-journals from databases	3	10.00

The above table 8 shows that 40% faced inadequate computer systems as the major problem faced by the researchers while accessing e-journals for their research work. 33.33% experienced a lack of familiarity in doing searches and 30% responded

e-journals in their field are insufficient. 26.67% of them identified a lack of guidance and training for using e-journals as the major problem. 10% of them indicated slow internet connectivity and restricted access to journal databases.

Discussions

The study reveals that the research scholars are aware of and indicated that each of them uses e-journals for their research endeavors. Researchers place greater emphasis on reading e-journals daily as a source for their research activities. The majority got to know about e-journals from the internet and co-scholars while only 30% responded that the library was their source of knowledge about e-journals. This points out the necessity of orientation and awareness programs that the library must facilitate to their users. Research scholars should receive instruction and guidance on particular search tactics, as they heavily rely on e-journals and that could greatly benefit them.

Up-to-date information and subject specialization are the most influential features that attracted research scholars to choose e-journals as their main source of information. The study found that research is the major purpose for which the users benefit the most from e-journals. The majority of the respondents indicated that they are satisfied with the availability of e-journals in the college library. However, inadequate computer systems, lack of familiarity in doing searches, and non-availability of sufficient e-journals in the respective fields of researchers are the major obstacles they faced while using e-journals.

Conclusion

The study reflects that the research scholars of Mar Ivanios College (Autonomous) Trivandrum are well aware of the significance of e-journals in their research careers. Being the essential knowledge-providing source for a researcher, it is inevitable for the research community to get deflect from using journals and most importantly nowadays e-journals. The scope of e-journals opens up by providing open access and easy accessibility making it useful for the wider population who seeks primary information. The researchers of the college must be given essential guidance and training to access and utilize the available resources by giving proper orientation about various e-journals providing databases subscribed by the library and their search techniques. Being one of the colleges having extensive access to various electronic databases and e-resources subscribed by Kerala University, the awareness that the library can give to the users can make a great difference in their usage and the intellectual output produced.

The study can yield a better conclusion about the use of e-journals in the college by expanding its limit by including faculty members who are also the other prominent section of the research community in the institution. This will help in deriving much more accurate results by increasing the sample population and getting more inferences.

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SOCIAL MEDIA LITERACY AMONG TRANSGENDER PEOPLE OF PUDUCHERRY – A STUDY

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Introduction

Gender expression is how a person presents themselves externally, but gender identity is how a person feels about their gender internally. Remarkably, not every departure from gender norms denotes transgender identity. The way that society perceives transgender experiences is changing, and this is causing constant changes in scientific, cultural, and intellectual discourse. Transgender people frequently face societal obstacles, including prejudice in public, healthcare, educational, and religious contexts. Their susceptibility to harassment when expressing their identity is exacerbated by this hostility in addition to familial disapproval. Transgender people who are in need of emotional support and assistance seek sanctuary in communities that provide such care.

Social media platforms have emerged as essential venues for transgender connection in the last ten years, providing avenues for conversation and the sharing of obstacles, chances for employment, and accomplishments. Transgender lives are significantly impacted by this digital growth, which offers opportunities for assistance and connections that help them overcome social obstacles and provide a feeling of safety and belonging in their communities.

Media Literacy: "To access, analyse, evaluate and communicate messages in a variety of forms" (Livingstone, S. (2003) of media formats is referred to as media literacy. It entails comprehending and being able to decipher the messages presented by various media, including newspapers, television, the internet, social media, and commercials. Media literacy gives people the ability to understand the intent, biases, methods, and possible effects of the information that is delivered, allowing them to effectively navigate the complex media landscape.

Social Media: Social media is a type of computer-based tool that facilitates connections, information sharing, and thought exchange inside virtual networks. It entails having the ability to find, access, and understand various media content. For the transgender community, social media platforms like Facebook, Twitter, WhatsApp, and others

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are essential since they promote community development, communication, and relationships. "Two sources of uncertainties identified are the information itself and the provider" (Babajide Osatuyi, 2013). These platforms promote a sense of inclusion and support by providing user-friendly interfaces, accessibility, and quick responses. On these platforms, particular groups allow for the quick sharing of important information. WhatsApp, Facebook, Instagram, LinkedIn, Telegram, Twitter, Facebook, and TikTok are essential tools that facilitate quick communication, connection, and support between transgender people. They foster a feeling of community by facilitating quick access to knowledge and support.

Significance of the Study: This study looks into how the transgender community in Pondicherry uses social media networking platforms. The fundamental goal of this research is to thoroughly understand the challenges that transgender people encounter, as well as their patterns of participation with social media networking sites.

Review of Literature

Buss (2022) Research has found that transgender individuals use social media to curate their online presence and experiences across multiple platforms over time. A study interviewed 20 transgender social media users, revealing strategic identity management practices. It indicates social media provides an important space for transgender individuals to explore, express, and validate their identity through strategic, platform-specific curation. Selkie (2020) A qualitative study explored how transgender adolescents use social media for transgender-related support. Interviews with 25 participants revealed online communities provided emotional support from peers and role models, appraisal support validating experiences, and informational support for health decisions and educating family/friends. It highlights social media's complex role, providing valuable support yet potential risks. Continued research is needed to harness social media to promote mental health in transgenders. Berger (2022) LGBTQ individuals faced high mental health risks compared to other gender peers so, social media can provide LGBTQ youth with spaces countering heteronormative environments, potentially supporting their well-being. The study examined how LGBTQ youth use social media for peer connection, identity development, and social support, and the impacts on mental health. Social media enables LGBTQ youth to connect with communities, negotiate identity, and obtain peer support. Quantitative studies linked social media use to reduced mental health concerns and increased well-being.

Objectives of the Study

- To find the educational backgrounds of the transgender population in Pondicherry, a Union Territory;
- To investigate the respondents' social media usage tendencies;
- To analyze the exchange of information within their community and
- To identify the difficulties that respondents encountered when using social media platforms and conveying relevant information.

Hypotheses

H_1: There is an association between the Use of social media and Information sharing among Transgender.

H_2: There is a significant difference between the age and the use of social media among Transgender.

Source of Data Collection: The primary data were collected from the target group of transgender people from various places in Pondicherry by using a survey method with a structured questionnaire. Secondary data like statistical information from the Government also have been utilized in this study.

Statistical tools for analysis: In this study Percentage Analysis, Mean, Standard deviation, Chi-Square, T-test, and software packages SPSS and MS Excel have been used to analyze the data.

Data Analysis and Interpretation

Table 1: Distribution of Respondents According to their Areas

Native	Frequency	Percent
Pondicherry	44	59.5
Tamil Nadu	30	40.5
Total	74	100.0

The table 1 shows the distribution of respondents, 59.5 % of transgender received from Pondicherry union territory.

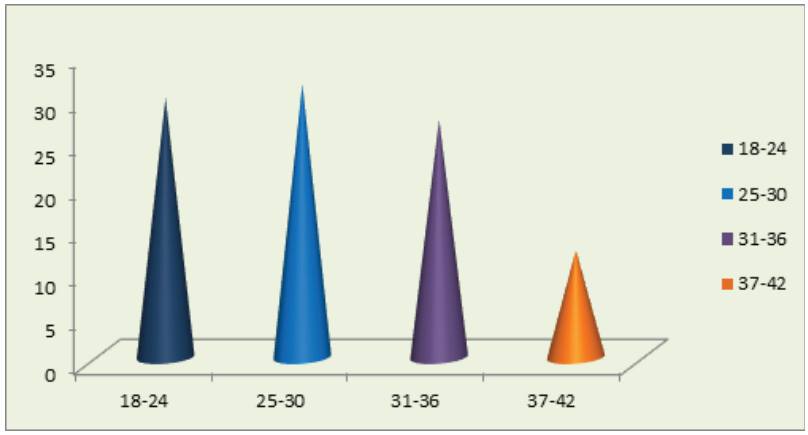


Fig.1 Distribution of Respondents According to their Age

Figure 1 illustrates that in the age group, 18-24 & 25-30 are more number responded.

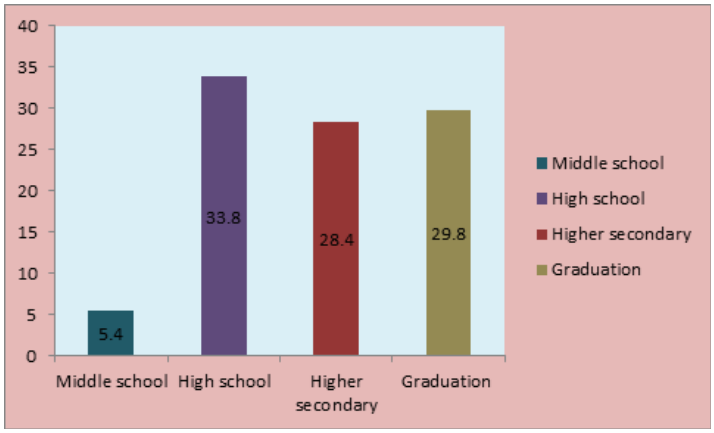


Figure 2: Frequency distribution of Education of Transgender people

Figure 2 explains the education of transgender, 33.8 % of respondents completed High school, 29.8% of transgender qualified graduated, 28.4 % of respondents completed higher Secondary, and a very small number (5.4%) completed middle school.

Table 2: Chi-Square Test for use of social media per day and Information sharing amongTG Community

Items	Hours	Strongly disagree	Disagree	Moderate	Agree	Strongly agree	Total
Personal information	30-1hr	0	0	0	5	6	11
	1-2hr	0	0	0	14	30	44
	2-3hr	0	0	1	5	12	18
	Above 4hr	0	0	0	0	1	1
Medicalissues	30-1hr	0	0	0	7	4	11
	1-2hr	0	0	4	15	25	44
	2-3hr	0	0	1	7	10	18
	Above 4hr	0	0	0	0	1	1
Communityproblems	30-1hr	0	0	1	4	6	11
	1-2hr	0	0	1	12	31	44
	2-3hr	0	0	0	6	12	18
	Above 4hr	0	0	0	0	1	1
Govt. schemes	30-1hr	1	0	2	4	4	11
	1-2hr	0	0	10	13	21	44
	2-3hr	0	0	5	6	7	18
	Above 4hr	0	0	0	0	1	1
Bank loan	30-1hr	1	0	5	3	2	11
	1-2hr	0	0	15	19	10	44
	2-3hr	0	0	9	5	4	18
	Above 4hr	0	0	0	0	1	1

Others	30-1hr	1	0	6	3	1	11
	1-2hr	0	2	20	22	0	44
	2-3hr	1	1	10	5	1	18
	Above 4hr	0	1	0	0	0	1

Table 2 epitomizes the use of social media per day and information shared among Transgender community and depicts that from the 74 respondents.

Table 3: Chi-Square Test for use of social media and Personal Information sharing among TG Community

Variables	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.561[a]	6	.601
Likelihood Ratio	4.534	6	.605
Linear-by-Linear Association	.164	1	.686
N of Valid Cases	74		

The chi-square value is 4.561 and the estimated significance value is .601, which is greater than 0.05. Hence the null hypothesis is accepted, showing there is no significant association between the use of social media per day and personal information of the respondents.

Table 4: Chi-Square Test for use of social media and medical issues among TG Community

Variables	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.663[a]	6	.588
Likelihood Ratio	5.581	6	.472
Linear-by-Linear Association	.605	1	.437
N of Valid Cases	74		

The chi-square value is 4.663 and the estimated significance value is .588, which is greater than 0.05. Hence the null hypothesis is accepted, showing there is no significant association between the use of social media per day and medical issues of the respondents.

Table 5: Chi-Square Test for use of social media and community problems among TG Community

Variables	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.321[a]	6	.768
Likelihood Ratio	3.480	6	.747
Linear-by-Linear Association	1.097	1	.295
N of Valid Cases	74		

The chi-square value is 3.321 and the estimated significance value is .768, which is greater than 0.05. Hence the null hypothesis is accepted, showing there is no significant association between the use of social media per day and community problems of the respondents.

Table 6: Chi-Square Test for use of social media and sharing Government schemes among TG Community

Variables	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.805[a]	9	.554
Likelihood Ratio	6.256	9	.714
Linear-by-Linear Association	.472	1	.492
N of Valid Cases	74		

The chi-square value is 7.805 and the estimated significance value is .554, which is greater than 0.05. Hence the null hypothesis is accepted, showing there is no significant association between the use of social media per day and Govt. schemes of the respondents.

Table 7: Chi-Square Test for use of social media and other purposes among TG Community

Variables	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	27.459[a]	12	.007
Likelihood Ratio	17.312	12	.138
Linear-by-Linear Association	.970	1	.325
N of Valid Cases	74		

The above chi-square value is 27.459 and the estimated significance value is .007, which is greater than 0.05. Hence the null hypothesis is accepted, showing there is no significant association between the use of social media per day and others of the respondents. From the above table, it can be verified that transgender people are using social media mostly to share information personally, to share the community problems faced by them, and for medical issues, not for other purposes.

Table 8: Age*Usage of social media One-way ANOVA

Variables		N	Mean	Std. Deviation	f	Sig.	Hypothesis
WhatsApp	18-24	22	4.68	.894	1.140	.339	Accepted
	25-30	23	4.83	.388			
	31-36	20	4.95	.224			
	37-42	9	5.00	.000			
	Total	74	4.84	.550			
Face book	18-24	22	3.95	.844	1.715	.172	Accepted
	25-30	23	3.83	.834			
	31-36	20	4.30	.470			
	37-42	9	4.11	.333			
	Total	74	4.03	.721			

Instagram	18-24	22	4.36	.953	.748	.527	Accepted
	25-30	23	4.39	.722			
	31-36	20	4.50	.607			
	37-42	9	4.78	.441			
	Total	74	4.46	.744			
YouTube	18-24	22	4.68	.894	.503	.682	Accepted
	25-30	23	4.70	.470			
	31-36	20	4.85	.366			
	37-42	9	4.89	.333			
	Total	74	4.76	.592			
Twitter	18-24	22	1.91	1.231	.205	.893	Accepted
	25-30	23	1.91	1.203			
	31-36	20	2.05	1.276			
	37-42	9	1.67	1.118			
	Total	74	1.92	1.202			
LinkedIn	18-24	22	1.59	1.297	1.356	.263	Accepted
	25-30	23	1.26	.864			
	31-36	20	1.15	.366			
	37-42	9	1.00	.000			
	Total	74	1.30	.887			
Telegram	18-24	22	2.73	1.420	1.349	.266	Accepted
	25-30	23	2.30	1.363			
	31-36	20	2.40	1.429			
	37-42	9	3.33	1.414			
	Total	74	2.58	1.414			
Others	18-24	22	3.41	.854	3.208	.028	Rejected
	25-30	23	2.96	.767			
	31-36	20	3.20	.616			
	37-42	9	3.78	.441			
	Total	74	3.26	.760			

The above table 8, 13 estimates the significance value for factors such as WhatsApp, Facebook, Instagram, Youtube, Twitter, LinkedIn, and Telegram is greater than 0.05. Hence the Null Hypothesis is accepted, showing there is no significant difference between the above factors and the Age of the respondents.

Table 9: Frequency Distribution of Barriers to Accessing Social Media

Barriers to accessing social media	Frequency	Percent
No device	1	1.4
Network issues	12	16.2
Unable to recharge	25	33.8
Financial problems	35	47.3
Others	1	1.4
Total	74	100.0

Major Findings

- Distribution of Respondents According to their Areas: Finding the Native of Transgender are majority of respondents are from Pondicherry 44 (59.5%) out of 74 respondents.
- Distribution of Respondents According to their Age: Findings out of 74 respondents, 23 (31.1%) respondents are of age between 25-30.
- Distribution of Education of Transgender People: It represents the findings of education of the Transgender people in 25 (33.8%) majority of respondents are High school out of a total 74 respondents.
- Use of social media and Personal Information sharing among TG Community: It represents there is no significant association between the use of social media per day and the personal information of the respondents.
- Use of Social Media and Medical Issues among TG Community: It represents there is no significant association between the use of social media per day and the medical issues of the respondents.
- Use of Social Media and Community Problems among TG Community: It represents there is no significant association between the use of social media per day and community problems of the respondents.
- Use of social media and sharing Government Schemes among the TG Community: It represents there is no significant association between the use of social media per day and the Government schemes of the respondents.
- Use of social media and other purposes among TG Community: It represents there is no significant association between the use of social media per day and other purposes of the respondents.
- Use of Age and Social Media among Transgender: It represents the Null Hypothesis is accepted, showing there is no significant difference between the above factors and the Age of the respondents.
- Distribution of Barriers to Accessing Social Media: It represents analyzed findings showed that the financial problems 35 (47.3%) are the maximum and main barriers of participating respondents.
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- CONCLUSION

This study explores the ways in which the transgender community in Pondicherry and Tamil Nadu uses social media and shares information. Most of the people who live in Pondicherry are in their twenties, have completed their high school education, and work on a regular daily wage basis. Age and education were found to have an impact on differences in information availability, staying current, and obtaining career-related advice. Moreover, there were a variety of motivations for social media use. Notably, links were made between libraries, advancing careers, staying informed, improving knowledge, and raising awareness among transgender people. It is proposed that creating transgender-specific libraries-whether government-initiated or sponsored by non-governmental organizations-could greatly address the information demands of this population and contribute to their personal growth.

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AUTHOR INDEX

Abhijith R S 409
Abitha Shekar 31, 661
Abraham Prakash 783
Adeena M K 957
Akarsh R 1211
Alka Bansal 281
Alka Raj G 425
Alok V N 643
Amrita Devi 895
Anandraj K C 909
Anandu G 127, 145
Ananthnag K 1201
Ananya H V 231
Anjan Gohain 415
Aravind S 909
Arunima Baiju 1129
Arya Asok A R 809
Ashtamy L 571
Asok Kumar S K 381
Aswathy Ajayan 1167
Atheena V 1139
Baburao P 263
Babusankar S 627
Baek Ji-Won O 507
Bagavathi A 171, 369
Bakkiyaraj N 875
Baskar K 241
Baskaran C 1147
Beongkee Lee 1041
Bikika Laloo Tariang 415
Butdisuwan Sujin 699
Daksh Rupani 249
Deepalakshmi R 183
Dhanalakshmi S 653
Dhanalakshmi B 849
Dhanyasree V K 1187
Dilli Babu K 1179
Doraswamy M 515, 1159
Duangkaew Ngernpoolsap 337
Elango 1051
Ganesamoorthy 145
Ganesh P 211, 997, 1007
Geetha N 137, 627
Ghazzali N N 835
Gnanasekaran D 71
Gnancy Subha G D 305
Gone Rangappa Naidu 587
Goswami Sadhana 435
Grace M 153
Granth Pal 249
Greeshma S S 425
Gururaj S Hadagali 737
Hamza Musa Ukashatu 491
Harikanan P 127
Harinarayana N S 723
Hasina Begum 543
Hassan Usman 491
Hema Adhikari 1115
Hemavathi B N 525
Hemavathy C 855
Hima K 751
Hyo-Jung Oh 345, 507
Hyunsoo Kim 345
Indraji C 1139, 1219
Iranna M Shettar 737
Jagadeesh K 263
Jenny Prisca Barla 389
Jeyshankar R 89, 221, 751
Jithin K.S, 1139
Jitu Mani Das 895

Jutatip Chanlun 619
Kala N 241
Kalaimani S 997
Kandawan Kunanonvithaya 619
Kangundi 867
Kasirao V 1179
Keshava 587
Khushboo Kumari 281
Kim Eungi 463
Kishoreraja P C 249
Kittiya Suthiprapa 1081
Kodanda Ramaiah 867
Kothainayaki S 137
Krishnamoorthy P 287
Krishnamurthy M 3, 231, 293
Kulthida Tuamsuk 1081
Kushagra Soni 249
Kusumakumari K 1171
Ladan Abubakar 491
Lakshmi V 183
Lal D D 671
Madasami R 153
Madhavi Ch 1171
Mahalakshmi K R 887
Mahalakshmi M 119
Mahapatra R K 205
Mandira Bairagi 99
Manikandan C 1219
Manjunath Kaddipujar 737
Md Gouse Riajuddin 559
Meena Priya Dharshini 305
Mini Devi B 273, 409, 571, 637
Mohammed Ibrahim 491
Mohanathan P 949
Mukut Sarmah 971
Murugan S 991
Muruli N 723
Muthuman M 127
Muthumathi Dharuman 305
Muthuraj A 875
Muthuvennila S 127
Nakum Jignesh K 443
Namtip Wipawin 337
Natarajan N O 991
Nazar Shinsa 637
Neha Joshi M 1099
Ngo Thi Huyen 355
Nilati Patorn 601
Nishavathi E 797
Oh Dong-Geun 463
Padma P 821
Palanivel K 55
Panduranga Swamy M 71
Pavithra K 1107
Pitchaipandi P 1147
Prabakar S 981
Prabakaran M 1015
Prabakaran T 55
Prabhu R 691, 855
Pramila M C 1201
Pranjal Deka 971
Prasantha Kumari M 1121
Puspanjali Jena 47
Radhakrishnan S 949
Rahul K P 939
Raja L A 287
Rajendra Babu H 887
Rajendran P 713, 1051
Rajesh Kumar K 821
Rajini Chagantipati 327
Ramakrishna N 263
Ramakrishnan 765
Ramesh Babu B 699, 1027
Ramesh R 783
Ramesh Ramasamy 381
Ramu Naik P 1187

Ravi Sankar G 765
Ravichandran P 783
Ravichandran S 1007
Rekha R V 313, 809, 939, 957, 1129
Reysa Alenzuela 1063
Rima Hazarika 921
Rungtiwa Klibngern 619
Sabique Mohammed 643
Saengkaew Chakkrit 13, 611
Sai Prasad G 849
Sakon Muangsun 619
Sarin M S 1107
Saritha R 1167
Saurabh Kumar Rai 3
Savitri Krishna 475
Seeja K R 89, 221
Selvakamal 145
Senthilkumar MKS 163
Seshaiah O 81
Sethukkarasi R 109
Sevukan R 835
Shalini R Lihitkar 99
Shivarama J 197, 389
Shri Priya Ranjan Mahalik 205
Sirajo Danzangi Abubakar 491
Siva N 713, 981
Smruti Rekha Swain 47
Sneha Kamble 197
Socrates C 1015
Srilakshmi B 153
Srinija Bathinapatla 515
Srinivasa Rao V 263, 1159
Sudhier K G 451, 921
Sugunaraj O 1015
Suja K 579
Sujatha R 691
Sukula Shiva Kanaujia 533
Sunil M V 197
Suraj Kumar 249
Surendra Babu K 867
Suresh Babu M 543
Suresh Jange 475
Swetha R 683
Talasee Jinnawat 13, 601
Terzi Paschalia 1063
Thanuskodi S 1167
Thavamani K 765
Theeradej Manakul 1081
Uma Swarna Manjari A 55
Veeranjaneyulu K 19
Venkat Ragavender B 327
Venkateswarlu Y Ch 39
Vidya Vinod 89, 221
Vikas Kumar 293
Vineeta Jain 71
Vipul Banker 443
Vishnu Prasad N 713
Vispat Chaichuay 1081
Visvanathan 981
Vivekanandhan S 211, 981, 997
Vrindha K A 313
Yashashwini H L 231
Yashaswini 403
Yeo Jisuk 463
Yesu Nesa Joy Singh P J 109
Zabeen Ahmed 273, 435

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