

**RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL
INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY**

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY**

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BY

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Submitted

In partial fulfillment of the requirement of the Degree of Doctor of Philosophy in
Library and Information Science of Mizoram University, Aizawl

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C E R T I F I C A T E

This is to certify that the thesis entitled **“RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY”** submitted by **BISWA BAG** for the award of the Degree of Doctor of Philosophy in Library and Information Science is carried out under my supervision and incorporates the student's bona-fide research and this has not been submitted for award of any degree in this or any other university or institute of learning.

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MIZORAM UNIVERSITY
September, 2025

I **BISWA BAG**, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form basis of the award of any previous degree to me or to do the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/Institute.

This is being submitted to the Mizoram University for the degree of Doctor of Philosophy in Library and Information Science.

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ABBREVIATIONS AND ACRONYMS

ABBREVIATION	DESCRIPTION
ABET	Accreditation Board for Engineering and Technology
ACM	Association for Computing Machinery
AICTE	All India Council for Technical Education
AHSS	Arts, Humanities, Social Sciences
AI	Artificial Intelligence
AIChE	American Institute of Chemical Engineers
AISHE	All India Survey on Higher Education
ANU	Australian National University
APA	American Psychological Association
APC	Article Processing Charge
API	Application Programming Interface
ARCHER2	Advanced Research Computing High-End Resource 2
ARIIA	Atal Ranking of Institutions on Innovation Achievements
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
BIOA	Black Open Access
BPCL	Biju Patnaik Central Library
BrOA	Bronze Open Access
CAS	Current Awareness Service
CBCS	Choice Credit System

ABBREVIATION	DESCRIPTION
CD	Compact Disk
C-DAC	Centre for Development of Advanced Computing
CDRI	Central Drug Research Institute
CODATA	Committee on Data for Science and Technology
CSIR	Council of Scientific and Industrial Research
CSE	Computer Science Engineering
CSIP	Centre for Social Impact and Philanthropy
CSV	Comma-Separated Values
CUG	CV Raman Global University
DDC	Dewey Decimal Classification
DELNET	Developing Library Network
DiOA	Diamond Open Access
DLI	Digital Library of India
DMPT	Data Management Planning Tool
DOAJ	Directory of Open Access Journal
DOAB	Directory of Open Access Books
DOIs	Digital Object Identifiers
DRDO	Defence Research and Development Organisation
EBC	Eastern Book Company
ECE	Electronics and Communication Engineering
ECM	EBSCOhost Collection Manager
EE	Electrical Engineering

ABBREVIATION	DESCRIPTION
ETHOS	Electronic Theses Online Service
FAIR	Findable, Accessible, Interoperable, Reusable
FFP	Fast Field Program
GOA	Gold Open Access
GrOA	Green Open Access
HOLLIS	Harvard On-Line Library Information System
HSCSIT	Haryana State Council for Science, Innovation and Technology
HTML	Hyper Text Markup Language
HyOA	Hybrid Open Access
ICAR	Indian Council of Agricultural Research
ICPSR	Inter-university Consortium for Political and Social Research
ICSU	International Council for Science
IEEE	Institute of Electrical and Electronics Engineers
IETE	Institution of Electronics and Telecommunication Engineers
IIL	Integrated Library Management
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
IITD	Indian Institute Technology, New Delhi
INAE	Indian National Academy of Engineering

ABBREVIATION	DESCRIPTION
INDEST	Indian Digital Library in Engineering Science and Technology
IPCC	International Pharmaceutical Companies
IR	Institutional Repositories
IRB	Institutional Review Board
ISRO	Indian Space Research Organisation
ITPI	Journal of Institute of Town Planners
JISC	Joint Information Systems Committee
JCR	Journal Citation Reports
JESE	Journal of Environmental Science and Engineering
JET	J-Gate Engineering and Technology
KIIT	Kalinga Institute of Industrial Technology
KIOSK	Kommunikasjon Integrert Offentlig Service Kontor
KISS	Kalinga Institute of Social Science
MHRD	Ministry of Human Resource Development
MIT	Massachusetts Institute of Technology
ML	Machine Learning
MLA	Modern Language Association
MOOC	Massive Open Online Courses
NAAC	National Assessment and Accreditation Council
NASA	National Aeronautics and Space Administration

ABBREVIATION**DESCRIPTION**

NABH	National Accreditation Board for Hospitals and Healthcare Providers
NABL	National Accreditation Board for Testing and Calibration Laboratories
NBA	National Board of Accreditation
NCI	National Cancer Institute
NDLI	National Digital Library of India
NDSAP	National Data Sharing and Accessibility Policy
NFSC	National Fellowship for Scheduled Caste Students
NKN	National Knowledge Network
NLM	National Library of Medicine
NPTEL	National Programme on Technology Enhanced Learning
NTS	National Talent Scholarship
OA	Open Access
OAI	Open Archives Initiative
OATD	Open Access Theses and Dissertations
OER	Open Educational Resources
OPAC	Online Public Access Catalogue
OPJEMS	OP Jindal Engineering and Management Scholarship
ORCID	Open Researcher and Contributor ID
OSS	Open-Source Software
PMRF	Prime Minister's Research Fellowship

ABBREVIATION	DESCRIPTION
PQDT	ProQuest Dissertation & Theses
R&D	Research and Development
RDS	Research Data Services
RDM	Research Data Management
REC	Regional Engineering College
RFID	Radio Frequency Identification
RS	Reprographics Services
RSS	Research Support Services
SAGA	Special Academic Group Autonomy
SCONUL	Society of College, National and University Libraries'
SDI	Selective Dissemination of Information
SDGs	Sustainable Development Goals
SERB	Science and Engineering Research Board
SIT	Silicon Institute of Technology
SPSS	Statistical Package for the Social Sciences
SQL	Structured Query Language
STEM	Science, Technology, Engineering, and Mathematics
SVU	Sri Venkateswara University
SWAYAM	Study Webs of Active-learning for Young Aspiring Minds
TISS	Tata Institute of Social Sciences
TSV	Tab-Separated Values

ABBREVIATION	DESCRIPTION
UCE	University College of Engineering
UK	United Kingdom
UKRI	UK Research and Innovation
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPC	Universitat Politècnica de Catalunya
URL	Uniform Resource Locator
UTM	Universiti Teknologi Malaysia
VIDWAN	Expert Database and National Researcher Network
VLSI	Very Large-Scale Integration
VSS	Visual Search System
VSSUT	Veer Surendra Sai University of Technology
WAME	World Association of Medical Editors
WPA	Writing Program Administration
XML	Extensible Markup Language

CHAPTER-1

INTRODUCTION

1.1. IMPORTANCE OF RESEARCH IN SOCIETAL DEVELOPMENT

‘Research’ is derived from the French word ‘researcher’, meaning ‘see again’ (Dhiman, 2015). “Research is the scientific and systematic search for pertinent information on a specific topic” (Kothari, 2019). Research is an activity, highly associated with discovering new knowledge (Uttarakhand Open University, 2001) through critical questioning to uncover new insights to answer complex situations. The primary purpose of the research is to contribute to the welfare of societies. Research institutes of all countries, educational institutions, voluntary organisations, and philanthropists have been conducting research to improve society in various fields. Through research, a researcher may either confirm his/her in-depth expertise on a subject and circumstance or offer fresh information or an idea that would benefit society. By conducting research, the practitioner develops a thorough and precise understanding of the topic and creates superior, long-lasting solutions for a given problem. By carefully examining the state of its many facets, it has been demonstrated that modern human civilisation is entitled to the authority of a perfect society. A nation prioritising research has shown tremendous sustainable development in education, economy, military power, social lifestyle, art, culture, etc. Therefore, the statement that research is the focal point of the nation's overall development is not hyperbole.

The paradigm shift from ancient to modern civilisation is the result of self-realisation through research. An agrarian society, an industrial society, and an information society are witnesses. Any environmental, educational, clinical, biological, transportation, or luxury development is the outcome of continuous research. Research is the only way to progress in different areas, including early problem detection, diagnostic facility enhancement, and a comprehensive approach to sustainable growth. Research plays a crucial part in enhancing the quality of life in society's marginalised communities by encouraging people towards the mainstream.

Human society feels immensely proud and takes pride in the architectural monuments built between 2500 and 3000 years ago. To our surprise, there was no advancement in literature or mechanical development; still, buildings, temples, stupas, or channels were constructed scientifically. However, there is no documentary evidence of research activities from the ancient period; the existence of dated architectural buildings/monuments with marvellous engineering and aesthetic depictions of painting was made possible only through rigorous research by the architect. Indian architects were blessed with exceptional research skills to construct massive and world-famous temples, monuments, medicine, and many more that flourished into the new generation as well.

1.2. PRESENT STATUS OF INDIAN RESEARCH ENDEAVOUR

As per the report published in 2023 by 'Nature Index from 1st January 2022 to 31st December 2022, the United States of America stands at the top with a share metric of 21745.07 and a count metric of 30853. Colombia is listed at the bottom of 50 countries with a share metric of 25.56 and a count metric of 247. This data is presented here to differentiate the developmental research activities among the countries. The USA is far better than Colombia in terms of economic growth, business sector, social and geographical inequalities, poverty, political instability, trade, etc. The data proves how dedicated the American youth and educational institutions are to the research, making America the most economically and militarily powerful nation today. On the other hand, the Nature Index has established very few research metrics in favour of Colombia. It would not be an exaggeration to say that Colombia's social inequality, political instability, and poor quality of life are being ignored. India stands 11th out of 50 in this index, with a share metric of 1296.45 and a count metric of 2037. India is in a good position, but there is a difference of 20448.2 share metrics and 28,816 count metrics compared to USA (Springer, 2022). Hence, more involvement and investment in India are expected in the field of research for development.

1.3. NATIONAL EDUCATION POLICY 2020 AND PROMOTION OF RESEARCH

In its recommended document, NEP 2020 emphasises the importance of research. The document stated that research is a multidisciplinary approach that must be promoted at the level of higher education institutions. Research possesses the efficiency to develop the core 21st-century skills among students, such as critical thinking, communication, creativity, problem-solving, information literacy, media literacy, global awareness, adaptability, ethical decision-making, and leadership (NEP, 2020). Higher Education Institutions (HEIs) are pioneers in research for students, enabling them to develop research communities across disciplines, including cross-disciplinary research. The HEIs contribute remarkable literary activities within the scholarly community by facilitating support and guidance. HEIs will prioritise research and innovation by establishing start-up incubation centres, technology development centres, and centres focused on cutting-edge fields of study. They will also foster stronger industry-academic relationships and promote interdisciplinary research that includes the humanities and social sciences. HEIs will implement specialised support programs and competitions to cultivate creativity among students. Additionally, the National Research Foundation (NRF) will play a key role in nurturing and sustaining (Makri, 2019) a vibrant research and innovation culture within HEIs, research labs, and other research institutions (NEP, 2020). Details of research promotion in HEIs are stated in the NEP 2020 document in para 10 under the heading ***“Institutional Restructuring and Consolidation”*** and are presented here:

1. Ending the fragmentation of HEIs is necessary to prepare them to become hubs of multidisciplinary institutions (NEP, 2020).
2. HEIs will promote cross-disciplinary research through research communities and scholars.
3. HEIs will create well-rounded and innovative individuals, like the exemplary ancient universities of Takshashila, Nalanda, Vallabhi, and Vikramshila.
4. HEIs will equally concentrate on teaching and research and be recognised as a research-intensive university.

5. HEIs will support educational development, community engagement services, and contributions to various practice fields.
6. The deadline for 2040 is to transform all the HEIs into a greater educational hub with thousands of students enrolled.

1.4. THE CONCEPT OF RESEARCH

In the sixteenth century, "research" was first used in English to refer to a controlled, systematic inquiry or investigation process. Related concepts like "innovation" and "discovery," which are the results of a basic process of inquiry, were used in other modern contexts (Bushaway, 2024). Research is characterised as an analytical, scientific, and methodical process. It adheres to a tried-and-true process designed to increase expertise in a field. The ultimate objective of research is to present rational and well-founded evidence to achieve long-term, socially beneficial effects. It provides the best and most effective way of solving societal problems through research. A person or institution conducts research on a specific subject matter within a specific time frame. Research improves society and increases its knowledge of the subject being researched.

In the present study, the faculty and research scholars of selected technical institutions are involved, who are engaged in finding new ideas. Finding ideas or knowledge is rooted in existing knowledge. The researcher would have followed the correct research cycle while coming up with novel concepts or inventions, and in this study, scientific investigation is referred to as "RESEARCH." This process, which results in technical advancement, involves acquiring new information, perspectives, or theoretical understanding. As a result, students' research projects at these institutions are distinguished by a systematic and organised methodology, which helps create new knowledge that is significant and worthwhile to society. The research may include any project,

PhD thesis, or publication of journal articles with new concepts or ideas in the respective subject domain.

1.4.1. DEFINITION OF RESEARCH AND RESEARCH SUPPORT

Different eminent scholars have given their ideas on research as follows:

According to Sadhu and Singh (1996), “the concept of research in its modern setting consists of: avenue of quest, inquisition or investigation; specific or well defined-domain; a well-laid hypothesis; capable of being based upon observable data; scientific technique of analysis; and logical interpretation of results and several other parameters” (Dhiman, 2015). The periodic study of the causes of the events and their subsequent results is called research.

"A set of systematic procedures followed by a researcher or a student, to identify all aspects related to a scientific topic or problem, and the ultimate goal is to solve that problem" (Elyas, 2023).

According to Creswell, "Research is a systematic investigation to establish the facts." He also stated research in a broad sense: “Research includes any gathering of data, information, and facts for the advancement of knowledge" (Wikipedia, 2021).

Research is the manipulation of things, concepts, or symbols to generalise, extend, correct, or verify knowledge, whether that knowledge aids in the construction of theory or the practice of art (Kothari, 2019).

According to Datt & Chetty, "research is a careful investigation or inquiry, especially through search for new facts in any branch of knowledge." (Chetty, 2015).

Hoffman (2016) defines research support as “anything that a library does that supports the activity of scholarship and research at its parent institution” (Hoffman, 2016; Singh, 2022).

Research support, as defined by Parker (2012), is a set of services and facilities that assist in increasing research productivity and scholarship (Parker, 2012; Singh, 2022).

Bent (2016) defines research support services as library staff interventions in the research lifecycle, including, but not limited to, identifying funding opportunities,

searching the literature, advising on data management plans, creating researcher identifiers, advising on dissemination, tracking citations, etc. Research support services establish new trends, roles, and responsibilities in academic libraries to enhance high-quality outputs (Bent, 2016; Singh, 2022).

1.4.2. RESEARCH DIFFICULTY

As students, researchers often encounter many obstacles in their academic journey. Finding quality materials is a significant concern. Databases, journals, and current materials vital for their research work are often hard to find for many researchers, particularly due to universities' financial constraints. Moreover, lack of funds can be a significant obstacle as research costs (travel, specialised materials, publication costs, etc.) can be prohibitive without funding. Time management is a second issue; handling research, academics, teaching, and life together requires detailed planning and can be overwhelming.

Methodological concerns evolve, particularly if the individuals working on the data lack the relevant expertise in data analysis, research design, or software packages related to research. Dealing with unforeseen issues during data gathering or navigating complicated statistical methodologies can be frustrating and hamper development. Furthermore, the publication pressure might increase stress since burnout is frequently caused by the need for regular, high-quality publications to obtain financing or academic prestige.

Finally, researchers suffer from mental pressure and often feel lonely, anxious, or suffer from impostor syndrome. These challenges demonstrate the need for robust support to help research scholars navigate the complexities of research support, such as access to resources, funding, mentorship, and mental health support.

In this context, the role and responsibilities of libraries in higher education are becoming challenging. Libraries play an essential role in providing a comprehensive shape to a project by offering various forms of support. For effective and qualitative research, libraries extend different kinds of support, and the competencies of LIS professionals are under surveillance. To provide support in research to scholars with

all facilities related to research and to provide them with services and facilities throughout their research, ‘**Research Support Service**’ is highly essential.

A library or the concerned institution's LIS professional is solely responsible for conducting seminars and workshops to create awareness among scholars and faculty about government agencies upgraded statutory procedures/guidelines (UGC, AICTE) for conducting research. Orientation programs on literature review, writing research proposals, resource acquisition, designing and validating questionnaires, managing bibliographies, testing for plagiarism, funding agencies, source of publication, presentation technique, etc., are needed for scholars. Also, a library must provide information about various digital services, such as a digital library, a library website, a digital subscription, etc., to extend virtual support to aspirants.

So, the researcher has conducted this study based on all these elements. This study is an attempt to analyse the present research support service of the library and its quality in selected technical educational institutions of Odisha, which are ranked among the top 200 technical institutions of India by NIRF (National Institutional Ranking Framework)- 2022, based on their institution’s performance and research output.

1.4.3. RESEARCH SUPPORT

Support of institutions' students, staff, and research scholars is an integral part of universities. Indeed, it is a decisive factor (Chandran, 2017) for the university-educated community to pursue further education. Scholars' development depends on the services and support provided by the concerned institution. All-around support of universities is helpful to excel in their careers and bring name and fame to the parent organization.

An institution is selected based on many criteria, such as academics, campus culture, scholarship, extracurricular activities, career prospects, etc. Recently, the scope of research promotion has been a key criterion for admission. Extension of institutional support has enhanced enrolment in HEIs. As per the report published by the Ministry of Education, the All-India Survey on Higher Education (AISHE) 2021-2022, a massive percentage of enrolment for higher education is listed. Among streams at “the postgraduate level in AISHE 2021-22, the maximum number of students are enrolled

in Social Science (21.1%), followed by Science (14.7%). Ph.D. enrolment has increased by 81.2% to 2.12 lakh in 2021-22 compared to 1.17 lakh in 2014-15” (Ministry of Education, n.d.).

As the vast number of PhD enrolments in Indian institutions is increasing, the responsibility of the concerned institutions is to support quality research. The necessity of research support has been felt due to the explosion of a wide range of information and the interpretation of technology in research. Research support is also required for innovation regarding quality and quantity because an institution is selected for enrolment based on its ranking, governed by many national/international agencies and organizations viz- NIRF (National Institutional Ranking Framework), QS (Quacquarelli Symonds) World University Rankings, Atal Ranking of Institution on Innovation Achievements (ARIIA), The World University Ranking, The Asia University Ranking, Times Higher Education Young University Rankings, etc.

Any institution's library plays a crucial role in supporting students at the university. Along with facilitating reading resources, the library possesses the skills and competencies to help research scholars innovate and enhance the institution's quality. The NKC (2007) states, "A library is not a building stacked with books – it is a repository and source of information and ideas, a place for learning and inquiry, and for the generation of thought and the creation of new knowledge.”

1.4.4. SUPPORT

Support is a person's competency, encouragement, and willpower to understand others' problems and needs. Support is an act or process through which a person renders assistance to a needy person. In the case of research, a researcher needs support from the library for a specific research purpose. The library provides several services to its user community to meet their educational needs, like circulation, cataloguing, OPAC, reference and referral services, Inter-Library Loans (ILL), etc. So, ' **SUPPORT**' is one of the most important and considerable behavioural approaches of the library in the present age. Any voluntary or need-based services offered by the library for scholarly and research endeavours to the institution's research enhancement are considered “SUPPORT,” or the assistance provided by the library to scholars and faculty is taken

into account as "**SUPPORT**" in this study. In essence, the research areas are where the assistance is found. Students who need assistance with research proposal writing, literature reviews, research data management, plagiarism testing, academic publications, funding assistance, data analysis, report writing, etc., can turn to the library for guidance. Therefore, "**SUPPORT**" refers to the assistance that scholars receive from their particular libraries in the aforementioned areas to enhance the quality of their projects and ensure their successful completion.

Support is the service being offered, even practically, by the LIS professional to help the researcher complete their research work. This involves starting from a literature search to reference management in research activities. In European (EU) countries, research support services are well-developed and functional in libraries to support the research performance of the research community. It is a need and challenge for library professionals to adopt effective and innovative support in their institution to become research supporters and research partners. LIS professionals' support depends on their competence in providing research-related services to scholars and faculty members as they complete their projects. The support may include online or offline help for the scholars.

1.4.5. SERVICE

A '**SERVICE**' is an act or performance that meets users' needs, often intangible and designed to provide value or support. Services are distinct activities that meet customer needs or desires by providing intangible benefits, either on their own or as a crucial component of a tangible product. According to William Stanton, "Services are those independently identifiable, essentially intangible activities that, when marketed to consumers and/or industrial users, provide want satisfaction and are not necessarily connected to the sale of something else" (Shoba, n.d.). Similarly, the American Marketing Association defines service as "Activities, benefits or satisfaction offered for sale or provided in connection with the sale of goods" (Garmaz, 2017; Veyrat, 2017). In this context, a research "**SERVICE**" refers to materials, instruments, and advice that support the research process. This covers reference help, instruction in research methods, data management support, database and scholarly journal access,

and more. As major repositories of academic knowledge, libraries are essential to providing research services. They provide crucial resources like books, e-resources, and archival materials, which are critical for academic research.

Furthermore, libraries offer specialized services such as research consultation, citation management classes, and recommendations for effective literature searching. Through these services, the quality and validity of academic work are improved by making the research process easier and ensuring scholars are drawing on comprehensive and accurate information. Thus, libraries are key enablers in supporting the research ecosystem. Hence, libraries voluntarily support the research community in the research acceleration process.

1.4.6. TECHNICAL INSTITUTIONS

Educational institutions (EIs) are categorized based on their level and specialization. At the level, EIs are considered to be schools, colleges, and universities. Based on specialization, they are Social Science, Medical, Agricultural, Technical, etc. The present study is an exploratory study of technical institutions (TIs). A technical institution provides specialized engineering, technology, applied sciences, and vocational training education. These programs emphasize practical skills and real-world applications, preparing students for professional careers. Degrees typically include B.Tech, M.Tech, M.Sc., and PhD in computer science, electronics, civil and mechanical engineering, IT, and business. Those institutions offering education on the above subject clusters are considered in the thesis as ‘**TECHNICAL INSTITUTION**’.

1.5. SIGNIFICANCE OF THE STUDY

A nation's future development and progress depend on its new strategic innovation. Innovation is the consequence of the dedicated efforts of research stakeholders. Sustainable practice is achieved by applying surveys, experiments, and case studies to the phenomenon. However, research activities in the present scenario have undergone tremendous changes. Information and Communication Technology (ICT) has occupied the customary practice of resource collection, storage, maintenance, analysis,

and dissemination of information. Copyright issues are also condemned more severely than previously. Most novice researchers lack pre-existing knowledge of these emerging research-oriented technological skills to complete a project.

A researcher must systematically investigate for new knowledge when conducting research, which is a stressful and challenging procedure. The scientific approach collects data by closely monitoring and contrasting numerous digital and physical sources. Scholars annotate the materials precisely with threats to ensure that background information can be correctly attributed to give credit to the original authors. Good data management can be complex, but it is likely problematic if we do not plan for and remember to record and manage our data as we complete all activities associated with the research project. Occasionally, research becomes incomplete due to missing data or overlooked references, which creates gaps in the overall scholarship. When this occurs, researchers often face the challenge of spending additional time retrieving data from earlier stages of their project. Such repetitions can ultimately lead to delays, heightened stress, and unnecessary expenditure of time and effort. Loss or misplacement of the data may significantly affect the quality and reliability of the end research outcome, and appropriate data management is therefore crucial to avoid this situation.

One of the primary responsibilities of researchers is gathering information for a literature review. It takes more than just noticing or quantifying a few data points to determine the research gap in a given topic; a thorough analysis of existing literature is crucial. A significant amount of information is required to identify the research gap and complete research-related duties correctly. Several collections primarily hosted in institutional libraries, often based on printed materials such as books, magazines, and journals, offer valuable resources to researchers. Nevertheless, in the case of some physical collections, their data may be limited for answering a study question optimally.

In contrast, online databases and journals present a wider range of data, valuable for more advanced research. They allow researchers to access more relevant material and perform a comprehensive literature review. This comprehensive approach to data

capture enables the scholar to establish gaps in the research and develop a powerful thesis. Discovering reliable content and conducting good research involves using digital and physical resources.

Without research, ideas, and support, the researcher may lead to the worst consequences. Hence, in the research process, help and support are needed for the new researcher and faculty members to find various sources of information to analyse and discover the existing gap. Support is required to select the best updated, authentic sources of journals, magazines, databases, reference management tools, plagiarism testing software, authentic sources for publication, etc.

This research problem aims to profoundly investigate the active and effective area of research support services (services, tools, software, and skills) and determine LIS professionals' and researcher communities' awareness and competency in handling and utilizing these services.

The study's consequences will help emerging scholars familiarize themselves with various research support services that require awareness and competence. It will also help LIS professionals design and adopt more effective service methods to maximize the institution's output in the dynamic research environment.

1.6. SCOPE OF THE STUDY

Realizing the importance of science and technological education, which continuously improves the quality of “living standards by producing trained and experienced manpower” (Khayal, 2019), scholars have undertaken this project to understand research support services in technical institutions of Odisha. One hundred fifty technical institutions are functional in Odisha, according to a report from the website of the Biju Patnaik University of Technology, Odisha (BPUT, n.d.) on Date. 02.03.2023. However, to logically consider the number of institutions, the NIRF ranking is taken for the study. Hence, the present study covers only technical institutions of Odisha that rank under 200 in the engineering category as per the NIRF ranking 2022. As per the ranking report, seven geographically distributed technical institutions of Odisha are within the ranking, as stated in Table 1.

In these institutions, students are enrolled in different subjects for UG, BTech, and MTech, so taking all the students into the research project is impossible. Though it relates to research support service, the population group, including research scholars and faculty, is best suited. So, the population group for the study is limited to only faculty members and PhD scholars who are pursuing their research work and engaged in research publication, and not to other students of the selected technical institutions. Additionally, the study focuses solely on extending the libraries' Research Support Services of these selected institutions. It does not cover any other library service for the objectives analysis.

Table 1: Top-Ranking Technical Institutions of Odisha

Sl.No.	Name of Institution	Year of Establishment	Nature of Institution	NIRF Ranking 2022
01	National Institute of Technology (NIT), Rourkela	1962	Public	15
02	Siksha 'O' Anusandhan (SOA), Bhubaneswar	1996	Private	27
03	Indian Institute of Technology (IIT), Bhubaneswar	2008	Public	36
04	Kalinga Institute of Industrial Technology (KIIT), Bhubaneswar	1997	Private	42
05	C.V. Raman Global University, Bhubaneswar	1997	Private	98
06	Veer Surendra Sai University of Technology (VSSUT), Burla	1956	Public	111
07	Silicon Institute of Technology (SIT), Bhubaneswar	2001	Private	161

(Source: NIRF Website)

1.7. REVIEW OF LITERATURE

The literature review is one of the important criteria in a scholar's research journey. The literature review helps formulate and analyse existing research problems on the intended topic. It provides a complete and concrete idea, overview, summary, and critical evaluation to find out the research gap and proceed to the next step of the investigation.

A systematic literature review is undertaken to understand the broader application of RSS and its implications for the theme. The complete literature review part is distributed into four broad areas by the scholars and presented accordingly. These four areas are taken into consideration as a) concept and evolution of research support services, b) role of libraries and information centres in research support, c) research support services in technical and higher education institutions, and d) assessment and impact of research support services.

1.7.1. CONCEPT AND EVOLUTION OF RESEARCH SUPPORT SERVICES

Njagi and Njoroge (2025) found overwhelming librarian support (96.77%) for repository architecture over Blackboard for research data management. While Blackboard lacked RDM suitability, repositories offered structured metadata, version control, and interoperability, making them the preferred, scalable model in academic library environments.

In order to track the evolution of data management positions in academic libraries, Yuan et al. (2025) used topic modelling on 803 job postings. The results show how libraries have strategically adapted to the open science era by shifting from metadata-focused duties to integrated, system-driven responsibilities.

Ranganadham (2024) surveyed SVU research scholars, revealing high awareness and use of library research support services, especially publishing and plagiarism tools. However, gaps remain in training and outreach, with many facing barriers like language and limited awareness.

To map global trends in information literacy and research support, Ali et al. (2023) used bibliometric analysis of 4,079 Web of Science documents. Their results highlight

a growing scholarly interest, with the University of Illinois and the United States making the most significant contributions.

Aslam (2018) explores through his study the evolving trends impacting academic libraries and the leadership skills required to meet emerging challenges. Through reflective analysis, the study identifies that library leaders must cultivate competencies in collaboration, communication, digital transformation, and change management. The paper highlights the importance of leadership development programs, emotional intelligence, and strategic planning to navigate technological shifts, user expectations, and institutional change, positioning future-ready leadership as essential for sustaining effective academic library services.

Cox et al. (2017) conducted an international survey to assess research data service maturity in academic libraries. Findings revealed strong library leadership in advocacy and training, yet technical RDM services remained underdeveloped, with skills gaps, funding constraints, and organizational limitations persisting globally.

Atkinson (2016), in his article "Academic Libraries and Research Support: An Overview," suggested that the various kinds of research support services that academic libraries specifically need to be extended to their research scholar. He elaborates on a different set of active and potential services of the library, such as idea development, seeking funding, proposal writing, conducting research, dissemination, and publication in the research cycle of the researcher.

Kennan et al. (2014) in their research article entitled "Making Space in Practice and Education: research support service in academic libraries" found that the majority of libraries in Australia, New Zealand, the UK, and Ireland are extending user services in key areas such as bibliometrics and data management. Nonetheless, there is a demand for grant writing assistance, journal publishing platforms, and research support. This research report identified staff skills, knowledge, confidence gaps, and resource concerns as constraints.

In order to evaluate librarians' preparedness, attitudes, and involvement in research data services (RDS), Tenopir et al. (2012) carried out a comprehensive survey across academic libraries in the United States and Canada. According to the study, only a

small percentage of librarians had RDS as a fundamental component of their work, despite the majority acknowledging its importance to the institutional research effect. Lack of time, inadequate training, and poor administrative prioritizing were among the obstacles noted.

Cugliandolo (2007) presents a theoretical framework explaining dynamic fluctuations in glassy systems using time-reparameterization invariance. Through analytical modelling and numerical simulations, the study identifies fluctuation mechanisms relevant to nonequilibrium states, advancing understanding of disordered systems' aging and response behaviours.

1.7.2. ROLE OF LIBRARIES AND INFORMATION CENTERS IN RESEARCH SUPPORT

Alfaro Jimenez et al. (2024) reveal that university libraries' research roles are evolving but fragmented. Their study offers a thematic and temporal framework, recommending broader, diverse sampling and the adoption of quantitative or mixed methods to enhance future investigations.

Toane and Shujah (2024) conducted a repeated cross-sectional, mixed-methods survey at the University of Toronto to study the changing research needs of campus entrepreneurs. Results indicated elevated library use over five years, with users appreciating secondary market research but complaining about information overload and access restrictions. The study indicates the importance of customized, scalable research services and assistance with critical literacies, situating academic libraries as essential collaborators in entrepreneurial environments and applied research.

Sutar (2024) applies descriptive analysis of India's NEP 2020 to reveal the role of libraries as agents of transformation in making it a reality. The research shows how libraries make higher education inclusive, interdisciplinary, and accessible through digital access enablement, research assistance, value-based learning, and institutional accreditation. Drawing attention to the development of infrastructure, translation and interpretation services, and student outreach, the article establishes libraries as prime facilitators of change in

education, in accordance with national policy to promote holistic development and international academic competition.

African academic libraries were examined by Leonard et al. (2023) to study the extent of librarians' integration into research processes. Findings revealed varied levels of embedment, with most librarians involved in traditional support roles but lacking competencies in areas like research data management and systematic reviews. They listed the need for reskilling, institutional support, and formal structures to enhance embedded librarianship, reinforcing librarians' value in the evolving research landscape of higher education.

Anandkar (2022) provides a thorough summary of the changing role that academic libraries play in assisting with research. The study describes a wide range of services through descriptive analysis, including digitization, plagiarism checks, institutional repositories, bibliographic tools, and reference management. Academic libraries are becoming knowledge centres, according to the paper, which emphasizes proactive training, resource access, and digital integration. In order to match services with the changing research demands of higher education institutions, it promotes libraries to take on the role of consultants.

Fazal and Chakravarty (2021) sought in their research paper "Library as a Research Support System for AHSS Doctoral Students: Impact of Marital Status and Gender on Researchers" recommended the active initiative of libraries in supporting researcher's different kinds of issues such as excess workload, anxiety, piled work, stress, depression, sleeplessness, lack of family support, work-life balance, etc.

The function of institutional repositories (IRs) in facilitating scholarly research via digital transformation is examined by Grammenis and Mourikis (2020). They emphasize the roles that IRs play in maintaining research production, improving accessibility, and raising academic exposure through the use of interpretative techniques and librarian interviews. The study underscores IRs' organizational value, user benefits, and the evolving technical and soft skills librarians must acquire. IRs are positioned as strategic digital assets enabling open access, research dissemination, and institutional reputation in the digital age.

Igbinovia (2017) employed a survey in investigating Nigerian librarians' participation in cross-disciplinary research and its contribution to the attainment of UN Sustainable Development Goals (SDGs). The findings indicated that librarians have extensive knowledge of research processes but are primarily involved in LIS-related activities. The research calls for increased participation by librarians in interdisciplinary teams to maximize their contribution to society, emphasizing the importance of funding research, ICT competencies, and policy backing to advance their position in sustainable development activities.

Vitale (2016) highlights how libraries' role in promoting research reproducibility through better data management is constantly changing. Libraries must implement best practices, improve workflows, and provide staff with specialized training to support reproducible, transparent, and morally sound research processes, in line with funding agency demands for transparency.

Johnson et al. (2012) describe how Minnesota's Health Sciences Libraries responded to emerging e-science demands by building staff competencies, infrastructure, and partnerships. Their phased approach illustrates how academic libraries can evolve into active collaborators in data-intensive research, particularly within health sciences, through proactive service development and institutional alignment.

Librarians have taken on new roles since the development of interdisciplinary research, as explored by Knapp (2012). The study identified problems, including siloed disciplines, restricted access, and insufficient collaboration. It argues that librarians can overcome these obstacles through embedded services, knowledge commons, and other specialized forms of teaching. This study adopts an adaptable focus and portrays librarians in the role of facilitators and meta-scholars, who are crucial in providing aid for multi-dimensional academic research in a complex, evolving context.

1.7.3. RESEARCH SUPPORT SERVICES IN TECHNICAL AND HIGHER EDUCATION INSTITUTIONS

Chigwada and Ngulube (2024) conducted a literature-based study to identify challenges and success factors for implementing RDM services in African universities. Findings reveal policy gaps, skills shortages, and infrastructural constraints, leading to a framework tailored for resource-limited higher education contexts.

Due to limited research data management (RDM) infrastructure in North Macedonian universities, Limani et al. (2023) found that researchers rely heavily on personal storage and informal sharing methods. Consequently, they recommend institutional repositories with tailored features to support RDM and lifecycle needs.

Santharooban (2022), in the article "Research Support Service Model of Academic Library: Case Study at Eastern University, Sri Lanka," examines the research support service model of Eastern University's library, with a focus on the introduction of a personalized research consultant service for RSS to individuals or groups of people who need help. There are other difficulties for RSS, like the absence of adequate market policy, inadequate human resources and physical facilities, and a lack of competence and capacity among library professionals.

Vila et al. (2021). "Library Research Support Service: The Universitat Politècnica de Catalunya-BarcelonaTech Case" points out the characteristics of the UPC, and how its library, publications, and archives are distinct from typical libraries and have evolved through time to provide research consumers with options that meet their present and potential future needs.

Codina-Vila et al. (2021) present a case study of UPC libraries, highlighting their strategic, personalized, and technology-driven research support services. Findings emphasize the integration of open access, bibliometric tools, and embedded librarianship to enhance institutional research outcomes and visibility.

Huang et al. (2021) explored RDM policies and services in Chinese university libraries through website analysis, surveys, and interviews. Findings showed RDM practices remain underdeveloped, with minimal policy implementation and low service

maturity. Barriers included a lack of librarian skills, limited institutional support, and a weak cultural emphasis on openness, while researchers' needs and national mandates were identified as key potential drivers.

Borrego, and Anglada (2018) "Research Support Services in Spanish Academic Libraries: An Analysis of Their Strategic Plans and an Opinion Survey Administered to Their Directors" analyzes the evolution and current provision of research support services in Spanish academic libraries and found academic libraries are firmly embedded within universities' research activities, and that most of them depend on vice-rectorates for research or scientific policy.

Alice Keller's (2015) "Research Support in Australian University Libraries: An Outsider View" based on research support, the study provides a summary of the modifications made to libraries' service offerings as well as the altered duties and responsibilities of librarians in the maintenance of institutional repositories, open access facility, support of bibliometric and enhancement of research impact, support for research students and research data management.

Krishna and Singh (2015) conducted a quantitative study using chi-square and correlation tests to evaluate e-resource services at Allahabad University. Results demonstrated significant links between e-resource access, search behaviour, and OPAC usage, emphasizing their positive impact on research scholars' productivity.

Searle, Wolski, Simons, and Richardson (2015) "Librarians as partners in research data service development at Griffith University" highlighted various initiatives undertaken by the Griffith University library in supporting research data management ranging from fostering strong national partnerships, policies, and strategies, Iterative software development, well-supported infrastructure, training program, repositories support, and data planning service.

Rubbia et.al (2014) in their paper entitled "Research support services in Higher Education and Research Institutions: approaches, tools and Trends" highlighted the Italian government's initiative to acknowledge the research support required for the researcher. Various funding agencies are involved in promoting and internationalizing Italian research projects. In his study, he listed the Italian government. Funding

agencies that are keenly interested in providing financial support to boost the researcher's creativity. The initiative of the government in setting up the government office to assist individuals and institutions concerned in obtaining various research funding through the externally sponsored program.

Andrade and Kollen's (2012) article titled "Using Needs Assessment to Develop Research and Grant Support Service" suggested a Research Support Services Team constitution at the University of Arizona Libraries, bearing a project sponsor, project manager, project member, and stakeholders for an effective.

1.7.4. ASSESSMENT AND IMPACT OF RESEARCH SUPPORT SERVICES

In order to identify new leaders and institutional practices that support research data management (RDM) in Kenya, Nakitare (2024) carries out a scoping review. The results show that early cultural changes toward better data sharing, reuse, and transparency are crucial for raising the calibre of research in developing contexts.

Gupta (2023) examines the application of Citation Gecko, a citation-based discovery tool, in enhancing library research support services and entrepreneurial activities. The paper highlights how the tool facilitates systematic reviews, reference generation, and forward/backward snowballing, thus aiding librarians in offering efficient, targeted support. The study suggests that integrating such technologies empowers libraries to better assist researchers and entrepreneurs with up-to-date, context-specific resources in rapidly evolving academic and market environments.

Ashiq et al. (2022) conducted a systematic literature review of 19 studies to examine research data management (RDM) practices, challenges, and services from 2016 to 2020. Findings revealed low RDM adoption, especially in developing countries, due to infrastructural, skill-based, and policy-related challenges. The study emphasized the need for institutional support, librarian training, and collaborative efforts to improve RDM services and align them with researchers' evolving needs.

Lakra and Verma (2021) found high awareness and frequent use of library e-resources among CSIR-CDRI researchers. Though users were largely satisfied, issues like slow

internet and difficulty locating information persisted, highlighting the need for training and service improvements.

Pradhan and Naidu (2021), in their article "Research Support Service in Academic Libraries," found the effectiveness of Indian library web pages in providing research support services through institutional repositories along with subscriptions to research databases. They have also found the subscription rate of research databases where Web of Science is most widely subscribed to by HEI, followed by Scopus, MathSciNet, and SciFinder, respectively.

Si, Zeng, Guo, and Zhuang (2019) investigated 79 world's top academic library websites and elaborated in the article "Investigation and analysis of research support services in academic libraries", where 76 are dedicated to promoting research support services however their libraries set up for the purpose are not similar by name and types and level of resource organization.

Raju, Raju, and Johnson (2016), in their article entitled "Research Support Services in South African Academic Libraries," highlighted research support services in South Africa regarding Open Access (OA). The survey focused on OA content restriction and the effectiveness of the institutional repositories of libraries where research articles are uploaded, abiding by the terms and conditions of Gold Open Access.

After studying the relevant literature on the proposed research problem, it was found that no research has been undertaken on the proposed work. It is a unique and original topic in nature. Therefore, the researcher is motivated to fill the gap while undertaking this research.

1.8. RESEARCH GAP

Numerous studies have been conducted on research support services by various eminent scholars worldwide. They have received encouragement from their educational institutions to analyse and evaluate the importance and necessity of expanding research support services for scholars to achieve quality research outcomes and maintain the right/authority of innovation.

After scanning the exhaustive available literature on the said research problem, it is found that no research has been undertaken on the status of research support services of libraries in technical institutions of Odisha and their impact on institutional researchers. This topic is unique, original, and necessary for research scholars and faculty members of higher educational institutions. Therefore, it has encouraged the scholars to fill the gap.

1.9. RESEARCH DESIGN

1.9.1. STATEMENT OF THE PROBLEM

It is imperative that the institution and its research scholars and faculty members keep abreast of the rapidly changing educational environment. Policy, curriculum, syllabus, resources, technology, research, etc. At this time, many progressive changes have been seen in the field of research. Educational institutions are ranked based on their performance in research activities. The simplicity of pre-licensing is no longer observed. Pre-licensing agencies take the transparency, honesty, and structure of any investigation very seriously. Open access, digitization, an institutional repository (Web services), Mendeley, Zotero, Endnote (Reference management tools), Turnitin, iThenticate, etc. (Plagiarism checking S/w), SPSS, Stata, R (Data analysis tools), APA, MLA, Chicago, etc. (Referencing style) are playing crucial role in cutting-edge research.

All these new changes and emerging concepts are not part of the existing knowledge of the new researchers who intend to carry out a project and are not familiar with the latest ideas for faculty. The researcher develops a great, enthusiastic approach to pursue their research project for professional advancement. They would not have the idea of an ethical issue, reference management, or sources of information, i.e., databases, journals, library resources, and other online sources helpful for their proposed research project. In that circumstance, the institution's concern and library play pioneering roles for research scholars.

Most students choose technical courses after finishing their formal education. Technology has become an integral part of their academic careers. They start to work as researchers, inventors, and build flourishing careers. Nevertheless, bad guidance

and support could seduce them into making their goals vanish. Hence, they have to know about the latest and updated advances in research. Advanced research in technological institutions is beneficial in strengthening and enabling the country in the technology field. Therefore, the role of their institution's libraries in research collaboration with technological institutions is vital.

The library of engineering institutions is highly resourceful in meeting the all-around educational demands of the students arising from time to time. Print, electronic, and digital resources are provided to serve the academic requirements of the library's students and faculty. However, the library's research support service is much anticipated. The library cannot be marginalized in boosting the institution's impact factor and strong prestige. Hence, the initiatives of the library and competencies of LIS professionals in extending research support services are needed by institutions to improve academic performance. All these features promoted and motivated the scholar to take up this research problem.

1.9.2. OBJECTIVES OF THE STUDY

The proposed study is conducted with the following objectives:

1. Evaluate the effectiveness of the research support service on the academic performance of the researcher in selected technological institutions of Odisha.
2. Assess the satisfaction of the researcher regarding various research support services.
3. Find out the competencies of library professionals in providing research support services.
4. List out the outreach and promotional endeavors of libraries for the research support service.
5. Find out various challenges and problems faced by library professionals for the implementation of research support services.
6. Design a model of a quality research support system for research scholars.

1.9.3. HYPOTHESES OF THE STUDY

A hypothesis is a shrewd guess intended to explain certain facts or observations on

the topic of study. For the present study, the following hypotheses are proposed to be tested.

H1- There is no significant difference in extending research support services to the students in public and private technical institutions' libraries.

H2- There is no significant difference in resource subscription for research support services in public and private engineering institutions.

H3- There is no significant difference in research support competencies of LIS professionals in public and private institutions.

1.10. RESEARCH METHODOLOGY

A method is a planned process for achieving a specific objective (Wikipedia, 2022), and “Methodology is the philosophical framework within which the research is conducted or the foundation upon which the research is based” (Brown, 2006). It is on the researcher's part to adopt suitable techniques and tools to help carry out the research work and find the best answer to the research problem formulated at the beginning.

1.10.1. SAMPLING SIZE AND TECHNIQUES

For obvious reasons, collecting data on the entire population is impossible. In survey research, a representative sample is crucial, which is why population sampling is carried out. A sample is a group of respondents selected to represent the entire population as accurately as possible. A suitable sample establishes the reliability of the data and survey. The precision and rigor of the process are ensured by two metrics that guide the selection of the population size. They are Confidence Intervals (Margin of errors) and Confidence level.

To determine the appropriate sample size that will help the scholars achieve the most satisfactory result, the most popular technique called “Solvin’s Sampling Technique” was applied to this study to select the exact sample size. Solvin's as: $n = N / (1 + (Ne^2))$

Table 2: Execution of Sample Size

$n=7200/(1+(7200*0.05^2))$	n= Sample Size
$n=7200/(1+7200*0.0025)$	
$n=7200/(1+18.1575)$	N= Sample Population
$n=7200/19.1575$	
$n=378.9$	e= Margin of error
$n=379$ (Approx.)	

The current research problem involves seven (07) technical institutions in the state of Odisha by using a straightforward random sampling technique with respondents pursuing Ph.D. and faculty members in the various departments of the educational institutions covered under the study. The sample size of the population for data collection is 27 Ph.D. students and 27 faculty members. In total, 54 respondents were covered from each of these institutions. Along with this, the researcher purposefully took one librarian from each institution. The total sample size for data collection is limited to 379 plus 7 librarians.

1.10.2. DATA COLLECTION TECHNIQUES

To determine the effectiveness of the set objectives, the researcher collects data from the research scholars and faculty members using the following two techniques.

A. QUESTIONNAIRE METHOD

A standardized questionnaire divided into five sections, namely Section A: Personal Information, Section B: Basic Information, Section C: Awareness on Library Research Support Services, Section D: Effectiveness of Research Support Service, and Section E: Researcher Satisfaction, prepared to cover all aspects and distributed among the research scholars and faculty members (27 from each group) of the institutions, covered under the study for data collection. The questionnaire is also circulated through the dedicated email ID of the research scholars and faculty members of the institutions covered under the study to collect data. A separate questionnaire for Librarians was also prepared to collect responses to explore the current status of RSS and professionals' competencies regarding RSS technology.

B. INTERVIEW METHOD

In addition to the questionnaire, Librarians of the concerned TIs (Technical Institutions) personally interacted to gather more information and to find out more about their recommendations on how research support services affect teaching-learning, academic and professional growth of faculty, and help Ph.D. students in systematic completion of their research projects.

1.10.3. DATA ANALYSIS AND INTERPRETATION

In order to answer the research questions and accomplish the study's goals, the analysis plan offers insights into the best way to summarize and analyse the vast amount of data that was gathered (Ramachandran, 1993). The data was analysed using SPSS (Statistical Package for Social Sciences) and Jamovi (A tool for data analysis). The data have been subjected to both descriptive and inferential statistical analyses. Descriptive statistics for researchers and faculty are conducted in SPSS, whereas Jamovi is used for librarians' responses to describe and summarize data sets. In contrast, inferential statistics are conducted manually through MS Excel to test the hypotheses and generalize from a sample to the entire population (Foster, 2001). Tables, charts, and diagrams have accompanied these statistical analyses to make the research more straightforward, unique, inventive, and scientific.

1.11. BIBLIOGRAPHICAL CITATION STYLES

Citations are a reference and recognition of the sources used during the research process. It specifies the source's location and clarifies the source's debt. Any research should include references to the sources that were consulted. Thus, it is important to make a correct reference and cite all references. The references, in-text citations, and bibliography are arranged according to the American Psychological Association (APA) Style 7th edition for this study.

1.12. CHAPTERISATION

The total project is organized into five chapters to distinguish the phases and optimize the current investigation process. The following are the chapters and their title:

Chapter 1 describes the researcher's research design for the successful completion of the study. It sets out the key components of the research and serves as a scheme for the whole research process. This chapter succinctly discusses the problem statement, the purposes, and the reasons for the sample choice. It also lays a comprehensive basis for the investigation by discussing the data collection and analysis methods.

Chapter 2 provided the theoretical background to research support services, its components, enabling technologies, the issues and opportunities, and the library's role in the delivery of RSS.

Details of Odisha technical institutions selected for the study are given in **Chapter 3**. It also focuses on the libraries of the chosen institutions and their materials and services.'

In Chapter 4, the analysis and presentation of research in various dimensions in the direction of research objectives, based on data from the institutions, are depicted.

Chapter 5 emphasizes the researcher's findings and likely recommendations for enhancing RSS, followed by a conclusion.

1.13. CONCLUSION

Enhancement of research expertise has been a dramatic issue in academic settings. Colleges are assigned numerous research projects that require a great deal of intellectual input from young researchers. Nonetheless, participants' lack of research skills and subject knowledge may have negative impacts and diminish the effectiveness of the projects.

On the flip side, engagement in research projects offers the opportunity for excellent career advancement and a better understanding of the research and subject-specific fields. Research activities are taking readers help from fast-emerging technology-driven services, which help them to do research efficiently from a time-saving perspective.

In the context of research, institute libraries play a vital role in strengthening the academic and research endeavours of scholars. Their responsibilities go beyond simply providing reading materials; they assist in information discovery, ensure access to quality scholarly resources, and guide researchers in effectively utilizing these resources for their work. With the growing complexity of research, many libraries are shifting from traditional service models to contemporary, research-driven approaches such as offering data management, research consultation, and digital scholarship services, thereby establishing themselves as essential partners in the university research ecosystem.

Hence, librarians and researchers should be aware of Research Support Services (RSS) and its components. Building on this basis, Chapter 2, Research Support System and Services: Conceptual Framework, provides a better understanding of the theoretical perspective of RSS.

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CHAPTER-2

RESEARCH SUPPORT SYSTEM AND SERVICES: CONCEPTUAL FRAMEWORK

2.1. INTRODUCTION

Traditional references in an academic library often focus on the research needs of students and faculty (Kott, 2015). The library's primary role was to provide the right resources and services to the users to find the appropriate collection kept in the library. Librarians there possess the prerequisite qualifications and skills to arrange these resources (acquisition, classification, cataloguing, indexing, abstracting, stock rectification) to track the collections and meet every user's requirement. Along with cataloguing and classification, different kinds of extension services are also provided, such as reference services, referral services, selective dissemination of information (SDI), current awareness services (CAS), and reprographics services (RS). Hence, the faculties and researchers fulfil their educational needs. Magazines, journals, and newspapers are add-ons to books and reference books, subscribed physically and online to help the research process and teaching-learning. Exceptional cases Inter Library Loan (ILL) are also supported.

The requirement of such services extended by the library is basically to meet educational needs and provide assistance in generating new knowledge. However, S. Santharooban believes that traditional library services do not impact readers as the user demands: “service at the fingertips in digital format” (Santharooban, 2022) at the pick of library service. To scholarly understanding, traditional library services still exist innovatively, and this is also true of the effectiveness of electronic media for advanced education systems. To summarise, a library of any kind is supposed to be equipped physically and electronically for the educational acceleration of faculty and students. The development of information and communication technologies (ICT) in the twenty-first century (Kusuma & Suwartono, 2021) has made more resources digitally available, and new-generation readers prefer online resources as their first preference, pushing libraries to acquire physical and digital resources simultaneously.

Intellectual progress is crucial in an institution, especially for students and teachers. This consequence also gives an institution a good academic ranking. Along with infrastructure, teaching, and facilities, the number and quality of publications in different impactful journals give an institution an attractive national and international ranking in different academic criteria. As a result, organizations are eager to add top-notch research to their publications. Stakeholders mainly depend on libraries to provide factual evidence for their surveys in an environment with a significant quantity and quality of output demand. Over time, libraries have developed from general repositories to research-focused establishments that support the creation of high-calibre publications while offering their patrons resources and services.

(Vaughan and Atkinson, 2013) stated, “Traditionally, library support for research has often been restricted to the provision of library collections and support in finding and managing information, in support of the ‘Ideas development’ and ‘conducting the research’ stages in the research lifecycle.” (Martín, 2023) states that Research 2.0 depends not only on researchers' efforts but also on supporting services provided by academic libraries.

Regular assessment and study are necessary for a system or society to function more effectively and fulfill its objectives. Researchers and analysts must review the current system and propose a new one. Any successful idea or procedure demonstrates how deeply the system understands the problems and potential solutions. It may be a long-range process for which the reviewer or researcher requires possible support in finance, human resources, system information, technology support, etc. The prompt in conducting research highly affects any country's economy and social status. To improve the quality of research output, most nations are trying to impose different Acts and guidelines, especially the European nations' funding program “Framework Programmes for Research and Technological Development-2014” (the funding programs were named Horizon) (Giuliana, 2014), which is notable and exemplary for the other countries.

The research culture and its procedures are changing with the recent advancement of new technologies. The Web-based research platforms are anticipated to be crucial in

assisting with research efforts (Yao, 2006). In the present situation, higher educational institutions are many and varied (Webb, 2007) and remain under the influence of technology. Web technology, which significantly impacts library collections, services, and housekeeping operations, is applied in every system library. Web tools are becoming a methodology in educational institutions for imparting quality education, which helps stakeholders achieve their goals. The application of digital libraries, blogging, social media platforms, online bulletin boards, content management, instant messaging, online databases, and advanced web searching tools is becoming tremendously beneficial for institutional faculties, research scholars, and students. To clarify the research support system in general, this chapter broadly presents the definition, concept, components, tools, library initiative, and best practices worldwide in detail.

2.2. OVERVIEW OF RESEARCH SUPPORT SYSTEM

The Research is not new to society, so the research support is. Supporting research originated in the United States of America (USA). It shifted the practice to Britain after experiencing the large-scale management of Research projects during the Second World War (Bushaway, 2003). National and international-level Research institutions could have been developed with government assistance and support for their establishment. Exemplary institutions like NASA, ISRO, DRDO, International Pharma Ceutical Companies (IPCC), and the Aerospace industry are the outcome of Research support. Medical research institutes in India also provide ample opportunities for research and building better healthcare facilities for people. These Research Institutes work toward a single disease and try to find a long-term solution via applied and operational field Research (Unacademy, 2022). On the other hand, Research has observed that Research performance can only be measured by the most recent study findings because Research constantly evolves. Researchers and academic institutions should be clear that Research needs to be developed as an ongoing process evaluated against new difficulties and stated goals that need to be established, examined, renewed, and resourced over a specific time frame.

(Padhan and Naidu, 2022) Research is the basis for economic and social development in the country. The economy and society are inextricably linked. It cannot be doubted that the omission of one would render the patronage of the other worthless. In this context, while society strives to improve the economy, economics takes a long-term, balanced, organized, and continuous approach to society. According to Rubbia and others, the global economy has been affected by prominent changes in research and innovation (Rubbia, 2014). The country lagging in strengthening its economy and social status is investing more than ever in research and innovation in educational institutions. There has been a significant paradigm shift in how research has been conducted over the past two decades, in both quality and quantity. It is possible to make assumptions about rising researcher habits, financial assistance from national and international organizations, marketing efforts by higher education institutions, and professional advancement. Completely changing to a different research culture after a decade of habituation could make it difficult to finish any project.

Santharooban, Library, Faculty of Health-Care Sciences, Eastern University, Sri Lanka, has defined research support services as one of the “innovative services of the library to support the research endeavour of any educational institution meticulously” (Santharooban, 2022). The library should substantially support the research process as an academic institution within the higher education system. The library of any institution receives substantial assistance and support from the administration for services being provided for research activities, beyond the traditional pattern of services. Keeping this in view, the library must prioritize research support services today and emphasize related areas. Especially under the Research Support Service (RSS), the library has to highlight the area chosen by the educationists across the country; such services include frequent access to Library Resources, formulation of research problems, writing research proposals, assistance for literature review, data management, awareness on research tools, ethical and regulatory guidance, technical support and infrastructure, bibliographic record, data analysis, report writing, etc. these area are generally can be considered as significant components of RSS.

2.3. CONCEPT AND DEFINITION OF RESEARCH SUPPORT SERVICES

“Research support services are a relatively new area in which different competencies are associated” (Rubbia, 2014). The creative and meticulous work performed during experimental research and development (R&D) aims to broaden the existing reservoir of knowledge (University of Queensland, n.d). The last two decades have been recognized as the age of comprehensive intellectual development in technology, education, agriculture, medical science, societal culture, and tradition. All this is possible because of the involvement of young students and the promotion of government and educational institutions towards research activities. Successful research output is possible with constant help and support from young intellectuals for their study. Dr. Sanjaya Kataria says, “Due to the change of technology, forms, and format of resource acquisition and dissemination practice, RSS has been initiated to improve library services” (Librarian Guide, 2021). As part of the research, the process, new methods, and practices have also been pressed to think of services beyond the existing ones. Competency and skill indeed play a crucial role in practical results. Adequate research is regarded upon its fruitful implementation in society rather than merely obtaining a higher educational qualification. Hence, to prove that high intellect benefits society, they needed regular support for their research involvement.

What does it mean to Research Support (RS)? What is the important assignment included in the term? The term RS indicates the administration of research.

Generally, RS included:

- Costing, pricing, financial administration, and research grant and contract.
- Authorization of research grant and contract applications, proposals, and tenders.
- Administering the human resource function.
- Academic Administration
- Estate Issues
- Laboratory accommodation
- Equipment and facility
- Academic Administration

- Legal Issues (Bushaway, 2024)

Research support services are defined as assisting the researcher in many aspects of the research process. Support and assistance are mostly related to the institution's library, where LIS professionals have devoted their time to providing reference services for various offline and online materials. Assistance was provided with developing research proposals, managing data from studies, publishing, managing bibliographies, obtaining financing, conducting data analysis, etc. The libraries of the majority of higher education institutions are now outfitted with cutting-edge technology and highly qualified staff members who can support their essential institutional services. Thus, assistance or support might be summed up as facilitating the ideal study outcome. Depending on the necessity and advancement of the research practice they encountered, numerous researchers and authors have expanded the notion of research assistance from their point of view.

As per the Law Insider, a contract database and resource centre, “Research Support means that compensation allocated to and identified with defined research and development efforts aimed at advancing Licensed Product(s) towards commercialization” (Law Insider, n.d.).

Kari-Mette Walmann Hidle of NLA University College says, “Research support is regarded as library services that could increase research efficiency” (Hidle, 2014).

Blessing Chiparausha (Bindura University of Science Education, Zimbabwe) and Onias Topodzi (Bindura University of Science Education, Zimbabwe) state that “Help given to researchers during the research process” is called Research support (Chiparausha, 2020).

“This applies to all forms of grants, cooperative agreements, and research contracts that support research activities (directly or indirectly, including infrastructure and other centralized resources) and for which an individual and/or project has been peer-reviewed.” and “Funding of research activities.” (NCI Thesaurus & NLM, 2023). The RS of Titi Tudorancea Bulletin is according to NCI Thesaurus and NLM Medical Subject Headings.

(Bushaway, 2024) in his book entitled *Managing Research*, he described ‘Research Support’ as

“The tasks of enabling, facilitating and nurturing research, usually from a corporate perspective and, in particular, financial and human resources management, research information management, advice and guidance on research and funding opportunities, networking, coordination of policy and procedures and strategy-setting, as well as supporting the commercialization and exploitation of research results in the form of intellectual property”.

2.4. KEY COMPONENTS OF RESEARCH SUPPORT SERVICES

Libraries offer a variety of value-added services to help streamline the research process and are therefore essential to researchers. Academic support includes access to journals, databases and e-books that are indispensable for data analyses and literature review. To help researchers efficiently arrange citations, libraries also provide reference management software such as EndNote, Zotero, and Mendeley.

To enhance research skills, libraries offer workshops and training on how to use databases, academic writing, and research methodology. Publication assistance services, including journal selection and promotion services, help researchers to efficiently share their findings, while offering a range of publication support services through the publication process, from submission to acceptance.

2.4.1. LIBRARY RESOURCES AND ACCESS

Research support services require access to a wealth of library resources. This includes subscriptions to scholarly journals, databases, and digital and physical libraries. Researchers need access to academic resources for in-depth literature evaluations and collecting pertinent project data. Library resources can be separated here by e-resources and printed collections. It is not to be contradicted that only digital resources and technology are in demand in research. However, print resources are crucial in providing research-related data, even in the digital age. Libraries of any kind have to develop the required physical collection to meet the user's needs. Physical resources include content-based books of renowned authors, including foreign authors, high-

impact journals, magazines, and newspapers for general outlook, fiction and non-fiction for developing language skills and entertainment, etc., keeping the influence of the ICT and users' transformation in mind e-resources including journals, magazines, databases, take a high position in the present-day library.

Facilitating open-source journals and the creation of institutional repositories have to be prioritized. Acquiring and subscribing to massive amounts of physical and electronic resources is not likely to help those in need, but also to make quality resources readily available for the purpose for which the users searched for them. The LIS profession's managerial and technical skills must ensure user recognition and the standard adoption of methods for their arrangement in the library for the earliest access. Online resources must be linked with the dedicated library website with an eye-catching pop-up heading. Resources must be indexed and abstracted for easy understanding of the journal and its contents. As per the DOAJ registration, as of December 2022, the database counted 18,650 open-access journals with 8,265,272 (Doaj, n.d) articles related to social science, medicine, science, and technology. Institutional repository and library digitization are essential in facilitating a single window to the numerous journals for the participants. The practice helps impact the author metric of institutional scholars, such as the i10-index, h-index, g-index, etc.

2.4.1.1. ONLINE DATABASES AND JOURNALS

For researchers, databases and journals are essential resources since they give them access to scholarly information and supporting data that serve as the cornerstone of their work. Scholars are guaranteed access to current and dependable content because of the millions of peer-reviewed books, conference papers, theses, and articles in academic databases like Scopus, PubMed, IEEE Xplore, and ProQuest. However, journals also offer a platform for exchanging original research, promoting scholarly discussion, and deepening our knowledge of specific subjects.

A wide variety of research relies on these facilities. They allow academics to do deep dives into the literature, certain areas that need further exploration, and knowledge that came before. “Specialised databases and publication access help researchers to stay updated on developments in the field and methods as well as on the quality of their

work about their methods,” one reviewer says. The citation and referencing tracking features of databases also allow researchers to see links between work and a sense of how ideas have developed over time, thus promoting cross-disciplinary research.

Of course, the availability of various databases and studies at an early age is important. With subject-specific databases (e.g., MEDLINE for medicine or LexisNexis for law), much of what we need to know about a discipline can be discovered. In contrast, for comprehensive databases (e.g., JSTOR and ScienceDirect), there is less detail but more exhaustive coverage of topics. Open-access journals democratize access to research, removing the barriers of subscription to journal articles and ensuring that inclusivity and knowledge sharing across the globe are possible.

Libraries step in to help researchers gain access to these important materials. Libraries give academics access to expensive journals and databases that might otherwise be out of reach through institutional subscriptions. Libraries often hold conferences and training sessions on subjects like database searching, citation management, and evaluating the credibility of publications to assist scholars in effectively using these resources. Library employees also help researchers find relevant materials and use advanced search tools to guarantee a successful research process.

Hence, databases and journals are essential resources for research academics and entry points to academic success. Scholars may access, use, and add to the world's knowledge base with the help of well-equipped libraries, promoting interdisciplinary study and innovation.

2.4.1.2. INSTITUTIONAL REPOSITORY

With the increasing need for online resources, institutions worldwide are developing institutional repositories (Webb, 2007). The prime motto behind every institutional repository is to enable a digital platform to disseminate electronic information (Kaladhar, 2018). IR is a digital store that houses a collection of electronic resources. Depending upon the organization's specialization, IR is developed as a subject specialization web platform of resources. The majority of repositories follow the Open Archives Initiative (OAI) compatible open access (OA) philosophy (Kennan, 2006). Though digitizing printed documents is not a new concept, it dates back to 1971 with

the project called Project Gutenberg (Shinde, 2008). In the 21st century, the emerging digital library concept is widespread among HEIs libraries. The main objective of the IR (Institutional Repository) is to organize, manage, preserve, and disseminate the institution's knowledge base and intellectual ideas for access and to advance further research endeavours. (Mercieca, 2006) stated that IRs are an alternative form of publication of institutional unpublished research papers/ideas. To express his emotion on IRs, librarian of the National Library of New Zealand, Penny Carnaby, draw the attention of the world that *"Significant amount of our thought, writing and publishing as a nation are now only ever in electronic forms- which is no less precious and no less fragile than its print counterpart- and it would be a real tragedy for this country if it is lost for the want of somewhere to store it"* (Carnaby, 2006).

2.4.1.3. INSTITUTIONAL REPOSITORY AND SCHOLARLY FRATERNITY

In the current IT growth phase, university libraries have expanded the number of institutional repositories (IRs). It is now widely accepted for these university libraries to house information in their repositories. Institutional repositories are essential for presenting research data more effectively. Research data are highly impactful for supplementing and improving the in-depthness of the project. As the research stands, 'RE-SEARCH,' that means what exactly is available to fill the gap within the project selected. For that, thousands of related research and projects have already been undertaken and published in various costly journal publications. So, all the time, these practical and highly cited journals and articles are not always available at the end of the institution or library to subscribe to or access their content.

Furthermore, technological advancements have enabled researchers to access information from scholarly, peer-reviewed journals via the Internet at their desks (Kennan, 2006). The way the information is displayed in university repositories is preferred by the users of these data (Asadi, 2019). Numerous academic institutions intend to use their IRs to offer research data services. Scholarly peer-reviewed periodicals are essential to researchers' and academics' work.

2.4.2. OPEN ACCESS INITIATIVE

Open Access Initiative (OAI) is an international movement (Kamalon, 2022) that provides access to and circulates a wide range of publications freely through an open platform. The concept of giving open permission to every interested scholarly community to access, read, download (Sasi, 2024), use, share, and print for academic purposes within the ethical and legal circumference. The open access initiative is a substitute for the traditional form of subscription, where institutions and scholars have to bear a considerable cost for the subscription to the journals and databases. This initiative allows the scholarly fraternity to create and disseminate their research papers and findings for broader circulation. One of the main characteristics of OAI (Open Access Initiative) is to facilitate the selection for research publication because selecting the right platform to maximize the usage of the research work always plays a crucial role in author recognition. For the promotion of OA, many OA advocates argue that most of the research is funded by the government directly or through agencies, so the funding is publicly funded. Hence, there must be an obligation to make the research output available to the public without restriction (Webb, 2007).

(Nicholas et al., 2005) have experienced progress in the field of OA compared to different countries. They stated in their book that authors from Asia, Africa, Eastern Europe, and South America were about twice as likely to publish in OA journals compared to those based in Australia (McCulloch, 2006), the US, and Western Europe. Interestingly, they also observed that authors from biochemistry, neuroscience, mathematics, and material science possess concrete knowledge of OA compared to authors from the arts and humanities, social sciences, economics, and business.

Several enablers have motivated the development of open-access publishing. These include global movements and initiatives for open access like the Open Archives Initiative, the Budapest Open Access Initiative, Scholarly Publishing and Resources Coalition, and Free Online Scholarship, as well as the initiatives undertaken by ICSU, UNESCO, and CODATA (Rajashekar, 2006).

However, the challenges that remain with scholars in storing and disseminating their long-term research papers are a limited selection of journals, a lack of guidance on

publication policy, and an unacceptable APC (Article Processing Charge). In this situation, the library has to support access and barrier-free dissemination of intellectual ideas through a triggered (Raju, 2016) open access (OA) platform. With the development of OA, institutional repositories of the EI (educational institution) enhance author citation and collaboration among authors in research. For the understanding in the section on open access, different types of open-access publication media are functional depending on the service they provide, such as:

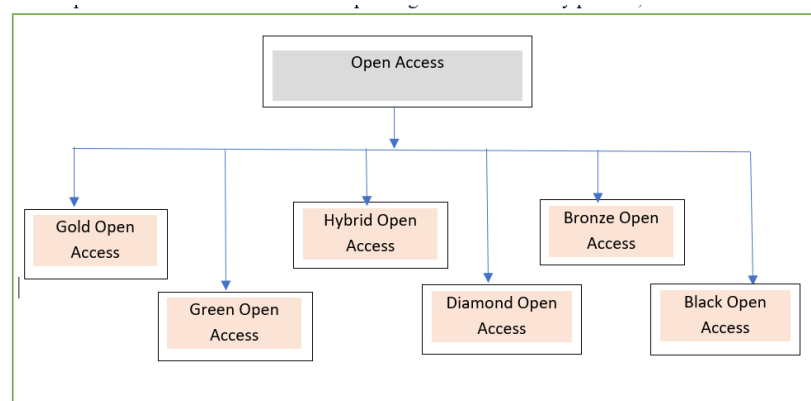


Figure-1: Type of Open Access

- A. Gold Open Access
- B. Green Open Access
- C. Hybrid Open Access
- D. Diamond Open Access
- E. Bronze Open Access
- F. Black Open Access

❖ **GOLD OPEN ACCESS (GoOA)**

Gold Open Access is a privilege for users. The best site for taking literary practice classes is Gold Open Access (GOA). The least restricted GOA gives researchers complete freedom to choose how their work is distributed and to freely and publicly gather data. Once the final research's rigorous results are published, anyone can access them permanently and for free.

❖ **GREEN OPEN ACCESS (GrOA)**

Green open access is related to the accepted article submitted to the institutional repositories of the concerned institutions. The submission of research papers by faculty and research scholars of the institution determines their further use.

❖ **HYBRID OPEN ACCESS (HyOA)**

This type of open access is cost-specific. In this open-access scholarly community, authors publish their papers in subscription-based subject-specific journals by paying a publication processing fee for the individual article. The journals further give the public access to the worthy recognition of the authors' articles.

❖ **DIAMOND OPEN ACCESS (DiOA)**

This refers to publications that allow readers and research authors to publish for free. Diamond open-access publications may not have a high impact factor since they are funded by institutions or other infrastructures, despite their sometimes misleading label (Mager, 2024).

❖ **BRONZE OPEN ACCESS (BrOA)**

This is considered an open-access platform, but the issue with the publication part of the journals is that this type of journal has never possessed an open-access license to facilitate free access to the journal articles. However, it freely and openly disseminates research articles.

❖ **BLACK OPEN ACCESS (BIOA)**

For the sake of sharing and facilitating the open right to access research papers, it is a serious issue concerning the sharing of journal articles without having an open distribution right. An illicit services model offers free access to scientific publications or other content.

2.4.3. RESEARCH CONSULTATION SERVICE IN LIBRARIES

Libraries are key players in supporting the research process and are ‘must-have’ service providers for students at all stages of their study. For those researchers who may not yet know where they need help or what the context of their assistance may be, mentoring services will provide specialized guidance so researchers can gain a deeper understanding of the trials that can and will exist for research.

A key role for research consultation is assisting researchers with identifying and accessing relevant material. Subject-specific librarians help researchers find the books, databases, peer-reviewed articles, and other scholarly materials they need for their research. They also help scholars develop effective search strategies and utilize advanced database features to retrieve high-quality information efficiently.

Advising on research methods and resources is a crucial additional role of research consulting. Librarians help researchers manage big datasets, use analytical software, and comprehend different approaches. They also offer guidance on using citation management programs like EndNote and Zotero, which help researchers properly format bibliographies and arrange references.

Research consulting services are also necessary for publishing and effect analysis. Librarians assist researchers in selecting reliable journals, understanding impact factors, and avoiding dishonest publishers. Altmetrics, citation counts, and h-index are metrics used to evaluate a study's influence.

In addition to these services, libraries assist with plagiarism prevention by employing plagiarism detection software and counselling researchers on moral writing techniques. Libraries guarantee that research complies with the highest ethical standards by raising awareness of academic integrity.

Research consultation services enable academics to perform high-quality research by bridging the gap between them and the enormous number of academic tools and resources available. Libraries promote creativity, improve the research process, and help academic efforts succeed overall by providing individualized support. These

services highlight how important libraries are to university institutions' scholarly endeavours.

2.4.3.1. FACILITATING ACCESS TO SCHOLARLY RESOURCES

Libraries' research consulting services are essential to increasing the accessibility of scholarly materials. Books, journals, conference papers, databases, and other literary materials are all accessible through libraries. However, because of the complexity of specialised databases and subscription-based journals, researchers could find it challenging to traverse this abundance of information.

By helping academics locate and use the most reliable and pertinent sources for their work, research consulting services help close this gap. Subject-matter experts in librarianship help researchers choose relevant databases, create accurate search plans, and locate excellent, peer-reviewed content. They teach researchers how to use resources like IEEE Xplore, PubMed, and Scopus, for example, so that they can benefit from advanced capabilities like keyword filters, citation analysis, and stored searches.

2.4.3.2. GUIDANCE ON ADVANCED SEARCH STRATEGIES

Finding and retrieving pertinent information fast and effectively is essential for conducting effective research. Libraries' research consultation services are essential for giving students sophisticated search techniques to handle the vast and complex world of scholarly resources.

Librarians help scholars create precise search terms relevant to their particular areas of study. They assist researchers in using truncation, wildcards, and Boolean operators (AND, OR, NOT) to hone searches and produce more precise results. While "climate AND policy" returns variations such as climate, climatic, and climatology, "climate change AND policy" guarantees targeted results.

Advanced search strategies help researchers understand database-specific functionalities. Each academic database, such as Scopus, JSTOR, or PubMed, has unique filters, thesaurus, and indexing terms. Librarians help researchers become

proficient in applying subject headings, employing proximity operators, or accessing citation indexes to track down important works in their field.

Librarians also educate researchers on performing a systematic literature search, a key requirement for meta-analysis and/or a literature review. This is to alert users of new articles, preserve search history, and allow researchers/companies to reproduce search engines.

To conduct literature reviews and meta-analyses, researchers need to know how to do systematic literature searches, which librarians teach. Researchers must create replicable search algorithms, keep track of search history, and set up alerts for new articles.

Consultation services often include examining multidisciplinary databases and open-access repositories to ensure scholars find obscure or specialized information related to their work. They also cover subjects like handling sizable datasets, eliminating out-of-date or unnecessary content, and finding keywords in non-English languages.

2.4.3.3. SUPPORT IN RESEARCH METHODOLOGIES AND TOOLS

To help researchers navigate the intricacies of research methods and resources, libraries are essential. Librarians help scholars choose the best qualitative, quantitative, or mixed methodologies for their research goals by offering research advisory services. Books, papers, and guidelines are among the resources they offer that describe methodological frameworks and their applications. Libraries contribute to systematic reviews by educating researchers in creating search protocols, building large datasets, and critiquing sources. Libraries provide researchers with support resources and the information necessary to develop rigorous studies and generate valid results.

2.4.3.4. ASSISTANCE IN PUBLICATION AND JOURNAL SELECTION

Publications and journal selection processes are often complicated for educators, but libraries are valuable to academicians and support their publication and journal selection activities. Research librarians offer consultation services for students who

need further assistance locating relevant publications related to their research question and academic discipline. They help measure journals by several criteria, including indexing, peer-review processes, impact factors, and journal scope. Librarians also educate researchers about predatory journals and how to avoid them by recognizing red flags like high article processing charges (APCs), unclear editorial boards, and rapid acceptance rates. Tools like **Journal Citation Reports (JCR)**, **Scopus**, and **Directory of Open Access Journals (DOAJ)** are often used to provide credible journal recommendations.

Every journal has its publication standards and policies. Libraries help researchers understand the different formatting specifications, ethical considerations, author publication charges, and journal submission criteria. Through this service, libraries help researchers publish research papers in respectable and impactful journals and increase their influence, visibility, and reputation as authors.

2.4.4. RESEARCH SUPPORT SERVICE AND OUTREACH PROGRAMME

In the business sector, marketing services would tremendously enhance product consumption. Subsequently, making the public aware of the services and functionality would bring customers to a point where they feel comfortable accepting the complicated product. Similarly, libraries should reach their existing facilities and their users' community.

In the context of RSS, the top priority is the need for research scholars to handle different perspectives of the research process. Hence, the library plays a prime role in assisting users with the research life cycle.

Many factors are involved in research activities, especially in the present scenario, with the paradigm shift of the research process and technology associated with research activities. These include understanding research metrics and impact factors, reference management (with ongoing citation style, e.g., MLA, ALA, Chicago, etc.), research data management, research visibility, writing assistance, plagiarism testing, etc.

- To understand the issues related to the areas mentioned above and overcome the associated problems to build requisite competencies, the institutional library's sole responsibility is to find such strategic planning to deal with the everyday issues that scholarly communities face.
- Suggestive activities can be taken as outreach programs, which include seminars, workshops, training, expert talks, user orientation, etc., through which the library can deal with the information explosion.

2.4.5. RESEARCH FUNDING AND GRANTS

Promoting invention, discovery, innovation, and progress while igniting the pursuit of new knowledge (Government of India, n.d.) are the key objectives of institutions. By acknowledging the genuine issues faced by society, socio-economic development initiatives have frequently been undertaken for the greater benefit of the population (Government of Odisha, n.d.). State and federal institutions and government entities support research on various topics of public interest. Financial aid has also been introduced to ensure that initiatives are completed successfully. This financial assistance includes funding for essential equipment, access to and procuring reference books and journals, hiring necessary technical services, contingency costs, travel, and field trips for raw data collection, printing, and other related expenses (UGC, 1956). A study by Giuliana et al. (2014) highlighted the transactional skills Italian researchers lack in securing funding, which is one of the significant concerns for Italian educational institutions to compete with the innovative activities of European countries. To our understanding, the research article published says that many academic institutions have not initiated RSS at their respective institution. That means it generally has to believe the shortfall of the institutions in providing financial assistance under RSS. Funding is one of the fundamental barriers to the practical completion of research work. Financial support extended by institutions and agencies can attract many high-quality research proposals from aspiring researchers who can address subject gaps and provide valuable, quality-driven insights. Funding for research enables engineers, scientists, and other experts to test theories, investigate novel concepts, and develop answers to challenging issues.

Several organizations offer financial support to encourage research endeavours in various topic areas. The project results are then disseminated more widely to increase awareness of the topic through publication in prestigious journals. In addition to giving the researcher the credit they deserve, this also creates prospects for future employment. However, the great concern is that intending scholars possess no knowledge and experience about the availability of funding assistance according to their needs. This ignorance keeps many of them far behind in research skills and career development.

Providing better accessibility to funding and grant possibilities is a standard service for research support services. For research to be successful, funding must be obtained. These services help researchers apply, create compelling applications, and locate appropriate grants. This component is essential for researchers. Research initiatives are typically supported by outside financing for candidates. Many good researchers are working on their studies. The student's competency is beyond doubt, but the project's quality might be hampered because of the financial instability of the researcher.

The library plays a vital role in assisting scholars in completing their research. Financial assistance improves the quality of research. The library must know the various research funding allocations released by different agencies. Due to academic pressure and ignorance, the research community is not aware of funding assistance. When they learn about the advertisement, the application deadline is closed.

On the other hand, if they are knowledgeable about funding assistance, the application procedure and eligibility criteria are still significant concerns that keep them from receiving financial support. Hence, the library of the concerned institution has to initiate funding assistance for its aspirant scholars. They must inform the scholars of the various funding supports and organize orientation sessions for the application procedure. By getting expert support from the institution, the proposal submitted has to be reviewed before submission to increase its chances of being selected. So, maximum financial support can be achieved for the institution with little effort from the library and its professionalism.

2.4.5.1. TYPES OF RESEARCH GRANTS

Research grants are crucial since funding agencies provide researchers with the necessary funding to conduct significant and high-calibre research. Through grants, academics can frequently pay for costs beyond their own or the institution's budgets, such as staff, travel, data gathering, and laboratory equipment.

Grants support innovation by supporting innovative ideas and exploratory research that are not ready for commercialisation but hold great long-term potential. They allow researchers to focus on doing their job (research) without the unnecessary emotional burden of finances and ensuring that the days to content markers are precise and that comprehensive data are the result of experiments. Research Funding Agencies. Many governmental agencies and NGOs offer research grants in diverse subject areas to promote research activities, identify research gaps, and provide suitable solutions for socio-economic development. Such funding agencies listed below are:

Table 3: Funding and Agencies

Sl. No.	Name of Funding /Research Grant-aid	Sponsored By	Tentative Month of Advertisement
01	UGC-NET Junior Research Fellowship	UGC	Between March and April
02	Google PhD Fellowship India Program	Google India	Between May and June
03	Tata Innovation Fellowship	Department of Biotechnology, Ministry of <u>Science</u> and Technology, Government of India	Between October and November
04	SBI Post-Doctoral Research Fellowship	State Bank of India	Between March and April
05	Azim Premji Foundation Fellowship	Azim Premji Foundation	Between August and September
06	CSIP Research Fellowship	Ashoka University's Centre	Between

		for Social Impact and Philanthropy (CSIP)	August and September
07	The Institute of Mathematical Sciences Post-Doctoral Fellowships (PDF)	Institute of Mathematical Sciences, Chennai	Runs throughout the year
08	Prime Minister's Research Fellowship (PMRF)	Ministry of Human Resource Development, Government of India	Runs throughout the year
09	National Fellowship and Scholarship for Higher Education of ST Students	Ministry of Tribal Affairs, Government of India	Between September and November
10	UGC National Fellowship for Scheduled Caste Students (NFSC)	University Grant Commission	Between May and July
11	Tata Institute of Social Science (TISS) Post-Doctoral Research Fellowship	School of Habitat Studies, Tata Institute of Social Sciences (TISS)	Between April and May
12	HSCST Fellowship Programme	Haryana State Council for Science, Innovation and Technology (HSCSIT)	Between May and June
13	National Fellowship for Persons with Disabilities	University Grants Commission (UGC)	Between January and February
14	Abdul Kalam Technology Innovation National Fellowship	Indian National Academy of Engineering (INAE)	Between May and June
15	SERB Ramanujan Fellowship	Science and Engineering Research Board (SERB)	Runs throughout the year
16	CSIR Nehru Science Postdoctoral Research Fellowship	Council of Scientific and Industrial Research (CSIR)	Runs throughout the year
17	CSIR Bhatnagar Fellowship	Council of Scientific and Industrial Research (CSIR)	Runs throughout the year
18	SBI Youth for India Fellowship	State Bank of India (SBI)	Between March and April
19	Ashoka University Young India Fellowship	Ashoka University, Haryana	Between March and April
20	Ravi Sankaran Fellowship Program	Inlaks Shivdasani Foundation	Between March and April
21	Fulbright-Nehru Doctoral Research Fellowships	United States-India Educational Foundation	Between March and July

22	New India Foundation Fellowship	New India Foundation	Between July and August
23	ICTS – S.N. Bhatt Memorial Excellence Fellowship Program	International Centre for Theoretical Sciences, Tata Institute of Fundamental Research, Bengaluru	Between December and January
24	Raman Research Fellowship	Council of Scientific and Industrial Research	Between November and February

(Karmakar, 2023)

Some of the famous India and Odisha-specific scholarships are :

1. PMS (Post-Matric Scholarships) (for SC-ST students) given by the Orissa Government
2. TCS (Top Class Scholarships) (All students) given by Tata Consultancy Services
3. Merit Scholarships (Govt. of Odisha) (All students)
4. NTS (National Talent Scholarship) (GoI)
5. TCS scholarship for CSE students
6. Indian Oil Scholarship
7. ONGC scholarship
8. Balmer Lawrie and Co. Ltd.
9. OP Jindal Engineering and Management Scholarship (OPJEMS)

2.4.6. RESEARCH DATA MANAGEMENT

Managing digital data (Franke, 2018) for the entire researcher community is crucial to their research life cycle. Any lapse in protecting the data collected during the research process (questionnaire, survey, experiment) can lead to unexpected consequences or a precarious situation. Research data is mainly collected by the researcher or accumulated most efficiently (Bouchrika, 2024) through observation or created by experiments that are purposefully used to validate research results (Sarah, 2013). Data collected by the researchers is essential for analysing any situation and is valuable for finding the requisite solution based on that data only. Reusable data for future research,

researcher collaboration, and the reliability and quality of research outputs are all made possible by efficient RDM procedures. RDM is also essential for fulfilling legal and ethical obligations about data protection and privacy (Cluster of Excellence, 2023).

What is this research, Data Management? To answer this, Frank et al. (2018) stated, "The administration of research data at every stage of its life cycle—from planning and creation to selection and evaluation to storage and processing for future use—is referred to as Research data management." (Whyte, 2011) defines "Research data management as the organization of data, from its entry to the research cycle to the dissemination and archiving of valuable results. It aims to ensure reliable verification of results and permits new and innovative research built on existing information" (Yu, 2017). Academic libraries and other research stakeholders in developed countries are more effectively adopting these services, and the intensity with which they are implemented is continually growing (Yu, 2017; Gajbe et al., 2021).

Data is very crucial, especially when it is related to research data. In addition to the requirements that these research data be open and follow the FAIR principles, they must be interpreted in a more comprehensive and intricate framework that takes into account public and private interests, policies, standards, regulations, and the various technologies and infrastructure that allow for their safe and secure access. (Wilkinson et al., 2016 and Martin-Melon, 2023). So far, no such advanced system for RDM (Research Data Management) tools has been developed in India. RDM is an issue with educational institutions in Asian and African countries. 'Datacite,' a leading global non-profit organization (Vierkant, 2024), is an example of RDM platforms developed and managed by NGOs. Introducing disciplines like 'Data Science' (Martin-Melon, 2023) has facilitated the production of information more rapidly and competently. Because of this advancement, a considerable amount of data and information is flourishing, enhancing the possibility of extracting the right resources from the sea of information. These resources are highly valuable in the research process, bringing transparency to scientific communication. According to Koltay (2019), present-day research is based on digital artifacts and massive datasets from open, networked systems. As a result, he called the current study methodology "Research 2.0." Martin-Melon, R., introduced two key concepts about research data: research data

management and research data service. These ideas are fundamental to the research process and are not only theoretical. Understanding and implementing research data management can significantly improve the efficacy and impact of the research process by influencing the storage, extraction, safety, reuse, preservation, distribution, and data sharing in a technical, moral, and legal framework.

According to the UK Data Archive (Melon, 2023 & Eyden, 2013), from generating these data to making them available to other researchers for reuse, the six stages of the data life cycle comprise a collection of organizational and technical operations (Table 2).

Table 4: Stages of The Data Life Cycle

	Creation of Data	Processing Data	Analysing Data	Preserving Data	Giving Access to Data	Re-Use of the Data
Activity	- design research - plan data management - plan consent for sharing - locate existing data - collect data - capture and create metadata	- enter, digitise, transcribe and interpret data - check, validate and clean data - anonymise data where necessary - describe data - manage and store data	- interpret data - derive data - produce research outputs - author publications - prepare data for preservation	- migrate data to the best format - migrate data to a suitable medium - archive data - create metadata and document them - place data in repository	- distribute data - share data - control access to data - establish copyright - promote data	- follow up research - new research - undertake research reviews - scrutinise findings - teach and learn

(Martin-Melon, 2023)

In this age of data-driven research, the availability of data management and analysis tools is essential. Research support services should offer training and supply software,

statistical software, and data collection tools. It supports effective data management, organization, and analysis by natural, social, and health science researchers. Most of the time, research data is treated as valuable when dealing with time and money. Good research management helps organize files and data for easy access and analysis (LibGuides: Research Data Management: Benefits of Data Management, n.d.).

Proper maintenance of research data reduces the workload. The practice is helpful for the researchers concerned and helps the institutions disseminate and preserve the records for future usage. However, there are diverse forms, formats, and natures of research data that a researcher comes across. Data consulted for the purpose may be analogue or digital. Hence, we can say two types of data are mainly appropriate:

a) Analogue or b) Digital

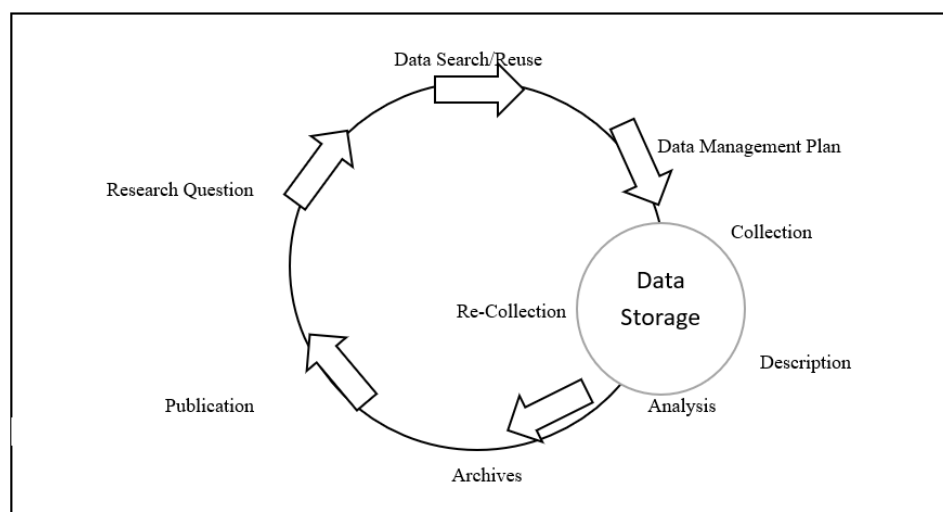
To elaborate for understanding

Data that can be created in a Digital form, i.e., Digitised
and

Data that is initially created in a Digital form, i.e., Born Digital.

2.4.6.1. RDM LIFE CYCLE

RDM includes creating procedures and guidelines for collecting, documenting, storing, analysing, and sharing data as well as for ensuring data security and longevity.



(Research Data Management, 2024)

Figure 2: Research Data Management Cycle

2.4.6.2. IMPORTANCE OF RESEARCH DATA MANAGEMENT

The importance of managing research data keeps growing for many different reasons.

- Data collected during the research is focused on educational purposes and, if not kept safely, may lose its value and importance.
- Managing the data will save time and reduce financial expenditures. In the future, suggestions can be made by easily accessing these data inputs.
- Rightly gathered data helps enhance the accuracy and quality of the research output. Dissemination of quality output will have the scope to generate a new set of ideas and information over time.
- Marginal errors during analysis can be avoided through proper organization and data maintenance.
- When approving research grants, funding organizations increasingly depend on data and repeatable outcomes.
- The authors' integrity is beyond doubt if the data is authentic, reliable, and well-managed.
- Collaboration research can be made possible by sharing the data with colleagues and researchers dealing with the same data.
- Risks such as sharing confidential records, losing important data, and embarrassing situations can be avoided.

2.4.6.3. FAIR PRINCIPLES OF DATA MANAGEMENT

A collection of rules known as the FAIR principles was created to aid in the findability, accessibility, interoperability, and reusability of research data. Research data can be made FAIR by:

- ❖ **Data Documentation:** Research data shall be documented and described to the extent that would allow a knowledgeable peer to understand the data and use this to challenge and/or substantiate the results. Relevant metadata, including the creator, date of data generation, and relevant publications, should also be captured.
- ❖ **Persistent identifiers:** It is strongly recommended that all datasets be cited using appropriate persistent identifiers (such as DOIs).

- ❖ **Data in standard format:** It is important to encode the research data in a common direction in a standard format that is mainly accessible and understandable by others.
- ❖ **Ensuring data security and privacy:** Research data should be shared and kept private and safe by legal and ethical requirements.
- ❖ **Making data openly available:** Research data should be made publicly accessible whenever feasible, along with license details and transparent, regulated access procedures (Cluster of Excellence, 2023).

2.4.6.4. RDM BENEFICIARIE

Managing research data is not only beneficial for the person who engages with any project or research work, but also quite helpful and provides benefits to other communities involved with data, research, and the publication fraternity. They are:

Researcher: Good data management enhances the quality of research and improves its impact. Understanding the pros and cons of a particular phenomenon and the scope of further research gaps has led to more impactful publications within the subject domain.

Research institutions: Appropriate research data management practice among students and faculty within the institution demonstrates an understanding of the importance of data and compliance with ethical and legal requirements. Such practice develops interpersonal relations with collaborative research endeavours on campus, which uplifts the institution's research productivity and quality.

Funding Agencies: Research data management can help funding organizations increase the transparency and impact of their financial commitments by ensuring that the research data produced by their funding is appropriately managed, disseminated, and conserved.

Journals and publishers: Collecting unpublished data from authors of studies they publish could be a new and sustainable source of data due to the potential of data management to increase scientific trustworthiness and the momentousness of data.

Factory managers and regulators: It can also be useful for factory managers and regulators to manage and ensure that research data are well-structured, disseminated,

properly protected, and compliant with ethical and legal regulations. This may add to the transparency and impact of the results.

2.4.6.5. CURRENT STATUS OF RESEARCH DATA MANAGEMENT

India offers a plethora of venues and efforts for data exchange and research data management (RDM). The effort has succeeded even though adopting the platform and infrastructure is not as developed as in the USA. (Tripathi et al., 2017) looked at the websites of 47 Indian central universities' libraries to evaluate how RDM services were being implemented. They discovered that these libraries are still developing an RDM policy and a plan of action to execute it. According to Sing, R.K. (2022), there is much concern among developed and developing countries towards RDM. He stated that the lack of proper RDM policy at the national and international levels persists in the 21st century. However, by surfing the internet and studying different articles, Table 3 highlights some of the leading RDM platforms and initiatives operating in foreign countries and India:

Table 5: Current Status of Research Data Management Worldwide									
Sl. No./Country	India	USA	UK	China	Australia	Canada	Germany	New Zealand	Ireland
1	INDIACat	DMPTool	UK Data Service	CNKI	ARDC	Portage Network	Forschungsdate n.info	NeSI	National Open Research Forum
2	ICSSR Data Service	Open Science Framework (OSF)	Jisc	NSFC	AARNet	CRKN	NFDI	NZ RIS	DRI
3	NDSAP	ICPSR	DCC	Chinese Academy of Sciences Data Sharing Network	NCRIS	FRDR	GESIS Data Archive	Figshare	IReL
4	Data Repository for NIRF	Dryad	Figshare	SciDB	Figshare	Open Science Framework-Canada	PANGAEA	Data.govt.nz	Science Foundation Ireland

5	C-DAC	Dataverse	Zenodo	CESSD	DataCite Australia	Compute Canada	Helmholtz Open Science	National Library of New Zealand	Zenodo
6	NKN	Figshare	ARCHER2	CDR	QCIF	Polar Data Catalogue	DARIAH-DE	Research Data Alliance- NZ Node	HEAnet
7	DLI	Zenodo	Re3data	National Population Data Sharing Platform	ALA	CAN-SHARE	re3data	MBIE	ISSDA
8	VIDWAN	-	UKRI	Alibaba Cloud and Tencent Cloud for RDM	ANDS	CARL	RADAR	Te Mana Raraunga	Open Research Data Taskforce
9	I-STEM Portal	-	National Archives	BGI Data Platform	Tinker	RDC	Zenodo	REANNZ	Repository Network Ireland
10	-	-	ETHOS	Open Research Data Initiative	-	Geodisy	DAASI International	Local University Repositories	-

2.4.7. RESEARCH ASSISTANCE TOOLS

Essential resources that help researchers design, conduct, and analyse their investigations are known as research tools. At every stage of the study, from data collection to results sharing, they improve efficiency, accuracy, and dependability. The procedure is now more efficient and effective because of the introduction of numerous instruments that address different facets of research brought about by technological advancements. These tools can manage enormous volumes of data, ease complex processes, promote teamwork, and guarantee that methodological and ethical norms are followed.

There are different types of research assistance tools available:

1. Literature Review Tool
2. Data Collection Tool
3. Data Analysis Tool
4. Collaboration Tool
5. Visualisation Tool
6. Publication and Impact Measurement Tool

2.4.7.1. LITERATURE REVIEW TOOLS

Researchers may improve the effectiveness and structure of literature reviews by using tools like Zotero, Mendeley, and EndNote to manage and arrange references and citations. Commonly used literature review tools are given details here.

❖ ZETERO

A free, open-source research tool called Zotero assists researchers in gathering, organizing, and analysing information and disseminating it in several ways. It combines the most outstanding features of contemporary software and web applications (the ability to organize, tag, and search) with the best features of older reference manager software, like the ability to export and preserve author, title, and publishing fields.

That data is formatted as references. Zotero works well with online resources; for example, it can automatically extract and save full bibliographic references when it detects researchers perusing a book, article, or other online content. Zotero, created by

George Mason University's Centre for History and New Media, has a user-friendly design and a wealth of capabilities that appeal to academics from various fields.

One of the best things about Zotero is how easy it is to collect and organize references. Researchers can save citations from databases, web browsers, and library catalogues with only one click. Zotero's automatic metadata capture, which includes journal titles, author names, and publication dates, guarantees complete and accurate records. Users can store full-text articles with citations by manually adding references and uploading files, including PDFs.

Zotero's organizational features make managing and categorizing massive reference libraries easy. To find particular resources quickly, researchers can categorize objects, create folders and subfolders, and employ sophisticated search features. This well-organized structure is beneficial during the literature review process because it facilitates the synthesis of practical information and keeps researchers abreast of relevant studies.

It also cannot be overstated how easily Zotero integrates with word processing software such as LibreOffice, Google Docs, and Word. The Zotero plugin allows students to add references to their papers and automatically generate bibliographies in Chicago, MLA, and APA style. This ensures consistent formatting down the page and is less work. In addition, Zotero fosters greater cooperation among scholars by allowing them to share references and resources. This is useful for team projects where scholars want team members to have access to a shared library. Zotero is a free, open-source utility with premium options for more cloud storage. Due to its versatility, strong features, and user-friendly design, it is a vital tool for researchers of all skill levels. Zotero streamlines the literature review process, allowing academics to concentrate on knowledge analysis and synthesis rather than citation management, regardless of the size of the database—a few dozen articles or an extensive database of references.

❖ MENDELEY

Mendeley is an academic and social network with a powerful Mendeley Desktop platform that acts as a research cooperative producing software with the potential to

save hours off the research process, particularly when undertaking literature reviews. Mendeley is an assistive tool created by Elsevier that research staff and students use to manage references and related documents. Researchers, students, and professionals manage their references and organize their readings. It is one of the preferred platforms for scholarly communities because it is user-friendly, with rich monitoring tools for references and collaboration.

The outstanding feature of Mendeley is that academics can store resources and references in one library. Besides automatically harvesting metadata (i.e., authors, titles, publishing information, and keywords), users can import research articles in multiple formats (e.g., PDF files). Its automatic completion saves time for both the record and the human compiler. Members can manually add or edit missing details to keep a well-tended library.

There are also good organizing tools in Mendeley. It allows users to tag articles for easy location and classify references by folders and subfolders. Its search function is advanced, meaning researchers can quickly find specific publications or topics useful for literature reviews.

One thing worth mentioning here is Mendeley's effortless integration with word processors like Word (MS) or LibreOffice. The platform offers researchers automatic bibliography and citation creation in APA, MLA, and Chicago styles. This is a huge time saver and assures uniformity in academic writing.

Mendeley can also be used for research networking and collaborative research. Researchers can join private or public groups to share references, discuss study topics, and work with users around the world. Its integrated academic and social network enables researchers to connect with colleagues, discover new research, and track trends in their fields.

Cloud-based synchronization is another advantage, enabling users to access their libraries from multiple devices. This ensures researchers can work seamlessly across desktops, laptops, and mobile devices without losing data.

Mendeley is an easy-to-use reference manager and academic social network. In addition to guiding scholars through research projects, Mendeley enables them to collaborate through groups and easily share with peers and colleagues in existing research groups. It is necessary to conduct systematic literature reviews due to its broad functionalities in referencing management, article annotating, and collaboration facilitation. Mendeley frees academics to focus on their research instead of learning research tools.

❖ **ENDNOTE**

Scientists, researchers, and other professionals frequently leverage EndNote, an advanced reference management solution by Clarivate, to accelerate the literature review. EndNote is a program used to maintain citations and create reference lists and bibliographies. It is a complete tool that improves productivity and time saving while research.

The capacity to build and manage an orderly library of references is the foundation of EndNote's capabilities. Users can import citations from databases, library catalogues, and websites that automatically extract metadata for correctness. Researchers can annotate and highlight papers directly within EndNote, and the program supports importing files in various formats, including PDFs.

EndNote's strong organizing features are among its best qualities. Users can apply tags, organize references into unique folders, and employ sophisticated search filters to find specific materials. This arrangement is invaluable during literature reviews when efficiently synthesizing material requires handling many references.

Because EndNote easily interfaces with word processing programs like Microsoft Word, researchers may automatically create bibliographies and add citations. With support for thousands of citation formats, such as Chicago, MLA, and APA, EndNote guarantees uniformity and conformity to formatting specifications. Its "Cite While You Write" feature allows for real-time citation management, freeing you from focusing on formatting.

EndNote's ability to foster teamwork is an extra advantage. Scholars and colleagues can collaborate on projects more effectively by sharing libraries. Users can change permissions to limit who has access to or change the shared references. Collaboration and multi-author publications benefit significantly from this collaborative tool.

EndNote's ability to work with web platforms adds even more capability. Researchers may ensure they can access their references at all times and places by syncing their libraries across devices.

Additionally, it integrates with the Web of Science and additional research resources to facilitate the easy discovery and updating of literature.

EndNote is a premium application, but for academics looking for a complete literature management solution, its sophisticated capabilities and wide range of customization options make it well worth the money. EndNote is a strong ally in carrying out productive and successful literature reviews because of its capacity to manage enormous reference libraries, promote teamwork, and interface with writing tools.

2.4.7.2. DATA COLLECTION TOOLS

As it is clear to every researcher, data plays a crucial role throughout the project and even after that. The researcher collects this data by devoting considerable time and resources (Taherdoost, 2021). Data collection refers to using various techniques for obtaining information about particular study variables to use in the data analysis stage to produce the study's findings, respond to the research questions, or test the hypotheses (Taherdoost, 2021). Data is collected through observation, interviews, oral questions, or structured questionnaires. The most effective and user-friendly tools used by Product Company researchers are SurveyMonkey, Google Forms, and Qualtrics.

❖ SURVEYMONKEY

SurveyMonkey is a market-dominating survey tool that creates survey questions. Though it impacts SMBs and enterprises, it is still a survey tool among the research community. Researchers use the tools to create survey questionnaires and collect data from the target audience efficiently (Yang, 2022). Gaining insight into a desired topic and feedback to improve any service is helpful. According to Ramshaw (2024),

“SurveyMonkey is online survey software that helps you to create and run professional online surveys.” As a top survey and feedback management tool, it helps users gather, evaluate, and analyze data to spur innovation and expansion. It provides an easy-to-use interface, editable templates, and AI-powered tools for creating, launching, and analyzing surveys (Ramshaw, 2024).

In 1999, Ryan and Chris Finley established SurveyMonkey in San Mateo, California. Its goal is to enable inquisitive people and institutions to assess, compare, and act upon the viewpoints that propel achievement. As of 2022, the company employs over 1,400 people (Wikipedia, 2024) and has over 17 million active users. Formerly known as **Momentive Global Inc.** from 2021 to 2023, its headquarters are in San Mateo, California, along with Portland, Ottawa, Dublin, Amsterdam, London, and Sydney. On January 9, 2021, Momentive Global Inc. announced its rebranded name as SurveyMonkey (Wikipedia, 2024).

SurveyMonkey features include Survey Building, Customization and branding, analysis and reporting, response management, team collaboration, security, and a mobile survey tool for Android and iOS.

❖ GOOGLE FORM

A survey administration tool called Google Forms is a part of Google's free online suite of Google Docs Editors. It is a web application of the Microsoft company and is a free online form builder app (Lau, 2024). Users can work collaboratively in real-time with the app while creating and editing surveys online. The gathered data can automatically update a spreadsheet (Wikipedia, 2024). Google Forms was first introduced in 2008. With increasing demand, many new features are added and updated to suit their needs. Over the years, there have been multiple improvements to the Google Forms service. Menu search, shuffled questions for a random order, one-time response limit, shorter URLs, personalized themes, automatically generated answer suggestions when constructing forms, and a "Upload file" option for users

responding to questions that ask them to share files or content from their computer or Google Drive are just a few of the features.

People can manage event registrations, create a quick opinion poll, create quizzes, and more. With Google Forms, they can create surveys or quizzes using a mobile or web browser—no special software is required. Instant results can be obtained as users come in. Moreover, they can summarize results at a glance with charts and graphs (What You Can Do with Forms - Google Workspace Learning Centre, n.d.)

Users can export their form replies to an existing or new Google Sheets spreadsheet that is updated as new responses are received or use the built-in analysis tools to examine the responses. Using the integrated analytic tools, one can view each response separately or in summary form. As an alternative, responses are available for download as a file with values separated by commas.

❖ QUALTRICS

A cloud-based platform, Qualtrics, allows users to create, distribute, and collect responses (NC State University, n.d.) and analyse survey data. Academic research, market research, customer happiness, and online feedback are just a few of the many uses for Qualtrics. Because of the following service compact within one platform, Qualtrics is highly popular. Such services are:

Qualtrics allows different question patterns, such as multiple-choice, matrix tables, text entry, images, descriptive text, rank order, drill-down, etc.

It is possible to refer to surveys, questions, graphics, and messages from the Qualtrics library that global users have already created.

The ability to quickly customize and disseminate surveys by uploading population information into Qualtrics

The survey questionnaire is easily distributed through different modes, such as social media, QR codes, Qualtrics e-mailers, and configurable survey URLs

The facility will send thank-you and reminder letters and track survey progress to plan accordingly.

The survey response can be downloaded in compatible formats, such as Excel, CSV, TSV, SPSS, XML, and HTML.

For better visibility and clarity, reports, graphs, charts, and statistical results of response data can be generated automatically for presentation over a query.

2.4.7.3. DATA ANALYSIS TOOLS

A researcher completes his data with the help of technology by going through many difficulties, such as personally visiting the respondents and collecting data. However, as important as data collection is, the entire research's result must be written after understanding and interpreting the collected data in detail. If a complete data analysis cannot be done, then the entire research result contradicts the objective. Only then does the intended research have negative consequences for oneself and society.

However, with the advent of technology, the collected data can be presented smoothly and accurately. Some such tools have maintained their dominance among researchers, such as SPSS, R, and Python for statistical analysis and NVivo and MAXQDA for qualitative analysis. Some of them are listed here.

❖ STATISTICAL PACKAGE FOR SOCIAL SCIENCE (SPSS)

Statistical Package for Social Science (SPSS) (Syafiqah, 2022) is a powerful statistical software program (Cho, 2006) used primarily for analysing, interpreting, and presenting research data and creating tables and graphs (Nagaiah, 2016) by users. After being created by Norman H. Nie and C. Hadlai Hull, SPSS was initially made available in 1968. The tool is influential among business personnel, social scientists, and researchers. Most educational and non-educational institutes use SPSS due to its user-friendly features (Rahman, 2021). SPSS can handle vast amounts of data and execute all the analyses discussed. Basic statistical operations, including descriptive statistics

to ascertain variance, frequency, etc., can be carried out via the Statistical Package for the Social Sciences.

Additionally, there are functions for bivariate statistics, analytic statistics, predictions of numerical results, and predictions of group identification for more sophisticated features. Data can be rearranged in SPSS to facilitate data processing. Data and groups can be renamed and edited as needed. There are just two categories of data: strings (text) and numbers. The Statistical Package for the Social Sciences then successively processes the data. Following treatment, users can export their results—tables or graphs—to other applications, such as Microsoft Word. The software is compatible with operating systems like Linux, Windows 7, Windows 8, and Windows 8.1(Nagaiah, 2016).

❖ **‘R’ PROGRAMMING LANGUAGE**

R has emerged as one of the most popular software for data analysis and statistics worldwide (Ghashim, 2017). Ross Ihaka and Robert Gentleman created the R language in the early 1990s. R is a comprehensive software suite with tools for calculating, displaying, and manipulating data (Venables, 2024). The software offers its users efficient data management and storage capabilities. R can be considered an implementation of the S language, which is the foundation of the S-Plus systems and was created at Bell Laboratories by Rick Becker, John Chambers, and Allan Wilks (Venables, 2024). It can function on Windows, Linux, and Mac operating systems.

❖ **PYTHON**

The software programming language Python is used for data analysis, and it is a simple, straightforward, and intuitive programming language (Morgan, 2016). Many researchers, scientists, and engineers use Python for scientific and numeric data analysis. It helps them quickly understand the complex data sets by getting insight into the data gathered. Professionals can concentrate on the more crucial elements of their projects and issues when using Python. It also helps to understand the nature of the problem and its implications in data sets. Python is easy to work with, but a researcher

does not need to be an expert on the syntax used in the programming language; they need basic knowledge of it to use it effectively. The things a researcher wants to perform are already routine or pre-built within the software.

2.4.7.4. COLLABORATION TOOLS

Collaboration tools are tools that researchers can use to share ideas, work in teams, and facilitate the progress of a project. These solutions ensure effective and productive collaborative research by providing simple file sharing, work management, and communication. Communications platforms such as Google Workspace, Slack, and Trello are increasingly popular for research groups.

❖ GOOGLE WORKSPACE

Researchers can significantly benefit from Google Workspace, a set of cloud-based productivity tools. It contains programs that facilitate smooth communication and effective project management, such as Google Docs, Sheets, Slides, Drive, and Meet. Researchers may use Google Sheets to arrange data, store files safely in Google Drive, and collaborate to create and update documents in real time.

Google Meet enables virtual meetings, and Calendar ensures that you and your friends are always on the same page. A modern research project requires the use of a tool like Google Workspace—remote work, streamlined processes, and team communication are all optimised with the sharing features and seamless connectivity across tools.

❖ SLACK

Research teams can collaborate more easily thanks to Slack, a robust communication tool. Because of its well-organised workplace, academics can designate channels for particular teams, projects, or subjects, guaranteeing targeted conversations. Slack's file-sharing and real-time messaging features facilitate easy collaboration and speedy sharing of documents, data, and ideas.

Integrations with programs like Trello, Mendeley, and Google Drive increase efficiency by centralising procedures. Slack's search feature makes it simple for

researchers to find previous discussions and files. Slack's powerful collaboration tools enable academics to manage projects, collaborate with others, and remain in touch—even when working in remote teams.

❖ TRELLO

Researchers can effectively interact, track progress, and arrange assignments with Trello, a flexible project management tool. Trello is a visual "board and card" system that lets users make project boards, add task cards, and arrange them into customizable categories, like "To Do," "In Progress," and "Completed."

Because Trello centralises operations through interfaces with Google Drive, Slack, and Dropbox, it is an excellent tool for research teams handling complicated projects or balancing several deadlines. Its flexible and user-friendly interface improves researchers' efficiency and organisation and guarantees seamless project execution.

2.4.7.5. VISUALIZATION TOOLS

Researchers find it cumbersome to maintain complex datasets accurately. To solve these problems, they require visualisation tools. These tools make it very simple for researchers to understand the issue and create visualisations, whether they are dashboards, charts, graphs, or maps. They are necessary to surface patterns, trends, and relationships within data to inform decision-making and storytelling.

❖ TABLEAU

Tableau is one of the most effective tools for visualising data. It permits data review and interactive visualisation in a more attractive way for the researcher. It is widely celebrated for its drag-and-drop interface—you do not need any real programming knowledge to create charts, graphs, maps, and dashboards.

Tableau offers some nice features for aggregating and visualising data, linking researchers to various data sources (including databases, cloud-based tools, and Excel). The system includes robust analytics for trend analysis, pattern recognition, and real-time visualisation, which enable data-driven decision-making.

With Tableau, beneficiaries can access data insights quickly, filter data easily, and adjust data and dashboards on the fly. It also provides options for embedding visuals in reports or sharing them online. If that is not enough, it can already analyse some pretty complicated input and even supports statistical engines like R and Python! Tableau enables scientists to explain complex results in an easy-to-understand and efficient way, irrespective of the data size they are handling.

❖ **POWER BI**

The leading data analytics and visualisation tool, Microsoft Power BI, was created to assist enterprises and researchers in turning unstructured data into valuable insights. It is a vital tool for efficiently analysing, displaying, and sharing data because of its sophisticated features and easy-to-use interface.

To combine and consolidate data, researchers can use Power BI to connect to various data sources, including Excel, SQL databases, cloud services, and APIs. Bar charts, line graphs, scatter plots, maps, and dashboards are a few of the many visualisation options available on the platform that may be tailored to meet specific research requirements. Deep investigation and analysis of datasets are made easier by Power BI's features, which include interactive reports, real-time data updates, and AI-driven insights. Researchers can successfully find trends, patterns, and correlations because of their dynamic modelling and filtering capabilities.

Power BI is an indispensable tool for contemporary research and analysis. It allows researchers to present data holistically, whether for large-scale data projects or scholarly research.

❖ **MICROSOFT EXCEL**

Microsoft Excel is the most popular commercial spreadsheet program, designed and developed by Microsoft. It is used by millions of people worldwide to store, organise, and analyse data effectively in tabular form. Excel is the lifeline of academicians across all academic disciplines due to its flexibility and ease of use. Like the grid design of Excel, researchers can input, organise, and manipulate data to help them

organise and analyse data. Statistical analysis, computations, and data cleansing are made simple by built-in functions and formulas. Researchers may efficiently summarise and analyse massive datasets with the help of sophisticated features like Power Query and pivot tables. A report generated from Microsoft Excel provides data in charts, scatter plots, graphs, etc., which helps to understand the trends, patterns, and insights of the studied data. Whether performing simple analysis or preparing data for more sophisticated software, Excel is a dependable and user-friendly tool for academics due to its capacity to manage modest to moderately large datasets, interoperability with other tools, and simplicity of file sharing.

2.4.7.6. PUBLICATION AND IMPACT MEASUREMENT TOOLS

Impacted systems such as Scopus, Web of Science, and Altmetric collect statistics, including citation count, h-index, and similar metrics, which can shed light on what has been supplied by a researcher and the influence of the research. Crucially, they are tools that play an essential role in the development of the career and the promotion of scientific progress as they enhance the visibility, valorise the quality of the research, and show prospects for collaboration.

❖ RESEARCHGATE

A professional networking site called ResearchGate was created to help scientists and researchers interact, exchange work, and collaborate with other members of the academic community. Users can interact with peers worldwide, upload and share their articles, and participate in conversations. With more than 20 million members, ResearchGate promotes interdisciplinary collaboration by giving scholars a forum to share information, pose queries, and offer perspectives on various subjects. Additionally, the platform allows scholars to follow particular subjects, journals, or writers, which facilitates staying up-to-date with the latest developments in the field.

ResearchGate is important in assessing the impact of scholarly publications and individual writers. One of its main features is citation tracking, which lets authors see how often their work has been cited on the ResearchGate site. They can evaluate the

influence of their articles and the extent to which other scholars in the field cite their work in this way.

ResearchGate Score is an important metric. It provides a unique measurement of authors' engagement within their community by showing their research visibility and impact factor. The visibility and impact factors are considered, such as citations received, number of reads of the particular article, and downloads of the author's publication. A higher RG score indicates stronger engagement and influence within the academic network. It considers citations, the number of times an author's work has been read and downloaded, and the total amount of contact with the ResearchGate community.

❖ **ORCID**

A non-profit organisation called ORCID (Open Researcher and Contributor ID) (Forte, 2017) gives academics a durable, one-of-a-kind digital ID that sets them apart from other researchers with similar names. Thanks to the ORCID ID, an author's work can be reliably and consistently tracked across many platforms, journals, and databases. It serves as a permanent link to the author's publications and professional contributions. It helps prevent confusion between researchers with similar names and guarantees appropriate attribution of research products, including articles, datasets, and conference presentations.

ORCID has been developed to build and evaluate the impact of writers and works. When researchers give their publications an ORCID ID, they can organise and make their scholarly works easily discoverable. Community partners can examine the writers' publications and research records to evaluate their significant contributions. An author can determine their intellectual significance by looking at the number and calibre of publications in ORCID. ORCID provides a thorough overview of a researcher's achievements and influence across multiple domains because it is integrated with many academic databases, publications, and research platforms.

Funding agencies use the authors' ORCID information to complete grants before financial aid awards. This platform maintains academic community transparency, secures financing, and upholds intellectual norms. ORCID plays a vital role in quantifying and demonstrating the influence of researchers' work by offering a digital footprint that links a researcher's publications, grants, and contributions to an internationally recognised identifier.

❖ GOOGLE SCHOLAR CITATIONS

A freely available search engine, Google Scholar, is made to index academic literature from various fields, including books, journals, conference papers, theses, and patents. In addition to managing their scholarly accounts, it helps scholars find pertinent academic materials and keep track of citations. It is a widely used tool for researchers and scholars worldwide because of its comprehensive database and easy-to-use interface.

Like ResearchGate and ORCID, Google Scholar is also an author and publication impact measuring channel. A profile from Google Scholar allows individual researchers to list their work and keep track of statistics such as citations, h-index , and i10-index numbers. These tools help gauge the notoriety and the impact of a researcher in the scientific community (Engqvist, 2010).

Google Scholar monitors the journal citation counts, and information about how many times they have been cited for each publication shows the influence of the publication in different subject areas. The platform's "Cited by" feature lets researchers track how often their work has been referenced and garner links to other studies. Google Scholar updates and Alerts. Let us say that you are interested in keeping up with the latest articles (Hambardzumyan, 2016), studies, and other publications related to one of your topics, and you do not have the time or inclination to manually perform the search regularly. Second, citation metrics and tracking will enable authors and journals to evaluate their impact and raise awareness about their work within the scholarly community.

2.4.8. PLAGIARISM DETENTION AND ACADEMIC INTEGRITY

About two decades ago, writing research papers became a tedious task. This is especially true for the Hi-Hello researcher, who took the content from others' publications and presented it in their article, showing an interesting publication they brought to the community. This was a "COPY & PASTE" practice ten to twenty years ago. This was possible when no such advanced technology was associated with tracing the malpractice in the publication field, disabling the image and prestige of the original authors.

However, the days are gone; the "COPY & PASTE" or "GIVE & TAKE" culture, notable in research publications, is continuously tracked and checked at the publisher level. Parameters are already set at various distinguished levels to control the author's delicacy, so the writer/author is more concerned about this content similarity.

Plagiarism is a well-known and growing issue (Helgesson, 2015) for everyone involved in research. Plagiarism is arguably the most serious and well-known ethical transgression in scientific literature (Rogi, 2003). Research is one of the primary sources of any development, and it differs from other ideas and styles of content presentations. Indeed, publishers come across a third of the published papers containing plagiarism (Zhang, 2010; Bazdaric, 2011; Butler, 2010). Every researcher must cite the original authors by giving due credit to their paper, which would reduce plagiarism and improve the quality of the research.

2.4.8.1. DEFINITION OF PLAGIARISM

Plagiarism is the illegal copying (Jain, n.d) of someone else's work and pretending to be one's own. The word plagiarism, or "plagiary," comes from the Latin word "Plagiarism," which means a kidnapper. The dramatist Ben Jonson coined the term in 1601 to refer to a person who has engaged in literary theft. Halsted G.B. wrote the first piece, "Complement or Plagiarism," published in "Science" in 1896. Since then, numerous articles have been written on the issue (Roko, 2017).

The WPA (Writing Program Administration) Guide defines Plagiarism this way (<http://wpacouncil.org/node/9>). In an instructional setting, Plagiarism occurs when a writer deliberately uses someone else's language, ideas, or other original (not common-knowledge) material without acknowledging its source (Nelms, 2023).

As The Longman Contemporary English Advanced Learner's Dictionary states, Plagiarism occurs "when someone uses another person's words, ideas, or work and pretends they are their own" (Helgesson, 2015; Fanguy II, 2022).

In the scholarly definitions, the more technical notions of "appropriation" and "credit" are central: "Plagiarism is the appropriation of other people's material without giving proper credit" (The European Code of Conduct for Research Integrity).

"Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit" (US Federal Policy on Research Misconduct) (Litewka, 2011).

The definition of Plagiarism given by Merriam-Webster is "to steal and pass off (the ideas or words of another) as one's own: use (another's production) without crediting the source."

Merriam-Webster dictionary defines Plagiarism as (a) the theft and use of other people's ideas or words as yours own; b) the Use of sources without attribution; c) Literary theft; and d) presenting some ideas as one's own and as if it is new, while this idea already exists in another source (Roko, 2017).

The Royal College of Physicians of Edinburgh defined "Behaviour by a researcher, intentional or not, that falls short of good ethical and scientific standards." (Al-Marzouki, 2006).

ORI: defines research misconduct using the FFP model that includes:

Fabrication – Making up data or results and recording or reporting them.

Falsification: Manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record (Shokraneh, 2009).

The World Association of Medical Editors (WAME) defines using others published and unpublished ideas or words (or other intellectual property) without attribution or permission and presenting them as new and original rather than derived from an existing source" (Shokraneh, 2009).

Therefore, the fundamental concept appears to be that someone willfully appropriates someone else's work, whether it is an idea, a method, data, findings, or text, and presents it as their own without acknowledging the source of the ideas, results, or words.

2.4.8.2. TYPES OF PLAGIARISM

According to Jain and Renu (n.d) plagiarism is of two types

- Direct Plagiarism
- Self-Plagiarism

1) Direct Plagiarism- When a researcher counterfeits the exact data or information from other sources and does not mention the citation of the original work, this results in direct plagiarism. Such works are considered to be unethical and illegal in the research area. This is an illegitimate activity and is further punishable for whoever is involved.

2) Self-plagiarism- This is the practice of using one's work that has been prepared previously without the teacher's permission. If a student uses the assignment from his previous class in various other classes, he is deliberately engaging in self-plagiarism. The students must obtain permission from their teachers to cite.

On the other hand, Roka, Y.B. suggested 07 types of plagiarism, which are described below:

- Intentional or Unintentional
- Text/words or Ideas/data
- Source
- Ghost writing
- Collisional
- Mosaic/patch writing
- Self-Plagiarism

2.4.8.3. SYNONYMOUS TERM TO PLAGIARISM

Table 6: Synonymous terms to Plagiarism

CLONE–Submitting someone else's work, which is just transcribed, as his/her own;
CTRL-C–Contains most of the text from a single source, without alterations;
RE–TWEET–Includes proper citation, but with too much text used from the original.
ERROR 404–Includes quoting non-existent or inaccurate source;
AGGREGATOR–Includes proper citation of sources, but contains almost nothing of its own work;
FIND–REPLACE–Changing key words and phrases, but retaining a substantial part of the content of the primary sources;
EMIX–Paraphrasing multiple sources that are so arranged that they complement each other
RECYCLE–The use of their own work (if the article is already published somewhere and not cited);
HYBRID–Combine perfectly cited sources with the copied without citation;
MASH UP–Blending the copied material, which is taken from multiple sources;

(Source: Google)

2.4.8.4. COMMON WAYS TO AVOID PLAGIARISM

Table 7: Common ways to avoid Plagiarism

Always acknowledge the source of the idea, text, or illustration.
Enclose within quotation marks all the text that has been copied verbatim from another source.
When paraphrasing, use your own words.
When unsure if the idea/fact they wish to include is common knowledge, cite references.
One must cite references accurately. The writer must read the instructions to authors to know which style to use (Vancouver style or Harvard referencing).
Avoid writing multiple separate articles if he can present an extensive, complex

study cohesively in a single article.
Along with the manuscript, submit a cover letter to the editor, clearly stating any instances of overlap with previous publications and asking for advice.
If unintentionally using somebody else's ideas or text without appropriate referencing, write to the editor of the journal for advice.

(Source: Google)

2.4.8.5. AVOIDING PLAGIARISM IN WRITING ARTICLES

Plagiarism is widespread even in developed countries, and can be avoided by being honest while writing articles. Some ways to do this are by being original, taking time to write articles, writing in the researcher's own words, acknowledging all the studied articles, using proper references, and strictly adhering to the author or journal guidelines. Avoid copy-paste writing and always write any similarities with other articles in the literature in the cover letter to the editor. Some key messages given by different authors in the literature are summarised by P Mohan Kumar et al.

2.4.8.6. SUPPORT FOR PLAGIARISM

Considering the seriousness of similar content publication, developing unique ideas is crucial. Content writers must avoid comparing their ideas, sentences, and words with those of others. The ideas must not knowingly or unknowingly match the earlier philosophy or ideas. Technological advancements in verifying the uniqueness of research publications restrict the publication of papers, even with minor to significant penalty charges.

This issue should be given the utmost priority at the higher educational level. What the institution concerned can deal with in this regard is to

1. **Awareness:** All the scholarly communities within the institution must be aware of plagiarism issues and challenges. Action must be initiated to stay informed about the latest penalties and charges framed by the government regarding any involvement in any form of plagiarism.
2. **ICT Integration:** Numerous technological advancements have been made to prevent content theft/plagiarism. At the institutional level, the requisite anti-

plagiarism software, which is subscription-based, has to facilitate scholars and faculty in checking the level of similarity and acting accordingly.

3. **Orientation:** Concerned institutions are solely accountable for checking research quality. To improve the standard of research papers, an orientation on using anti-plagiarism software will be conducted. The orientation on using anti-plagiarism software is intended for both researchers who will use it and library staff who will organize sessions and check the similarity for institutional purposes.

2.4.8.7. AVAILABLE ANTI-PLAGIARISM SOFTWARE

Facilitating research support services regarding anti-plagiarism is most relevant and highly in demand. At the researcher's level, comparing the content or similar ideas throughout the publication world is impossible. Software development has advanced to verify the world of content, and suggestions have been recommended for further correction in the research papers. Many of the software programs are now available to the scholarly community, and subscriptions can be made monthly or yearly. The software is enabled with the features to check plagiarism, generate citations according to the relevant citation standards, check grammatical errors, and select proper vocabulary for the subject content. The anti-plagiarism software dominating the world is:

Table 8: Anti-Plagiarism Software

Name of anti-Plagiarism Software	Headquarter	Year of Commencement	Types of Software
Turnitin	Oakland, California	1998	Commercial
Grammarly	San Francisco, California	2009	Commercial
Unicheck	Sacramento, California	2014	Commercial
Viper	Fujairah, UAE	2007	Commercial
i-Thenticate	Oakland, Calif	2002	Commercial
<u>PlagScan</u>	Germany	2009	Commercial
<i>Scribbr</i>	Netherland	2024	Commercial
<i>Copyleaks</i>	New York	2015	Commercial
Originality.ai	Canada	2022	Commercial

(Source: Individual website of service provider)

2.5. ROLE OF TECHNOLOGY IN RESEARCH SUPPORT

Technology's role in transforming and surviving research support is, without doubt, transformative and essential to the current research landscape. It has changed how scientists discover, access, and distil information — how we find information, work together, use data, and share findings. Its primary role is in retrieving knowledge. With the internet resources, e-libraries, and search engines available, researchers also find themselves in an entirely new stage of accessibility to publications, provided they are made available by the publishers (Ghalia & Dahman, 2017). It is no longer a question of location when attempting to access materials without the restriction of geographical place, the limits associated with literature reviews, and background, with the advent of the internet.

It also forges an esprit de corps between global researchers and has mobilised friends and foes to work together effectively. Scholars can talk, exchange information, and cooperate on projects worldwide through virtual meetings, webinars, and collaborative platforms. This interconnectivity has fostered interdisciplinary collaboration and has broadened the range of views in the research, making researchers feel more connected and part of a global family.

Technological advancements have made different tools and software artefacts available for analysing complex data. These tools allow researchers to work more effectively, using data visualisation tools and machine learning algorithms to extract knowledge from their data, leading to more trusted data-driven research output.

Technology has changed how and to whom research reaches the world. The reasons for the shift were preprint servers, academic and social networks, and open-access publishing. These initiatives have injected transparency into research, accelerating the time it takes to discover research and making it available to more people.

In short, technology becomes an indispensable partner in research assistance, especially in accessing information, collaborating, analysing, and exchanging ideas.

As its integration into research methods proceeds, it becomes increasingly possible that it will enable innovation and drive understanding in a multitude of areas.

2.6. CHALLENGES AND OPPORTUNITIES IN RESEARCH SUPPORT SERVICES

Research support services are in demand at the time. It is expected to get the RSS from every institution's library. It is not limited to only research institutions or even funding agencies. However, to boost creativity and provide ample opportunity for the new generation to showcase their intellectual capability to the world. Every step, from the topic selection to thesis submission, is associated with the latest trends and research practices. So, it is difficult for the research scholars and a significant challenge for the library staff to comprehend the situation and the needs required for the research process. It involves many theoretical and practical skills. The library may face different challenges in extending research support services. At the same time, they can find a suitable scope to enhance the support services. The opportunity to grow library services in research areas to make it fully competent and resourceful in all respects. Some of the general challenges that can hamper the library support service are:

2.6.1. RESOURCE LIMITATIONS

The library comprises reading resources and human resources. However, it does not have a sufficient budget to procure all the resources necessary for the research and recruit the required library staff. Among these limited staff, there is a lack of competencies and skills to handle advanced technology. Some libraries lack the buildings and furniture to organise research-related services. These are significant limitations pulling back libraries' ability to offer adequate research support.

2.6.2. RAPID TECHNOLOGICAL ADVANCEMENTS

Present-day research activities and standards strategies are unlike the traditional research pattern, where physical resources surround research sources. This time, technology has dominated the research cycle. AI, machine learning, programming languages, data handling, and ethical dignity are common. Unless and until the LIS

profession is competent to handle such advancement, it cannot support its institution's research scholars. Hence, technical skills in handling advanced research practice are one of the challenges and barriers to providing effective research support services.

2.6.3. DIVERSE USER NEEDS

To appeal to a broad user base, research support services must balance customisation and flexibility. Each subject discipline from which researchers derive brings its vernacular, methodological approaches, and resource needs. For instance, while a scientist working in STEM may require data sets, laboratory help, or modelling software, a humanities researcher is likely to prioritise the ability to get access to archival materials and qualitative analytic tools. Given these varied needs, subject-specific support is needed to ensure researchers receive relevant and valuable support.

Researchers also differ in their resource utilisation. More experienced researchers may seek more advanced resources, such as software for systematic reviews or bibliometric analysis. At the same time, beginners usually require more fundamental assistance, such as training in database usage or information literacy. Research support teams and libraries must evaluate these variations and create individualised or tiered services to address skill gaps successfully.

Meeting various expectations, which may be influenced by institutional, cultural, or generational reasons, is equally crucial. Some users may prefer virtual platforms or self-service tools over in-person consultations. If a variety of distribution methods are offered and inclusion is promoted, all users will feel supported. Research support services may foster an environment where all researchers, regardless of their background or field of study, can flourish by embracing this variety.

2.6.4. AWARENESS AND ENGAGEMENT

Research support services face a significant problem in ensuring researchers are aware of and use the available resources. Many researchers, particularly those in their early careers, may not fully understand the range of services (Lukes et al., 2014) offered by libraries and support teams. Because of this misinformation, crucial resources like

training programs, advising services, and state-of-the-art research tools are regularly underutilized.

Furthermore, some researchers could be reluctant to ask for help because they have false beliefs about their ability to support themselves or because they are reluctant to admit when they do not know enough.

Support services can also be complicated or overwhelming to access for others, further deterring them from participating. Problems like these will be solved when institutions prioritise proactive outreach (workshops, orientations, focused communication strategies). It has the potential to generate widespread awareness as well as support for active engagement through the provision of tools that are easy to use, services at the point of need in the research life cycle, and an ambient environment supportive of doing so. This will ensure that the investments are used effectively in optimising research outputs.

2.6.5. DATA MANAGEMENT CHALLENGES

The library's task of good discipline, no doubt, is managing research data when expanding research support services. The explosive growth of information in every subject area is not manageable by the library in all instances; that is one of the interesting library trends in how the library connects its users with this explosion. Data security is another challenge, considering that libraries have to keep sensitive data from being compromised, yet they have to keep the data accessible to their clientele as well.

And then there are data-sharing expectations that complicate the picture. Researchers are often guided by the requirements of funders, institutions, and global open data standards, but variations may be considerable by discipline. Libraries must adhere to these guidelines by providing rules on creating metadata, selecting repositories, and documenting accurately. However, their ability to meet these calls may be limited by deficiencies in resources and expertise.

To address these challenges, investments in infrastructure, personnel training, and joint work with IT and research organisations are required. Libraries can enhance their support to researchers to address the growing demand for effective data management using state-of-the-art solutions such as data repositories and automated management tools.

2.6.6. PLAGIARISM AND ETHICAL CONCERNS

Libraries face several challenges in providing research assistance services because of plagiarism and ethical concerns. It is the duty of libraries to advance research integrity and to ensure that researchers adhere to ethical conduct on all levels of the study lifecycle. Dealing with this responsibility effectively requires sustained effort, investment, and attention.

2.6.7. COMPLEXITY OF PLAGIARISM ISSUES

Research plagiarism can take many different forms, such as self-plagiarism, incorrect citation, or direct copying. Addressing these problems calls for sophisticated knowledge and action. Researchers, particularly those in their early careers, are unaware of appropriate citation guidelines or the moral ramifications of exploiting someone else's work without giving credit. Libraries must teach researchers about plagiarism's repercussions and how to avoid it, as well as offer resources for detecting it.

2.7. NEED FOR ADVANCED TOOLS AND TRAINING

Libraries frequently spend money on plagiarism detection programs like iThenticate and Turnitin, which require significant financial and technological resources. Despite their effectiveness, these tools must be used with training programs that teach researchers how to use them correctly and analyse their findings. Also, training related to ethical dignity, writing style, and copyright is essential. These areas must be updated regularly to maintain library and professional dignity in performing library jobs.

2.8. CULTURAL AND DISCIPLINARY VARIATIONS

There are no other challenges to addressing the disciplinary/cultural differences in research ethics, education, application, etc. For instance, the definitions of plagiarism and ethical violations may vary between disciplines, so it is not easy to implement an across-the-board approach. Libraries will need to create training and policies that address these differences while upholding universal ethical values.

2.9. FRAMEWORK FOR EFFECTIVE RESEARCH SUPPORT

A Framework for Effective Research Support is needed to deliver the range of services researchers need in an organised and dependable manner. A workable architecture for research support has to be in place so that researchers can access the support, tools, and environment they need to sustain a career. Such a structure frequently has many significant components. Libraries must adjust to changing needs in today's fast-paced research climate, when interdisciplinary collaborations and technology breakthroughs are becoming more common. In order to match research support services with institutional objectives and international trends like open science, a framework helps arrange them into a logical structure. Both greater efficiency and the need to streamline, eliminate redundancy, and cater to the needs of individual research communities lead to optimal use of resources. The framework also incorporates fundamental topics such as data management instruction, research ethics, and plagiarism checks to augment the integrity and quality of the research.

Open communication is also the process's first and most important element (Core, 1997). Institutes must create an organized system by which researchers can easily access data regarding funding avenues, resources available, and news on institutional regulations and procedures. Open and consistent communication with researchers is important to keep them informed of the tools, educate them, and provide directions on their research topics.

Second, a central support hub developed to extend research support services would be more effective and convenient. This can happen to a dedicated section within the library building or an intensive webpage, which would be well-equipped and competent to assist the research community in getting the correct information,

receiving funding grant information, technical support related to their research work, and, more interestingly, expert guidance with legal support to deal with their research work. It will impact the research improvement of the institution concerned and develop managerial skills and professional competencies.

Personalized assistance is also priceless. Researchers have various needs; therefore, a one-size-fits-all strategy might not be enough. Institutions should provide targeted guidance and assistance, including mentorship programs, specialized training, or individualized grant-writing support. An environment for more inclusive and efficient research is one in which each researcher's particular needs are acknowledged and met.

The framework also includes trans-disciplinary projects and collaboration. To reiterate, NEP 2020, interdisciplinary research work has to be initiated among researchers to develop ground-breaking ideas and thoughts. Through the research support services, faculties beyond their discipline can explore the linkage with other disciplines within a collaborative state of mind.

Finally, it is critical to assess and adapt continuously. For quality assurance, the institution concerned should be accountable for reviewing and implementing research support services as needed regularly. The review committee has to gather feedback or administer a survey to evaluate the current state of services and the need for any advancement. A recommendation must then be submitted, and action can be taken at the higher administrative level.

2.10. ETHICAL AND REGULATORY GUIDANCE

Research ethics and regulatory compliance should be given the highest priority. These services offer advice on moral issues like obtaining informed consent and ensuring ethical research practices. They also help researchers navigate institutional review board (IRB) procedures and other regulatory obstacles unique to their line of research.

2.11. COLLABORATION AND NETWORKING

Teamwork is often the driving force behind innovation in research. They also feel that research support services might help in facilitating teamwork by providing shared user

access to interdisciplinary forums, communities of practice, and networking and collaborative tools and facilities. These factors enhance the quality and importance of researchers' work by promoting communication, sharing, and teamwork.

2.12. TRAINING AND PROFESSIONAL DEVELOPMENT

Learning and reskilling are essential for researchers. These services provide training seminars, workshops, and courses to improve researchers' knowledge of methodology, analysis, and research reporting. Being involved in training and professional development schemes allows researchers to stay updated on methodologies and trends.

2.13. BEST PRACTICES IN RESEARCH SUPPORT: WORLDWIDE

Realising the importance of research support services in support of research activities, countries worldwide are taking initiatives through their libraries to implement the best practices. These practices are remarkable and exemplary for others who want to get the service implemented for their researcher. Some of the best exemplary research support services worldwide are presented here.

Table 9: Worldwide best practices of RSS

Name of the Library	Country	Best Practice of RSS
Harvard University Library	USA	• Offers extensive research guides, tools, and personalised consultation services. • Provides workshops on citation management, data visualisation, and research data management. • Manages a vast array of digital resources, including HOLLIS+ (their integrated library system).
British Library	UK	• Houses an extensive collection of resources, including legal deposit materials and historical archives.

		• Supports researchers through services like the British Library Labs, which promotes the innovative use of digital collections. • Provides workshops on text and data mining and access to specialized databases.
University of Oxford Bodleian Libraries	UK	• Training programs on digital humanities tools and data mining. • Extensive manuscript and special collections for historical research. • Collaboration platforms to connect global scholars.
National Library of Singapore	Singapore	• Offers research services tailored to specific industries and academic disciplines. • Runs training programs for data-driven decision-making and systematic reviews. • Utilizes advanced AI tools to assist with resource discovery.
National Library of Medicine	USA	• PubMed Central for open-access biomedical literature. • Training on systematic reviews and evidence-based practices. • Advanced tools for genomic and clinical data analysis.
Australian National University (ANU) Library	Australia	• Focuses on open access and data curation through its Open Research initiative. • Provides bibliometric and altmetric analyses for researchers to measure impact. • Supports Indigenous knowledge and research through culturally sensitive practices.
Singapore Management University Libraries	Singapore	• AI-powered research discovery tools. • Personalized research consultation services. • Integration of makerspaces for hands-on learning and innovation.
Stanford University Libraries	USA	• Offers a robust suite of services, including the Stanford Digital Repository for data archiving and sharing. • Provides expert consultations on GIS, data science, and scholarly communication. • Promotes innovative use of technology, such as

		AI and machine learning tools for research.
Indian Institute of Science (IISc) Library	India	• Access to high-impact journals and databases in science and engineering. • Workshops on citation management and research ethics. • Collaboration with global publishers for webinars and updates.
University of Cape Town Libraries	South Africa	• Prioritizes access to African research and Indigenous knowledge systems. • Offers advanced services in data curation, digital scholarship, and impact measurement. • Provides strong support for interdisciplinary research.
Indian Institute of Technology, New Delhi	India	• Provides access to a vast collection of resources, including books, journals, databases, and patents, catering to multidisciplinary research needs. • Offers advanced digital services through its institutional repository, ePrints@IITD, promoting open access to research outputs. • Facilitates plagiarism detection using tools like Turnitin and iThenticate, ensuring research integrity. • Conducts workshops and training programs on topics such as information literacy, research ethics, and citation management.

2.14. FUTURE TRENDS IN RESEARCH SUPPORT SERVICES

Because of the increasing emphasis on open science, the need for interdisciplinary collaboration, and technology improvements, the future of library research support services is changing quickly. Libraries increasingly use technology advancements such as Artificial Intelligence (AI) and machine learning to expedite literature reviews, spot research trends, and offer scholars tailored recommendations. As libraries assist researchers in developing data management plans, guaranteeing FAIR (Findable, Accessible, Interoperable, Reusable) principles, and adhering to funder mandates, research data management is becoming an increasingly significant priority. The open

access and open data movements will likely grow, and libraries will have a role in curating and promoting repositories to ensure that scholarship is discoverable and accessible.

The advances in technology, the growing attention to open science, and the need for interdisciplinary support are the factors that make library research support services change so quickly. Libraries are turning to algorithms for all sorts of purposes, like speeding up the process of conducting literature reviews, identifying research trends, and providing scholars with customised recommendations. Libraries are increasingly using ML and AI to expedite literature reviews, spot research trends, and offer scholars tailored recommendations.

2.15. GLOBAL PERSPECTIVE ON RESEARCH SUPPORT ECOSYSTEM

As academic research becomes more intricate and linked, the global research support ecosystem is changing to meet these needs. An integrated system that helps researchers across the whole research lifecycle is being shaped cooperatively by libraries, research institutions, funding agencies, publishers, and technology vendors. Fostering open science methods to increase the accessibility, reusability, and transparency of research results is a significant effort on a global scale. Global equity in access to research resources is ensured by initiatives like Plan S and international funding organisation rules that support open-access publishing and data sharing.

Technological improvements are changing the research ecology. Big data analytics, ML, and AI (Hatti, 2021) are utilised to improve literature reviews, display intricate information, and forecast new research directions. Digital repositories guarantee long-term access to research outputs, while collaboration tools and platforms support interdisciplinary and cross-border research. National and regional frameworks, supported by strong legislation and training initiatives, place a strong emphasis on integrity and ethical research procedures in many nations.

Libraries are vital in this ecosystem because they help distribute information and provide essential services such as resource assistance, data curation, and bibliometric analysis. By aligning their services to global best practices, libraries contribute to the

development of a viable and equitable research ecosystem that narrows the rich-poor divide globally.

Key Components of the Global Research Support Ecosystem

Table 10: Global Research Support Ecosystem

Component	Examples
Open Science Initiatives	Plan S, OpenAIRE, UNESCO Open Science Recommendations
Research Funding Agencies	European Research Council, NIH, Wellcome Trust
Collaborative Platforms	ResearchGate, Academia.edu, ORCID
Advanced Technologies	AI-based tools, Data visualisation software, Plagiarism detection systems
Digital Repositories	PubMed Central, arXiv, institutional repositories

The Global Research Support Ecosystem is depicted in the flowchart below, which shows the connections between its main elements. Every component helps the ecosystem function and, ultimately, helps researchers generate significant research outputs.

Flow Chart Global Research Support Ecosystem

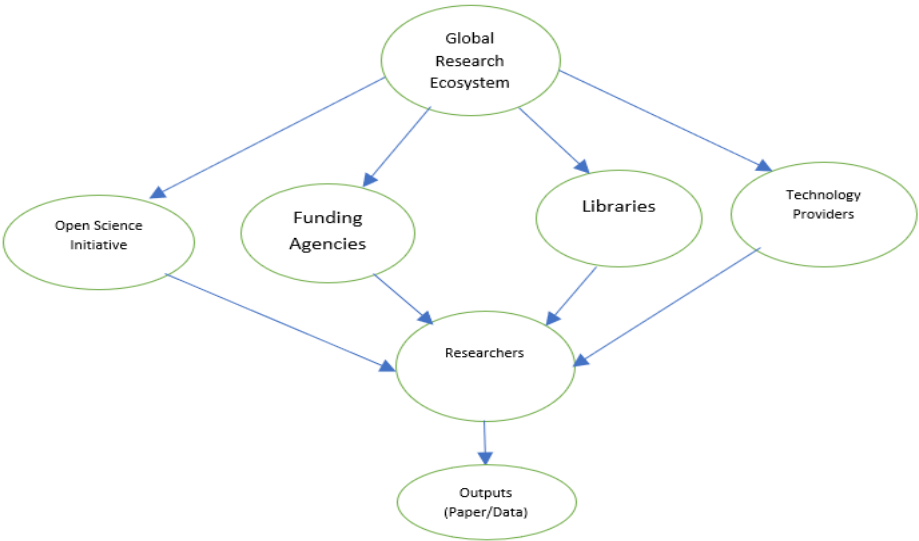


Figure 3: Flow Chart Global Research Support Ecosystem

2.16. ROLE OF LIBRARIES IN RESEARCH SUPPORT

Being the centre of the knowledge hub, an institution's library plays a crucial role in supporting research by serving as a central repository for information, knowledge, and services that enable researchers at every stage of the research lifecycle. It makes it easier to access various scholarly resources, including books, journals, databases, and digital archives, guaranteeing that researchers have the knowledge required to do work of the highest calibre. Libraries offer specialised assistance at different phases of research, including data management, publication, dissemination, and literature reviews. They improve researchers' abilities in data visualisation, academic writing, citation management, and information literacy through training programs. Libraries also support open access and open science initiatives, which ensure that research meets funder and institutional criteria while increasing its visibility and impact. They maintain research integrity by providing tools and guidance to prevent plagiarism and address ethical concerns. Libraries are essential to the contemporary research environment because they incorporate cutting-edge technologies for data analysis, bibliometrics, and plagiarism detection. Libraries continue to be vital partners in raising the calibre of research and academic excellence by encouraging cooperation, increasing research exposure, and influencing institutional policy.

Libraries are indispensable to researchers as they provide a platform for academic confirmation and the accumulation of complete knowledge. Not only do libraries make extensive digital and physical collections accessible, but they also educate scientists with the tools and critical perspectives presented here, along with researchers' expertise to navigate complex information environments effectively. They provide crucial services that help researchers match their work with international standards and best practices, like bibliometric analysis, research consultations, and support for systematic reviews. Libraries also assist researchers in effectively managing data by offering guidance on arranging, preserving, and distributing data according to institutional and ethical standards.

Libraries also contribute significantly to promoting research integrity by providing plagiarism detection technologies and educating researchers on ethical practices. In a

competitive global research climate, libraries help the academic community by fostering innovation and knowledge production through their expertise, technological integration, and researcher-centred approach.

2.17. CONCLUSION

The library's existence has never been ignored, as it serves the general purpose of reading and supporting research. The library has been continuously serving by improving various services. Research support for the library is another extension that is now a common demand of research scholars and the organisation's faculty. This is helpful for the research institutions' libraries and simultaneously plays a crucial role in the research endeavour of the educational institutions. Sustainable library practices have been used, from the collection development policy to developing a framework for effective research support services.

Services for meeting the current educational needs of students are required, as is developing research support for researchers, as per current research practice. The library regularly needs to review and analyse the services being offered, which is very suitable in response to the scholarly community's needs.

Therefore, research support services are categorised into various support areas, as detailed in this chapter. Each area or research support component is the focus of a policy developed by the library to provide this support. Many areas, such as similarity checking, data collection, data analysis, research data management, etc., often necessitate technology intervention. So, a skilful LIS professional comes forward to guide the installation, customisation, and application of these tools.

This chapter is designed to provide a comprehensive understanding of the different components of research support services. It aims to equip LIS professionals and researchers with the knowledge they need to utilise these services effectively in their work. By the end of this chapter, readers will clearly understand the essential services that every library should offer under its research support services.

The scholars have selected Odisha's NIRF ranking (2022) technical institutions to understand the said research support opportunities and advancement. Hence, having a brief knowledge of the institution under study is also important, including its library, which includes its collections (books and journals), automation, digitisation, appointed

staff, and other library services. All the details are elaborately explained in Chapter 3 (Libraries in Top Technical Institutions of Odisha: An Overview).

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CHAPTER-3

TOP NIRF RANKED TECHNICAL INSTITUTION LIBRARIES IN ODISHA: AN OVERVIEW

3.1. INTRODUCTION

India's educational system dates back to the Vedic era (Das, 2019). Instruction was given verbally throughout the Vedic era rather than through books, which may be why no libraries have been found in Taxila's archaeological digs yet, despite the city being a well-known centre of learning from 700 B.C. to 300 A.D. (Agarwal, 1954; Das, 2019). Libraries were created due to the practice of teaching through written language, which emerged with the arrival of Buddhism. Fa-Hien observed such libraries at the Jetavana monastery in Sravasti (U.P.). Nalanda University, one of the largest universities in history, was founded in 400 A.D. By 450 A.D., it gained international recognition as a centre of study (Chakravorty, 1954; Das, 2019). By the name of the educational center, the Nalanda near Patna grew to be the foremost Buddhist monastery where the oral and written form of education was imparted to its disciples. The same education also flourished in Odisha through Buddhist missionaries.

Odisha's history and culture are highly remarkable and have received due recognition in the state among all other states. Flourishing ancient culture, trade, administration, religious patronage, and international relations are elaborated with high dignity within the literature published by ancient historians, epics, travellers, and researchers. Dated back to epics like the Mahabharata and the Ramayana, Odisha is named Kalinga and Odra, and it refers to the sacred river Vaitarani and Goddess Viraja. Vayu Purana, Matsya Purana, Bhagavata, Harivamsa Purana, and Vishnu Purana also mentioned the Kalinga's Kings. Further, the Jainas and Buddhist literature like Avasyaka Nirukti, Harivamsa, Mahagovinda Suttanta of Digha Nikaya, Upalisutta of Majjhima Nikaya, Mahaparinirvana Sutta, Dathavamsa, Dighanikaya and Mahavastu, Kurudharma, Kalinga Bodhi, Sarabhang, Dipavamsa and Mahavamsa, etc. mentioned about the people of Odisha, Odisha Culture, Kings and Kingdom, Capital city (Dantapura), relation with Ceylon (Das, n.d.). So, as in the field of education, the state has earned remarkable fame at an early age. The influence of people towards Buddhism and

Jainism in the early period (3rd Century) can be considered the emergence of formal education in the state of Odisha.

The modern form of formal education in Odisha was started at the University of 'Puspagiri,' a contemporary of the oldest universities of Takshashila and Nalanda (Wikipedia contributors, 2024). The university could have flourished during the 3rd and 11th centuries with the same prestige and reputation as Takshashila and Nalanda, which were considered the major ancient centres of learning.

The state of Odisha has made significant strides in education in the 21st Century, with many universities and colleges offering specialized programs in mathematics, science, social science, and technology. Especially in the technology field, the states have imparted valuable education not only to the young aspirants of the state but also attracted students from neighbouring states to pursue a technological degree in computer science, electrical engineering, civil engineering, mechanical engineering, electronics, and architecture. Receiving fruitful technological degrees from Odisha technological institutions and universities produces several remarkable projects that recognize national importance at a later stage. Since 2000, pursuing a technological degree has become a craze among student communities. The demand from the stockholders and lack of availability of technical institutions invited the government and many educationists and business tycoons to start a larger number of technological institutions to cater to the educational needs of students and parents, as well as compete with the education system, pattern, and fee structure of existing universities and colleges. The opening of new engineering colleges in the state was not a wrong decision at the various levels; the institution ran very smoothly with an increasing number of students day by day. The quality of education imparted in Odisha is internationally and nationally recognized. State Technical University is ranked remarkably because of its education, infrastructure, and research initiatives.

Though there are more than 137 functional engineering colleges and universities all over Odisha, the seven technical institutions are making remarkable contributions to the field of technical education, for which, in the year 2022, they have been listed as the top technical institutions in the engineering category by NIRF. The scholars have

selected these universities for this study, and their brief descriptions are presented here to help in understanding the institutions better.

3.2. NATIONAL INSTITUTE OF TECHNOLOGY (NIT), ROURKELA

As per the NIRF ranking, the institution has been positioned at the top among educational institutions in Odisha since 2019 and remains at the top in 2022. Because of the institution's effort to impart quality education and meet its goal of producing a good number of future engineers in different branches of technological education, it has always retained the top position. Location, staff, infrastructure, initiative, administration, and education are perfectly set in the environment that can create the maximum number of engineers.

India's 31st National Institute of Technology (NIT), Rourkela, is located in the district of Sundargarh in the Northern part of Odisha. Establishing such a national-level institution in remote and tribal areas is somewhat surprising among parents and educationists. Leaders from the state and country have significant value in shaping such a national-level institution in the state. National Institute of Technology, Rourkela, laid its foundation on a remarkable day, i.e., 15th August 1961, in the name of Regional Engineering College (REC). The Regional Engineering College recognized the institute until 2002, with reference to the recommendation of the 2nd five-year plan (1956-60). For the high-reputation institution, the chief minister of Odisha, Biju Patnaik, handed over 1200 acres of land for its establishment, and the Prime Minister of India, Jawaharlal Nehru, laid its foundation stone in 1961. From this day, the institute has enormously imparted technical education, mainly to the aspiring students of Odisha and neighbouring states like Jharkhand, West Bengal, Chhattisgarh, and Bihar. Since 2002, the institute has been granted autonomy and functions independently under the Ministry of Education, the Government of India. The National Institutes of Technology Act of 2007 has recognized the institute as an Institute of National Importance.

3.2.1. BIJU PATNAIK CENTRAL LIBRARY

Intellectual place, the hub of a knowledge center- the BIJU PATNAIK CENTRAL LIBRARY OF NIT ROURKELA is named after the man behind the set-up of such an institution, former chief minister of Odisha, Biju Patnaik. The library is equally capable of catering to the needs of its users and researchers by facilitating both physical and electronic resources. The library is equipped with advanced technology and competent human resources to face the educational challenges of each learner and researcher. The library is located at the institution's centre, permitting easy access from all the departments and offices. Earlier in 2016, the library building was functioning from a two-story building and has shifted to a new three-story building with marvellous visual decoration. The building structure of the library is highly aesthetic and creates curiosity among the students and visitors to visit the knowledge center. The halls are well-ventilated with a centralised air conditioner, allowing comfortable furniture for silent reading and discussion. Books are kept on the open shelf with a standardised library classification code, i.e., DDC (Dewey Decimal Classification), to arrange books subject-wise for easy retrieval at the user's end.

The library has 90,700+ books, 18000+ bound volumes, 13,400+ eBooks, 8,000+ e-journals, 40+ e-databases, and 7616+ e-theses. In addition to this huge number of resources serving the academic needs of students and faculty, the library is well-developed with technological advancements, using different paid and free software and web tools for library purposes.

3.2.2. BPCL: LIBRARY EXTENSION SERVICE

Different library services are being offered by BPCL (Biju Patnaik Central Library) like book lending, reference, reprographics, reservation, selective dissemination of information (SDI), current awareness service (CAS), online public access catalogue (OPAC), research support service, research guide/subject guide, user education open educational resources (OER), e-books, e-journals. To avoid a long queue for book transactions, the library introduced the KIOSK desk to allow users to access a self-issue-return facility. This technological innovation saves users time, which will allow them to concentrate more on their education.

3.2.3. BPCL: TECHNOLOGY INTEGRATION

The BPC library has been using Libsys automation software. The complete library data has migrated to KOHA Integrated Library Management (ILM) and automation software. The integrated software lets library staff introduce a customised digital library interface in the designated OPAC (Online Public Access Catalogue) platform. It is as integrated as and compatible with generating book barcodes and supports RFID (Radio Frequency Identification) theft detection technology.

3.2.4. BPCL: APPLICATION OF LIBRARY WEB TOOLS

Being the technological institution's library, BPCL is experiencing optimum utilization of Open-Source Software (OSS) to impart library or user services. Software commonly used for digitization/ institutional repositories is Dspace, E-Print, and Fedora; blogs/weblogs through WordPress and Blogger are used for content simulation and organization. Institutional repositories developed using DSpace are immensely beneficial for readers who have accumulated a massive number of institutional publications, such as theses, dissertations, etc.

3.2.5. BPCL: READERS ASSISTANCE

All staff members are responsible for assisting their library users. There is enough infrastructure for reading. To best meet user demand and assist them in finding out about the resources and services available, the library offers services for reader support, both online guidance and offline service. It is undoubtedly noticeable that different research-related assistance is hyperlinked by the heading of 'Research Support' in their institutional repository site at the bottom left-hand side. The services are plagiarism testing of research papers through Turnitin and Drillbit, grammatical error correction through Grammarly, Reference management/ Citation tools, Promotion of academic integrity, Article request, Journal ranking, SCImago journal ranking, and Subject/Research guide.

3.3. INDIAN INSTITUTE OF TECHNOLOGY (IIT), BHUBANESWAR

The Indian government founded the Indian Institute of Technology Bhubaneswar in 2008 under the Institutes of Technology Act 1961, amended in 2012. On March 24,

2011, the Lok Sabha enacted the Act; on April 30, 2012, the Rajya Sabha did the same. After the Ministry of Education (Department of Higher Education) of the Government of India published a notice in the Indian Gazette on July 2, 2012, amending the Institutes of Technology Act, 1961, IIT Bhubaneswar became an Institute of National Importance on June 29, 2012 (IIT Bhubaneswar, n.d.).

The institute functions in a fully greened and more vibrant environment, including exotic and indigenous deciduous and coniferous trees and plants. IIT, Bhubaneswar, is an entirely constructed and well-furnished administrative and educational building, including an Administrative Building, Academic Schools, Lecture Hall Complex, Hostels, Guest House, staff Quarters, Auditorium, Sports Facilities, Defence Specimens, Commercial Complex, Gymkhana, and Health Centre.

IIT, Bhubaneswar provides education in the educational disciplines of Electrical and Computer Sciences (EE, ECE, & CSE), Basic Science (Physics, Chemistry, and Maths), Earth, Ocean and Climate Sciences, Social Sciences and Management, Minerals, Metallurgical and Materials Engineering, Infrastructure, and Mechanical Sciences. A considerable number of students and teachers are enrolled and employed. There are 2900 students enrolled under the experienced galaxy of 200 faculty, with 150 support staff in different offices and laboratories. The intellectual galaxy of faculty members has brought out 6000 plus publications and patented 20 ideas in their respective disciplines.

Though the IIT Bhubaneswar is young, like its establishment among the IITs of India, with the dedication of faculty, support of administration and management, and curiosity and enthusiastic young engineers, the institute has been recognized by renowned government and organizations. The institute has been ranked 36th in the engineering ranking by NIRF, which is ranked 2nd in the state of Odisha (NIRF Ranking, 2022), 801-1000th rank among top world universities by The Times Higher Education World University Rankings, and 701-750th rank among top universities by QS World ranking. The ranking and recognition provide inner motivation and energy for the faculty and staff, attracting aspiring students to select IIT Bhubaneswar as their ultimate hub for pursuing an engineering degree.

3.3.1. IIT, BHUBANESWAR: CENTRAL LIBRARY

One of the leading facilities tasked with supplying the academic and research community of IIT Bhubaneswar with high-quality information resources in all formats is the Central Library, a center for learning materials. The IIT Bhubaneswar Central Library began operations in July 2009 at the IIT Kharagpur Campus in a modest 300-square-foot space with a meager collection of 2300 textbooks. On April 1, 2011, the library relocated to Toshali Bhawan in Satya Nagar, which has a floor size of 2200 square feet. The library began providing services to the Institute's permanent site in Argul, Khordha, in 2016. In 2018, the Central Library moved entirely to its permanent campus in Argul, Khordha. With a dedication to excellence, the library plays a very important role in meeting the academic and research needs of the user community by obtaining and disseminating all kinds of information resources through prompt and creative services. The Central Library's service offerings are on par with those of any contemporary Indian library that meets international standards in terms of both scope and quality.

The library of IIT Bhubaneswar is presently on the 4th and 5th floors of its administrative building, with a sound collection of reading resources, a beautiful decorative interior, visibility, and comfortable reading furniture. The library serves nearly 2500 readers of the institution and actively meets all kinds of reading demands. Qualified, technologically sound library staff are well-versed in their readers' needs and facilitate a barrier-free reading environment.

In order to satisfy the needs of every school, the Central Library now collects books and online e-resources. Presently, the library holds more than 25600 books, 60 million e-books, which are accessed through NDLI (National Digital Library of India), 9700 e-Journal, 292 PhD Theses, 41 full-text databases, 08 Bibliographic and other Databases, 38 printed magazines and 10 daily newspapers (In English, Hindi and Odia language). The library remains open throughout the week except for any institutional holiday from 8.30 am to 9.00 pm from Monday to Friday and 8.30 am to 5.30 pm on every Saturday and Sunday as well.

The Dewey Decimal Classification (DDC) system classifies all books currently in print. They are organised on the shelf by classification number (topic-wise). For convenience, comprehensive shelf guides are placed in the stack area.

The fourth-floor reading area of the library is where the course reserve volumes are organised for reading exclusively. Near the central library's entrance (4th floor), subscribed printed magazines are grouped alphabetically. The library is automated with 'KOHA,' an integrated library management software. With the integration of the software in the library, all library circulation, cataloguing, OPAC, WebOPAC, barcoding, digitisation, open access facility, etc, are effectively disseminated to the readers. Also, the IIT library can be accessed remotely using their WebOPAC platform at <http://koha.iitbbs.ac.in/>. Advanced technology is applicable here, as by scanning the QR code, a reader can access the library's online catalogue.

3.3.2. IIT, BHUBANESWAR: LIBRARY SERVICES

The library extends many kinds of library services to meet readers' demands in all respects. Some of the services offered by the library are as follows:

Table 11: IIT, Bhubaneswar-Library Services

• Library Catalogue (WebOPAC)	• Circulation Service
• Reference Service	• Document Delivery Service
• Research Support Service	• Current Awareness/New Arrivals
• E-mail Alert Service	• Remote Access Service
• Digital Learning Space	• Barefoot Reading Space
• Reserve Book Facility and Books for SC/ST Students	• Resource Sharing
• Locker Facility for valuable items like Laptop	• Recent Research Publications of IIT Bhubaneswar
• A Book drop and Kiosk facility for self-check in and check out of book(s)	• Institutional Digital Repository (IDR)
• QR Code for smart access to the Library Catalogue through Mobile Phones	

(Source: Library website of IIT, Bhubaneswar)

3.3.3. IIT, BHUBAESAR: LIBRARY LENDING SERVICE

Books and other library resources are only issued to the registered members of the library on production of their ID (Identity Card) at the circulation desk at the time of issuing. In every transaction, the users get a receipt that allows them to take books out of the library on production to the security at the library's entrance. Library loan entitlement varies from user to user, i.e., the number of books and duration vary for the students, staff, faculty, and research scholars. The transaction details of the IIT Bhubaneswar Library are as follows:

Table 12: IIT, Bhubaneswar, Library, Lending Services

Category	Number books	Loan Period	Entitlement	Fine
U.G Students	3 books	30 days	TB, Gen. & RB	₹ 1.00
ITEP (B.Sc. B.Ed.)	3 books	30 days	TB, Gen. & RB	₹ 1.00
Preparatory	4 books	30 days	TB	₹ 1.00
P.G Students	5 books	60 days	TB & TRB	₹ 1.00
Research Scholars	8 books	60 days	TB& TR	₹ 1.00
Faculty/Academic Staff	10 books	180 days	TB& TR	₹ 1.00
Non-Faculty group-A Staff	8 books	180 days	Gen.	₹ 1.00
Scientific/Computer Staff	8 books	180 days	Gen. & TB	₹ 1.00
Group B, C, D Staff	3 books	60 days	Gen.	₹ 1.00
Project Staff	5 books	60 days	Gen. & TB	₹ 1.00
TB-Text Books, Gen-General Books, TRB-Technical Reference Books, RB-Rajbhasha books				

(Source: Library website of IIT, Bhubaneswar)

3.3.4. LIBRARY RESEARCH SUPPORT SERVICES

Along with helping the research community by providing the correct information and sources for in-depth knowledge execution, the library continues to assist them with their quality writing and maintaining ethical standards in the field of research. The library consistently assists research scholars and faculty in their research completion

in many respects. To test any similarity in their written work, they can use anti-plagiarism tools such as 'Turnitin' and 'Ouriginal' by visiting the library website and checking the similarity level by logging in to the Software. Otherwise, the scholars will ask the library staff to find the similarity percentage in their papers. Accordingly, they make changes and go for publication.

The library has subscribed to QuillBot, a research writing tool, for quality writing and sentence framing. This tool helps the IIT Bhubaneswar researcher check for grammatical errors, paraphrase, Flow, summarise, translate, and generate user citations.

Managing hundreds of references and bibliographies is critical, serious, and tedious. So, citing all the bibliographies in a proper alphabetical order very smoothly and efficiently, reference management tools such as 'EndNote,' 'Mendeley,' and 'Zetero,' open-source reference management tools, are facilitating. These tools keep the user's data safe and conveniently arrange their bibliography.

Many publications decline to accept research papers when the article does not follow their referencing style. To avoid such a situation, the library provides a link to the site that mostly follows the referencing style under the research support section on its website. The referencing style sources are APA, MLA, Chicago, Harvard, and Vancouver. So, by following these sites, researchers can easily maintain a citation style in their papers.

3.4. KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY (KIIT), BHUBANESWAR

Kalinga Institute of Industrial Technology (KIIT), a reputable name in education, has become popular as a learning destination for professionals in India. Because of the quality of its academic programs and community service projects, it is well-recognised as a university of compassion and humanitarianism. Since no other Indian educational institution has expanded in scope and scale as much as KIIT has in just 25 years, it has become a case study. Its amazing metamorphosis is genuinely a voyage from dirt to gold.

KIIT began as an Industrial Training Institution in 1992–1993. However, with the addition of undergraduate and graduate courses in engineering, management, and computer applications, 1997 is regarded as the university's foundation year. The School of Law, Biotechnology, Medical Sciences, Dental Sciences, Nursing, Mass Communication, Film & Media, Fashion, and KIIT International School were among the numerous additional institutions added to its umbrella in 2007. There has not been any turning back since. Approximately 40,000 students from all over India can now receive professional education at KIIT. Two thousand international students from 65 different countries are included in this. Over one lakh KIIT alums have succeeded in academia, business, government, and nonprofit organisations.

It is hard to believe that Dr. Achyuta Samanta, the founder of KIIT and KISS, a modest and unassuming individual, founded such a renowned institution with a worldwide reputation. He began the institute with a mere Rs 5000 as an initial investment. He was passionate about changing the world and had lofty goals. Dr. Samanta began KIIT with 12 students and two staff members in two rented rooms. The once tiny university has expanded to unfathomable proportions and occupies a massive academic township spanning 36 square kilometres. Over 3000 distinguished teachers, researchers, and 15,000 staff members are employed across its 25 verdant sites. KIIT and KISS comprise a family of more than one lakh individuals.

Because of its high calibre of research, innovation, publications, and citations, it has been accredited and affiliated with numerous national and international organizations, including the Institution of Engineering and Technology (IET), UK, and the (Bakhsh, 2023) Accreditation Board for Engineering and Technology (ABET), USA. Since its founding, KIIT has had a stellar placement record thanks to its high-quality teaching and learning methodology and strong brand. According to the Times Higher Education "World University Ranking 2024," KIIT is in the 601–800 cohort. Its total engineering ranking is between 401 and 500 worldwide, and its computer science engineering is between 301 and 400. The Times Higher Education Young University Ranking 2024 lists the top universities worldwide. The National Assessment and Accreditation Council (NAAC) has awarded KIIT an A++ grade, and the Ministry of Education's National Institution of Ranking Framework, or NIRF, has ranked it 15th overall in

India. According to the AICTE, Government of India, it has been the leading private university for innovation for two years (2020, 2021). According to the Times Higher Education Young University Ranking 2024, it is placed 168th out of all universities worldwide.

3.4.1. KIIT CENTRAL LIBRARY

Students, research scholars, and faculty from various schools can use the Central Library's materials and services. The library is housed on an independent campus and is complemented by 15 reputable independent school libraries in each of the KIIT Deemed to be University's schools.

The materials and services provided by the Central Library can be accessed by students, research scholars, and faculty of all Schools. The library is located on a standalone campus and supported by 15 well-known independent school libraries in each of KIIT Deemed to be University's schools. The Centre of Learning, the Central Library, an eight-story building covering 10,000m², is the University's main library. The main library is essential to the University's reinforcement of its academic curriculum. Once identified, reviewed, acquired, and prepared, these learning resources are available for faculty, students, and scientists to use for their teaching, learning, and research activities. As school libraries grow their holdings and services, they act as guides. In order to promote multidisciplinary and value-added research, the central library's resources include an outstanding collection of books, reports, journals, electronic resources, institutional repositories, and objects across all fields. For every subject taught at the University, the library also has a collection of VSS reports, MTS reports, project reports, case studies, working papers, and yearly reports. The institution has a distinguished Library Web Portal that facilitates access to electronic resources, including millions of electronic theses and dissertations, online databases, e-journals, and e-books.

Additionally, by assembling a well-rounded collection from renowned religious institutions, missions, and math departments, the University has recently opened a unique spiritual library at Jagannath temple, KISS, serving the requirements of religious people, lowly souls, saints, and philanthropists. The University opened three

impressive libraries in 2019: the Gandhian Library, the Fiction Library, and the Poetry Library.

3.4.2. LIBRARY COLLECTION OF KIIT CENTRAL LIBRARY

Students, research scholars, and faculty members from various schools can access library resources and services from the Central Library, housed on an independent campus, and from 15 reputable independent school libraries in the respective schools of KIIT Deemed to be University. The University's primary learning resource centre is the Central Library, a seven-story structure spanning 10,000 square meters. It is pretty surprising to imagine a vast collection held by a private institution's library. The central library acquired a marvellous collection of 2,27,770 reference books, 11,16,300 textbooks with 53,523 titles, 42 e-journals databases, 571 print journals, 67 magazines, 27 newspapers in English, Hindi and Odia language, more than 41,597 entire text e-journals, more than 4.3 million e-theses and dissertations from 1700 top universities of the world, 1,69,470 e-books and more than 29821 rare books collections.

3.4.3. LIBRARY BUILDING AND FURNITURE

KIIT Central Library is a seven-story building decorated with world-class furniture. Colourful library furniture, including racks, reading tables, and chairs, is very comfortable and attractive, creating a motivational reading environment for the readers. The library is a fully air-conditioned space, making it comfortable for reading. Library books are arranged by following the Dewey Decimal Classification (DDC), the latest edition, to arrange books with subject order. Library readers find their choice book in the library's WebOPAC. WebOPAC service is offered through KOHA-integrated library management software. Online Public Access Catalogue is an interface to search library books and journals, and provides a login platform for the readers to check their library transactions and membership status.

3.4.4. DIGITAL LIBRARY: CENTRAL LIBRARY KIIT

The digital library of KIIT is a home for thousands of online resources. A digital library is a platform for essential journals and a database of renowned publication companies. Such resources include a) Databases: Science Direct, ACM Digital Library, ProQuest,

Emerald, EBSCO Business Source Complete, Taylor & Francis Online Journals, etc. b) E-books: E-Brary, Thomson Reuters' E-Book, Elsevier e-books, EBC Reader. c) Rare Books: Atla Historical Monographs Collection: Series 1 and Atla Historical Monographs Collection: Series 2. d) E-Dissertation & Theses: PQDT (ProQuest Dissertation & Theses). e) Bibliographic E-Database: Scopus, Web of Science, Embase. f) Patent Database: Derwent Innovation. g) Institutional Repository: D-Space (IR Software).

3.4.5. LIBRARY RESEARCH ASSISTANT

Ensuring excellence in research quality and impact, the library supports a diverse array of research collections and services that help its researchers to increase their research quality and impact. The central library of KIIT is highly instrumental in rendering research support to its readers at various stages of research activities. To drill down, say, a research gap that the reader is looking for in their subject area, many journals and databases are available for access, reading, downloading, and addressing the required gap to advance the subject.

Research is sufficient by providing the resources and other areas that play an important role in the quality production. The KIIT library provides anti-plagiarism software 'Turnitin' to reduce content similarity with other worldwide publications. 'EndNote' software is designed to maintain research data. The software keeps thousands of collected articles safe and secure for users. Lastly, the software helps the researcher develop a standardised bibliography according to standard citation patterns, such as ALA, MLA, Chicago, etc. Analysis of research data is a very tedious task. The researcher has to critically analyse the qualitative and quantitative outcomes of the research. Effective software is used to make the analysis accurate and interactive. KIIT gave SPSS a data analysis service to its readers and faculty. With all this research assistance, the KIIT central library plays an important role in building an educational career and enhancing the institutional ranking of the faculty and researchers.

3.5. SIKSHA ‘O’ ANUSANDHAN DEEMED TO BE A UNIVERSITY

A transformative institution in the technical education sector, Shiksha' O' Anusandhan, deemed to be a university, is dedicated to educational excellence with all-round student development. The vibrant institute was founded by Prof. Manoranjan Nayak (GeeksforGeeks, n.d.), a visionary leader who has emerged as a frontier centre for education, innovation, and research. The students were pushed to acquire more in-depth information and competencies to flourish in any advanced setting with greater flexibility by the well-designed curriculum and teaching methods. Additionally, the organisation is dedicated to creating a friendly and socially conscious environment. An article by Himani Chopra in Jagran Josh on 4th November 2024 reported that the institute was founded in 2007 (Chopara, 2024). Siksha' O' Anusandhan (SOA) is a deemed university situated in Bhubaneswar, Odisha. The University has received an "A++" grade from the National Assessment and Accreditation Council (NAAC) and is accepted by the University Grants Commission (UGC). Siksha' O' Anusandhan is mainly famous among students and parents for its quality education in engineering, medical science and business studies, agriculture, Law, Pharmacy, Nursing, Veterinary and animal husbandry, and Hotel Management at various campuses. According to the 2023 NIRF rankings, SOA University is placed 27th in the Engineering category, 57th in Management, 16th in Medical, 8th in Law, 15th in University, and 26th in Overall. SOA has been ranked NAAC-accredited with a third-cycle "A++" rating and internationally ranked according to the 2025 QS and THE World University Rankings. The Indian government's UGC has granted the university Category-I Graded Autonomy Status. The MHRD NIRF India Rankings for 2024 place it 14th in the university category and 26th in the engineering category. In the 2024 MHRD NIRF India Rankings, the institute ranks ninth in the dental category and twenty-first in the medical category. 9th in the law category, 50th in the research category, and 62nd in the management category are the rankings for 2024 from the MHRD NIRF India. Swachh Campus: Third in the country. OBE stands for outcome-based education—programs certified by the NBA and ICAR. NABH accredits SUM Hospital, while NABL accredits the Diagnostic Laboratory.

To achieve a recognised position in NIRF, QS WORLD, Times of India, UGC, NAAC, NABH, and NBA ranking is a credit shared with students, faculty, administration, and management. However, the institution's library plays a crucial role behind the scenes. As the educational curriculum is responsible for the development of students and faculty, the library's role is to facilitate those valuable resources that supplement ideas and knowledge for the stakeholders in achieving their educational excellence.

3.5.1. LIBRARY: SHIKSHA 'O' ANUSANDHAN

The SOA library building is preferably accessible with a 1500 seating capacity. The library of S'O'A engineering institution is developed for the reading and research purposes of engineering students, faculty, and research scholars. The library is well furnished, entirely air-conditioned, and is in a five-floor building. The collection included textbooks, reference books, journals and magazines, back volumes, and daily newspapers. The library remains open for the readers from 8.00 am to 10.00 pm on Monday to Saturday, whereas on Sundays and holidays, it functions from 10.00 am to 2.00 pm. The library book bank addresses the educational needs of the ST/SC students and remains open from 10.00 am to 5.00 pm on all working days except designated holidays.

3.5.2. LIBRARY AUTOMATION AND DIGITIZATION

Like the other libraries, the institute library enjoys the benefits of automation and digitisation. The library is automated with Libsys, an integrated library automation software. The software is helpful to both the library staff and readers. With the help of automation, users can find their books on the shelves without wasting much of their valuable time. On the other hand, library staff perform issue-return tasks very smoothly, as well as data entry, cataloguing, and other library housekeeping operations.

For wider dissemination of library services and resources available online beyond library hours, DSpace is an open-source software implemented to digitise the library. The digital library facilitates resources such as institutional publications, PhD theses, and open-source journals by providing access to individual credentials for scientific

communication through the digital library interface. Resources that are highly impactful and effective in citing stakeholder research activities are logically selected.

3.5.3. DIVERSE LIBRARY SERVICE BY S'O'A LIBRARY

Providing different library services to suit the demands of its users is one of the library's proactive initiatives. The services include the acquisition of library books. The process is very systematic and selective as it involves the recommendation per the requirements of each reader. The library receives book requisitions online from its students, faculty, and research scholars. These are scrutinised with the existing library collection and processed online with the publishers and vendors to make them available. A minimum of 15000 new sets of books are added to the library every year, with a ratio of 1:4 (four books to each reader). The books are accessioned, catalogued, and classified by qualified LIS professionals and made ready to be accessed by the readers.

The circulation section is meant to handle the book's transactions through the Libsys software. Circulation demand is responsible for issuing, returning, reserving, collecting fines for overdue items, and issuing no-due certificates.

The reference service actively provides the right stack to the right users to meet their academic needs. Though it is extended to all its users, it is highly beneficial for the institutions' research scholars and faculty members. The service provides reference services to physical collections and guides users to the right online resources available at various sources.

The library has developed a book bank service that allows students to issue books for six months by paying only 15 per cent of the cost of the book; however, students belonging to SC/ST are exempt from such payment. Interested students must register with the book bank by paying only 20.00 rupees for the service's benefits. The book bank consists of 3760 books with 98 unique titles. Presently, the service is enjoyed by 534 students.

Among these services, the library regularly conducts user orientation regarding library usage and different online resources. Other services include reference services,

selective dissemination of information, bibliographic compiling, reprographics, new arrivals, user education, and alerts.

3.5.4. ONLINE JOURNALS AND DATABASES

Realising the importance of e-journals and databases regarding teaching and research, the S'O'A library subscribes to different e-journals and databases to meet users' demands. Such highly impactful journals, abstracts, and citation databases are Scopus complete text databases such as Science Direct (include 263 titles on Biochemistry, Genetics & Molecular Biology, 113 on Chemistry, 134 on Computer Science, 221 on Engineering, 687 on Health Sciences, 101 on Mathematics, 139 on Materials Science and 113 on Physics & Astronomy), IEEE Xplore Digital Library, EBSCO Host, PROQUEST, Royal Society of Chemistry, Springer Link, American Society of Mechanical Engineers (ASME), American Society of Civil Engineers (ASCE), Westlaw, Manupatra, Lexis India + International content - Legal Research Academic solutions, and Wiley.

The library includes ProQuest's Ebrary and Ebscohost's ECM, two e-book databases. A subscription to ProQuest's Ebrary allows access to 10,000 E-Books, whereas permission from Ebscohost's ECM allows access to 5,50,000 E-Books. Such a vast online database is definitely a paradigm in the field of education for the institution's students and faculty.

3.5.5. RESEARCH SUPPORT INITIATIVES

As mentioned above, the library facilitates a wide range of physical and electronic library resources for scholarly research and innovation through various projects and research initiatives. To justify the project's uniqueness and surpass ethical and legal aspects, the library helps the scholar find new resources and map the collection to identify the gaps in the field. Support writing the project with proper grammatical errors, including spelling, punctuation, phrases, etc.; support proper data analysis by incorporating available data analysis software, which gives a customised, demised, and visualised graphical presentation. The most important research cycle is to find out the project's similarity with any other that has happened earlier. The library provides

subscription-based anti-plagiarism software called 'Turnitin' to determine the designated similarity level. Users are informed to send their research papers to the library through a designated email ID to check project uniqueness. If any similarity beyond the permission level is found, it is immediately intimated to the author for due correction following the heading to its publication. Publishing the research paper is also a tedious task for the author; here, the library supports by suggesting and displaying high-impact factors in journals in the respective fields of the subject. A highly qualified and competent library staff provides service in a befitting manner.

3.6. VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY

By converting the University College of Engineering (UCE) Burla into a non-affiliating unitary university, the Orissa Act 9 of 2009 created the Veer Surendra Sai University of Technology (VSSUT) in Odisha. The Industries Department of the Government of Odisha issued the notification on July 1, 2009 (see Memorandum No. IV/TTI-33/2009-8553 and 8564 dated June 10, 2009). The Odisha government approved the first VSSUT, Burla 2010 statutes on June 21, 2010, through notice No. V-FE-II-01/2010/8697 from the Industry Department. The University Grants Commission (UGC), New Delhi, has also recognised this State Government University with UGC letter No. F.9-36/2009(CPP-I), dated January 5, 2010. Section 22 of the UGC Act gives the University the authority to grant degrees as determined by the UGC. By letter F.No.9-36/2009(CPP-I/PU) dated November 8, 2012, the University has been deemed eligible to receive central aid under Section 12B of the UGC Act.

Veer Surendra Sai, the famous Indian freedom fighter who was born on January 23, 1809, gave his life in battle against the British and passed away in obscurity in Asirgarh Jail on February 28, 1884; he is honoured by the name of this illustrious University. Veer Surendra Sai is the ideal role model for our professionals who want to commit their lives to the cause of their homeland in a university where so many young scholars have come to develop their lives. This real-life hero continues to inspire pride throughout the University.

The early history of the University, which is located at the base of the well-known Hirakud dam, is an intriguing part of the tale of technical education in Odisha. The first engineering college, known as the University College of Engineering (UCE), was founded at Burla on August 12, 1956, and operated as a component college of Utkal University in Bhubaneswar. Creating engineers capable of managing the Hirakud Dam was the engineering college's founding goal. Nearly 300 acres of beautiful property in Burla are owned by the University. The participation of the Odisha Irrigation Department was, in fact, the deciding factor in this University's location.

In addition to offering its students state-of-the-art facilities while upholding traditional values, VSSUT uses its extensive industrial connections to shape young, gifted people who can succeed in the global marketplace. VSSUT wants to be regarded as one of the world's top universities. Therefore, VSSUT aims to train people to be competitive not just in India but globally as well. The University has embraced a dynamic, international, superior, innovative, and communicative approach to education, research, and development in the face of fierce competition.

VSSUT continuously reorganises its physical infrastructure, research, and educational facilities to stay current with contemporary advancements. Students on campus have access to sufficient facilities in departmental labs and central facilities, including the library, computer centre, internet centre, workshop, separate dorms for boys and girls, a conference room, recreational facilities, and other utility services. Both undergraduate and graduate programs adhere to the semester structure. English is used as the teaching and learning medium. To keep the quality of technical education on par with other internationally renowned institutions, the syllabus is changed frequently, taking into account industry demands and technological breakthroughs. The University has infrastructures for all indoor and outdoor games.

The following academic programmes are available at VSSUT

- Bachelor of Technology (B. Tech)
- Bachelor of Architecture (B. Arch)
- Master of Technology (M. Tech)
- Master of Science (M.Sc.)

- Master of Philosophy (M.Phil)
- Master in Computer Application (MCA)
- Doctor of Philosophy (Ph.D.)

3.6.1. AN OVERVIEW OF VSSUT LIBRARY

The State's most significant technical library is the VSSUT Library. With the help of the State, U.G.C., and governments, a new library building was created, and the library has been operating in its newly built space since July 1997.

The new library building is 10,900 square feet and has three stories. The library's various divisions are organised over several floors. The General Book Bank and the Circulation Section are on the ground floor. The Library's Journal, Reference, Reprographic, and administrative sections are on the first level. The Textbook Section is located on the upper floor. This floor has a reading hall that can accommodate 100 students. The SC/ST Book Bank occupies a section of this floor. Every working day of the week, the library is open from 10 AM to 8 PM, except the sweltering summer months of April and May, when there is a break from 1 PM to 2.30 PM.

The library has acquired almost 70,000 books, including microfilms and photostats. About 70% of the collection comprises engineering disciplines, with the remaining 30% being general reference, science, and humanities. One microfilm reader is available at the library.

With funding assistance from the All-India Council of Technical Education, the university is now a part of the Indian National Digital Library in Engineering Science and Technology. Therefore, all library members have online access to the ASCE, ASME, and IEL periodicals. Additionally, the library has access to JET (J-Gate Engineering and Technology) under the INDEST's auspices. However, due to financial constraints, the library stopped subscriptions to foreign periodicals in 2004. Nonetheless, the library subscribes to twenty-seven (27) national journals. The Library's Journal Hall features a display of all of the current magazines. The Central Library is fully automated using KOHA (Open-Source Integrated Library System)

integrated library management software. The library subscribes to 53 print journals, 4066 E-Journals, and 2 Databases (Subscribed e-Resource, n.d.)

Regarding the research support services, the library knows the research needs and facilities. So, with the provision of access to quality journals for literature review and reference purposes, journals and databases are being subscribed to by the library. The library website is linked to the e-Sodhsindhu consortium, DELNET e-resources, and IEI e-resources. Along with these, other free e-resources, as mentioned in the table below, are also facilitated by the library for the researchers.

Table 13: VSSUR, Subscribed e-Resources

Sl. No.	Name of Free e-Resources Site	Sl. No.	Name of Free e-Resources Site
1	Directory of Open Access Journals (DOAJ)	18	National Academic Press - Free E books
2	Directory of Open Access Books (DOAB)	19	Bentham Open Access
3	Open Library	20	Bio-Med Central
4	InTech open Books	21	ChemSpider
5	Project Gutenberg	22	Current Science
6	Open Access Theses and Dissertations: OATD	23	Free Medical Journals
7	Open Directory Project Free Dissertations	24	High Wire Press Archives
8	OpenThesis.org	25	Indian Academy of Sciences (IAS)
9	PQDT OPEN: ProQuest Digital Theses	26	J-Stage
10	Thesis Abstracts and Dissertation Abstracts	27	MathWorld
11	Chemical Sciences Repository	28	Pub Med Central
12	HAL-SHS Archive of scientific literature	29	Scientific Research Pub
13	HAL open archive Scholarly documents	30	Scholarly Exchange List
14	PhilSci-Archive	31	American Institute of Chemical Engineers (AIChE)
15	CSIR-Indian Institute of	32	Nisclair Full Text Journals

	Chemical Biology		
16	Down to Earth	33	Journal of the Indian Institute of Science
17	Medknow Publications Journals		

(Source: Central Library, VSSUT, Burla)

The library is self-sufficient in providing physical journals to its scholars and students. Along with the e-resources, the following physical journals are also subscribed to by the library.

Table 14: VSSUR, Free e-Resources

Sl.No.	Name of Free e-Resources Site	Sl.No.	Name of Free e-Resources Site
1	IETE Journal of Research	27	IETE Journal of Review
2	Indian Road Congress Journal	28	Indian Highways
3	Nano Visions	29	Journal of Pure Applied and Industrial Physics
4	Indian Foundry Journal	30	Journal of Chemistry and Chemical Sciences
5	Indian Journal of Computer Sciences & Engineering	31	International Journal of VLSI Design
6	Civil engineering & Construction Review	32	Modern Machine Tools
7	Auto-monitor	33	Journal of Environment & Development
8	Advances in Theoretical and Mathematical Physics	34	International Journal of Machine Tools and Manufacturing Technology
9	Journal of Applied Physics	35	Journal of American Chemical Society
10	International Journal of Optimization Theory and Application	36	Journal of Hydro Environmental Research

11	Architectural Design	37	Proceedings of American Mathematical Society
12	Journal of Operator Theory	38	AICHE Journal
13	Canadian Journal of Chemical Engineering	39	Journal of Chemical Engg. Japan
14	Reviews in mathematical physics	40	Modern physics
15	ACM Transactions on sensor Networks	41	ACM Transactions on information and System Security
16	Indian Road Congress Journal + Indian Highways (Combined subscription)	42	Civil Engineering and Construction Review
17	Architecture+ Design	43	Inside Outside
18	Home Trends	44	Analysis and Applications
19	Architectural Record	45	Indian Concrete Journal
20	Journal of Environmental Science Engineering (JESE)	46	Indian Architect and Builder
21	ITPI Journal	47	LA, Journal of Landscape Architecture
22	Journal of the Indian institute of Architects	48	Urban India
23	Journal of Chemistry and chemical Science	49	Indian Science Abstract
24	Indian Journal of Chemical Technology	50	Architectural Review
25	Architectural Heritage	51	Journal of materials science: Matter in Electronics
26	Nature		

(Source: Central Library, VSSUT, Burla)

As ethical issues are very concerning and challenging in present-day research publications, the institute proactively works to avoid any unethical research activities by the stakeholders. Frequently, the library organizes an orientation program and provides one-on-one support in dealing with research papers and their proper citation. In this regard, an anti-plagiarism software service is provided with a subscription to Turnitin software to produce uniqueness in the research article.

3.6.2. VSSUT: LIBRARY SERVICES

The library's highly recognised and impactful services demonstrate the dedication and commitment of library staff to the readers and show their belonging to the university. Remarkable library services apart from disseminating resources are the circulation of books, reprographic services, reference service, internet-based lab facility, news clipping, library orientation, NPTEL online course, online e-newspapers, and magazines.

In a Boquete comprising resources, e-services, research support, community engagement, hard work, passions, and compassion, the library is a unique and well-respected place within the university.

3.7. SILICON UNIVERSITY OF TECHNOLOGY

Through demanding academic programs, advancing fundamental and applied research, and encouraging innovation and entrepreneurship, Silicon University (formerly known as Silicon Institute of Technology, Bhubaneswar) combines a dedication to offering the best engineering education with the support of India's scientific and technological development.

SiliconTech, the engineering school of Silicon University, was established in 2001 in the eastern Indian state of Odisha with its vision “To become a center of excellence in the fields of technical education & research and create responsible citizens” and mission “To provide the best of technical skills, professional ethics, and human values in enriching the disciplines of Science, Engineering, and Technology for Social development and Nation building” (SIT, 2024). It is renowned for its community of reputable and committed instructors, talented students, and efficient support and administrative personnel.

The SiliconTech facility spans 18.5 acres and is located in the centre of Infocity, Bhubaneswar. This residential institution has 166 academic members, five departments, 63 laboratories, and 2838 students. Engineering, data sciences, VLSI, embedded electronics and IIoT, molecular medicine, and computer applications are among the subjects covered in Silicon's undergraduate and graduate programs.

3.7.1. SIT: CENTRAL LIBRARY AND LIBRARY SERVICES

The central library of Silicon University, Bhubaneswar, is constructed within the beautiful, aesthetic educational campus. The library is situated at the campus's central location, allowing easy access to all its departments and offices. Silicon The Silicon Central Library, which occupies 17,000 square feet, is a leader in providing its staff and student body access to the best teaching, learning, and research materials worldwide. It offers a vast library of printed books, online and digital materials, and audio and video courses. LIS professionals' organisational and managerial skills are reflected, making it easy to find the most relevant and valuable resources for diverse subject areas. The collection mainly comprises books, reference books, periodicals, databases, electronic journals, and e-proceedings. The tables below show the number of educational resources the SIT library provides.

Table 15: Library Collection, Silicon Central Library

SL.NO.	Name of Collection	Number of Collection	Number of Title
1	Books	64835	10149
2	Reference Books	9045	5537
3	Periodicals	37	NA
4	ProQuest & Elsevier e-books subscription	41969	NA
5	e-Journals	981	NA
6	e-Proceedings	35911	NA

(Source: Library website, SIT, Bhubaneswar)

3.7.2. SIT: LIBRARY INFRASTRUCTURE

With its 17,000 square feet of air-conditioned space and 450 seats, Silicon's Central Library is the perfect place for individual and group study. Reading rooms with individual cubicles facilitate concentrated study, while discussion rooms encourage interaction and collaboration.

3.7.3. SIT: COURSEWARE & OPEN ACCESS RESOURCES

Thanks to the Silicon Central Library's curated collection of Open Access resources and other Courseware tools, students can quickly locate pertinent and helpful content. Such Courseware is:

- Special Academic Group Autonomy (SAGA)
- National Programme on Technology Enhanced Learning (NPTEL)
- MIT OpenCourseWare
- OERu
- Massive Open Online Courses (MOOC)
- Academic Earth
- Open Culture
- UTM OpenCourseWare (UTM OCW), etc.

3.7.4. SIT: OPEN ACCESS RESOURCES

The SIT library facilitates more than 39 open-access resources. These resources are selective, insightful, and practical for the university's scholarly communities. Some of the resources listed below are also visible on the main library webpage with a hyperlink to the source URL.

Table 16: Open Access: Silicon Central Library

Sl.No.	Name of Open Access Resources	Sl.No.	Name of Open Access Resources
1	American Society for Microbiology	11	ASCI Journal of Management
2	Atmospheric Chemistry and Physics	12	Atmospheric Chemistry and Physics
3	Beilstein Journal of Organic Chemistry	13	Bentham Open Access
4	Bio-Med Central	14	ChemSpider
5	Cochrane Library	15	Copernicus Publications
6	Current Science	16	De Gruyter Reference Global
7	Department of Physiology, All	17	DOAJ

	India Institute of Medical Sciences (AIMS) – IJPP		
8	Elsevier	18	Engineering Journal
9	Free Medical Journals	19	Friends Science Publishers
10	High Wire Press Archives	20	Hindawi Corporation

(Source: Library website, SIT, Bhubaneswar)

3.8. CV RAMAN GLOBAL UNIVERSITY

C. V. Raman Global University, Odisha (CGU, Odisha), founded in compliance with Odisha Act 01 of 2020, exposes students to fresh and creative educational approaches. It is a thriving community of staff, instructors, and students dedicated to changing society through innovative and purposeful leadership.

The university is proud of its collaborative culture and ethos, which encourages intellectual growth and involvement. Students at CGU, Odisha, are taught to question the status quo and use creativity and analytical rigour to address the most challenging situations. To provide a genuinely worldwide education in science and technology, the university continues to add multidisciplinary courses to its current offering.

C V Raman Global University is working with its vision “To emerge as a global leader in the arena of technical education commensurate with the dynamic global scenario for the benefit of mankind” (Rath, 2024) and mission “1. To provide state-of-the-art technical education at the undergraduate and postgraduate levels. 2. To collaborate with technical institutes/ universities/industries of national and international repute. 3. To keep abreast of the latest technological advancements. 4. To enhance the research and development activities.” (Rath, 2024).

CGU, Odisha, offers 18 undergraduates, 17 graduate, 11 doctoral, and 01 integrated M.A. with Ph.D. programs. The university defines the curriculum's structure using the "Choice Credit System (CBCS)." This facility is given to students who complete the courses offered on the SWAYAM platform and can choose to transfer their credits.

3.8.1. CV RAMAN GLOBAL UNIVERSITY: LIBRARY

Ignoring the library's role in the institution's successful placement, ranking, and recognition is hard. The library has its own space and enough resources to meet the demands of its patrons. Based on the requests of staff and students, the Central Library has a collection of about 64,000 print volumes in the following areas: technology, basic science, management, marine engineering, social science, literature, and reference books. The Central Library provides subscriptions to UGC-enlisted print journals and magazines for the C.V. Raman Global University academic community. As a helpful resource, numerous complimentary copies of newsletters and booklets are available. The central library's journal stacks showcase print journals and periodicals.

3.8.2. LIBRARY COLLECTION

The library acquires a wide range of physical and online resources. The collection is self-sufficient to meet the reader's demand and is updated regularly with the latest edition. The collection includes 75601 books with 18867 titles, 15699 reference books, 5871 book bank collections, 39 printed journals, 415 back volumes, 3300 e-books are institutional, and more than 40000 are accessed through DELNET, 2188 e-journals, 446 postgraduate and 28 PhD theses, 2253 educational CDs (Compact Disks) and 10374 video lectures.

The library provides e-journal resources through its database links to access various journals. Link to e-journals is provided through IEL Online (IEEE & IEE),

ASCE Journals (American Society of CIVIL Engg.), SCIENCE DIRECT, Springer, Institution of Engineers, DELNET, and PROQUEST.

3.8.3. LIBRARY SERVICES

To help the institution's reader community, CV Raman Library offers many proactive library services, which are necessary and very impactful from the user's point of view. The services offered by the library are Reference, Circulation, Book Bank, Digital Library Services, Research support, Web OPAC service, News clippings, new arrivals, Reprographic, Inter-Library Loan, Bibliographic services, Document Lending Services, E-Document Delivery Services, Referral, and CD/DVD database search.

3.8.4. TECHNOLOGY IN THE LIBRARY

An interactive and resourceful institutional repository or digital library has been developed for the library with the help of open-source software from D-Space/Koha Digital Library. The repository is invaluable in disseminating institutional publications, PhD theses, open-access journals and databases, and research support services. The library is fully automated with complete book barcoding. Libsys automation software is used for library automation. The competent staff is enthusiastically and passionately dedicated to the library and library service in the institute.

3.8.5. RESEARCH ASSISTANCE TOOLS

However, not all the research assistant tools are visible on the library website, except for “Quillbot” for plagiarism testing. However, in the physical mode, researchers and faculty are consistently being helped by staff members in searching different journals and databases. One-to-one sessions are held to handle Kindeley, Zotero, plagiarism tools, data analysis support, and literature reviews, among other topics, by the competent library staff.

3.9. CONCLUSION

An educational institution's library plays a very important role in its overall development. These technical institutes' libraries serve as a good example of the idea of having an institution's library. They are self-sufficient in both physical collections and provide their users with online resources. At the request of the academicians at the institutions and libraries, they purchase reference books and textbooks at regular intervals. The library subscribed to highly influential national and international publications to support cognitive development and promote scholarly networking through the exchange of intellectual knowledge.

Every library has comfortable furnishings ideal for reading. There are also enough peaceful reading areas for people to research or study for the semester. The buildings have air conditioning, enough lighting, and good ventilation to adapt the library's interior to its surroundings.

Libraries are recruited with qualified human resources who are highly skilled with their professional degrees. These people handle many technological aspects of the library, such as digitisation, automation, barcoding, RFID, blogging, podcasting, CMS, and social networking.

Every library actively provides research support services to its teachers and researchers, which is appropriate given the current level of research activity. The RSS frequently incorporates data management tools, referencing style, open access to a large number of online journals, subscription, and remote access features to online databases and journals, institutional repositories, outreach initiatives, and anti-plagiarism software in these technical libraries that check the content for similarity. Having such a library at this technical institution will elevate the institution's reputation and status.

Chapter 3 presented an overview of the libraries in the top technical institutions of Odisha. The study now moves toward empirical investigation. Chapter 4 focuses on data collection, followed by detailed analysis and interpretation of the findings. This chapter assesses the availability, awareness, and effectiveness of research support services as perceived by various stakeholders across the selected institutions.

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CHAPTER 4

DATA COLLECTION ANALYSIS AND INTERPRETATION

4.1. Introduction

Analysis and representation of data in the research are very crucial in bringing collected data into actionable insights. The present chapter, ‘Data Collection, Analysis and Interpretation’, is a reflection of the survey, purposively undergone by the research scholars. The prime objective of this analysis is to encapsulate and delve into the actual status of RSS and list out the related services and challenges for the pursuance of RSS. The researcher has illustratively described the raw data accumulated from the institutions under the study through quantitative analysis aligned with the study's objectives. Analysis of raw data is depicted in tabular form for each of the criteria covered in the questionnaire, supported by the graphical representation for clarity and comprehensive understanding. To bring out the objectives of the questionnaire and the thesis to an actual, understandable form, the data analysis has been conducted in two separate parts, i.e. a) Response analysis of Research Scholars and Faculty, and b) Response analysis of Librarians (Head of Library). Based on the analysis of these two variables, an interpretation was concluded, followed by a proposed model for the effective implementation of RSS in academic institutions.

The analysis section made use of outstanding and powerful statistical data analysis tools, such as SPSS in Part I for researchers and faculty responses and the Jamovi tool for librarian replies in Part II of the analysis. Jamovi is a statistical analysis tool that may be used to do a variety of statistical analyses such as correlation and chi-square (Ahmed & Muhammad, 2021). Descriptive and inferential statistical studies were made possible by Jamovi, an intuitive statistical application that supplied the qualitative findings with robust numerical underpinning. Moreover, Microsoft Excel is also engaged partially in the data analysis of both parts. The study and interpretation in the chapter are based on the narratives and experiences of 319 respondents, providing a substantial amount of qualitative data.

By remaining focused on the prior set objectives of the study, the analysis presented the responses in an unbiased manner. To ensure a thorough interpretation of the results, each objective was carefully examined from both qualitative and quantitative perspectives. Hence, the analysis is comprehensively aligned with the study's prior objectives.

The findings presented herein contribute to a deeper understanding of the need for research development and the significant role of LIS professionals in enhancing the skills and competencies of scholars and faculty by facilitating access to the required information, sources, and tools, thereby promoting innovative practice. Through purposeful interpretation, the researcher explored comprehensive insight into research support services in selected technical institutions of Odisha.

PART- I

RESPONSE ANALYSIS OF RESEARCH SCHOLARS AND FACULTY

4.2. Overview of Data Collection

This part of the analysis concentrates on examining the all-around involvement of the research community, which includes research-related technical skills, publication awareness, competencies to handle advanced tools, familiarity with the library program, etc. The data collected from the respondents of these seven technical institutions of Odisha spanned a period of one year three months from December 2023 to March 2025. There were 319 responses collected, of which 172 were collected through Google Forms (53.91%) and 147 were collected offline or physically visited by the scholar at the concerned technical institutions (46.9%). These responses are presented through tabulation and graphical representation, shown in further stages of this chapter.

Data analysis of the study starts from Table 17 with a basic understanding of respondents' professional biodata from data analysis part I and concludes with Table 74 with majoring libraries' overall satisfaction with their research support services from data analysis part II, hence it follows:

4.3. Analysis of Collected Data

4.3.1. Distribution by Designation

The respondents' distribution by designation is seen in Table 17 and Figure 4. According to the data gathered, the majority of respondents—169, or 53 percent—were research scholars. Additionally, 106 (33.2%) of those surveyed were Assistant Professors. Nonetheless, 17 (5.3%) and 27 (8.5%) of the respondents were Professors and Associate Professors, respectively.

Table 17: Designation of the Respondents

Designation	Frequency	Percent
Assistant Professor	106	33.2%
Associate Professor	27	8.5%
Professor	17	5.3%
Research Scholar	169	53%
Total	319	100%

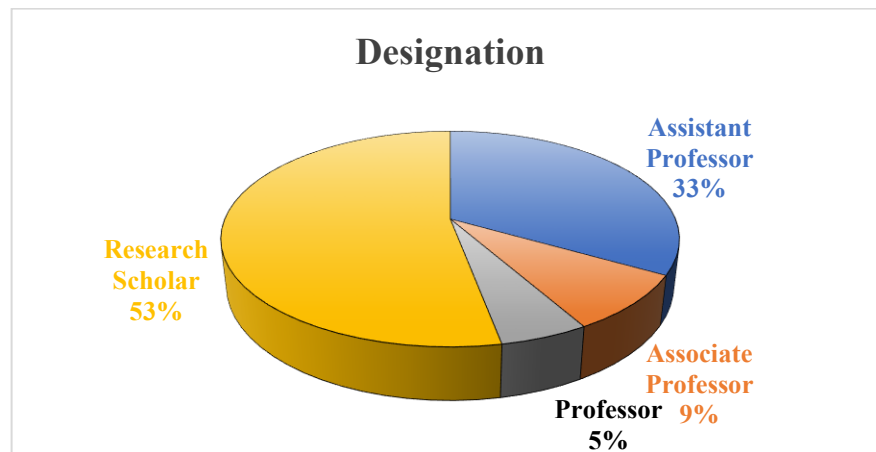


Figure 4: Designation of the Respondents

4.3.2. Distribution by Respondents' Age Group

Table 18 and Figure 5 show the respondents' distribution by age. According to the data gathered, the majority of respondents—122, or 38.2 percent—belonged to the 26–30 age group. Additionally, 59 (18.5%) of those surveyed were aged 36–40, while 54 (16.9%) fell in the 31–35 age bracket. Furthermore, 30 (9.4%) of the respondents were in the 20–25 range. The data also revealed that 28 (8.8%) participants were aged 41–45. A smaller proportion of the respondents were in higher age brackets: 12 (3.8%) were between 46–50, 5 (1.6%) were aged 51–55, another 5 (1.6%) were aged 56–60, and only 2 respondents each (0.6%) were from the 40–45 and 50–55 categories. In total, 319 respondents participated in the survey across the various age groups.

Table 18: Age Group of Respondents

Age	Frequency	Percent
20-25	30	9.4%
26-30	122	38.2%
31-35	54	16.9%
36-40	59	18.5%
40-45	2	0.6%
41-45	28	8.8%
46-50	12	3.8%
50-55	2	0.6%
51-55	5	1.6%
56-60	5	1.6%
Total	319	100%

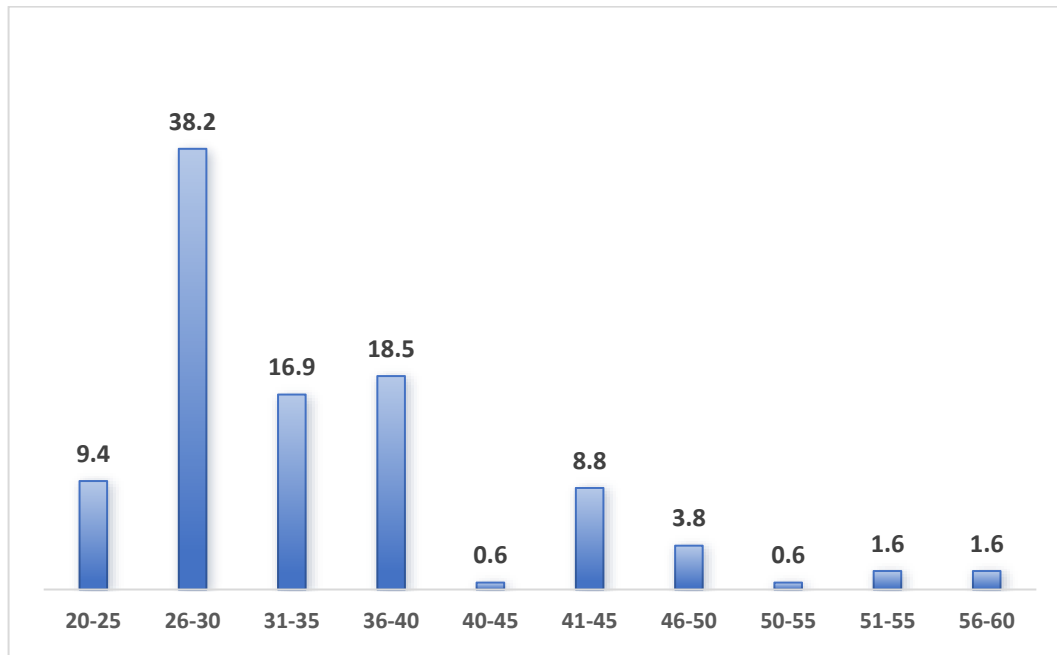


Figure 5: Age Group of Respondents

4.3.3. Distribution by Gender

The respondents' distribution by gender is presented in this Table 19 and Figure 6. According to the collected data, the majority of respondents were male, accounting for 203 individuals or 63.6 percent. In contrast, 116 respondents (36.4%) identified as female. Altogether, the survey included 319 participants across both gender categories.

Table 19: Gender of the respondents

Gender	Frequency	Percent
Female	116	36.4%
Male	203	63.6%
Total	319	100%

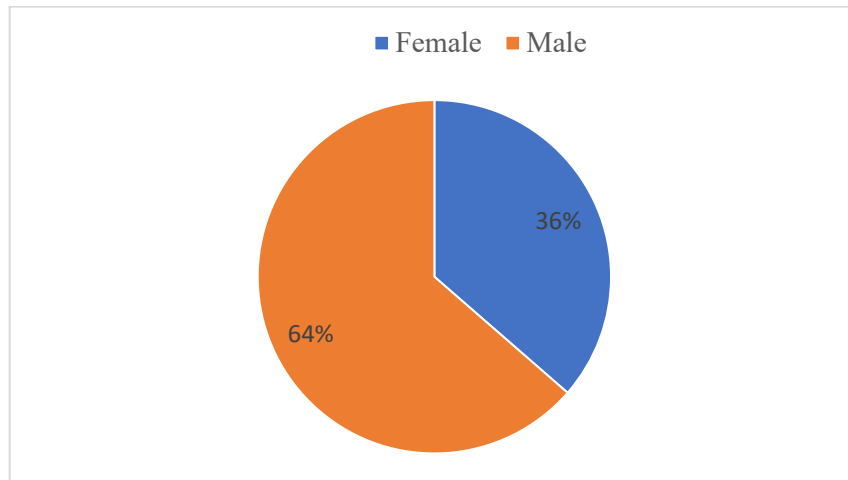


Figure 6: Gender of the respondents

4.3.4. Response Distribution by Institution

The respondents' distribution by the name of the technical institution they are affiliated with or enrolled with is shown in Table 20 and Figure 7. According to the collected data, the majority of respondents were from NIT Rourkela, accounting for 58 individuals or 18.2 percent. This is followed by KIIT University, Bhubaneswar with 55 respondents (17.2%), VSSUT, Burla with 48 respondents (15%), and IIT Bhubaneswar with 47 respondents (14.7%). Additionally, C V Raman University accounted for 42 respondents (13.2%), and SOA University, Bhubaneswar, had 42 respondents (13.1%). Silicon Institute of Technology, Bhubaneswar, had 27 respondents, with 8.5%. In total, 319 respondents were affiliated with various technical institutions.

Table 20: Response Distribution by Institution

Name of the Technical Institution Affiliated/Enrolled to	Frequency	Percent
C V Raman University	42	13.2%
IIT Bhubaneswar	47	14.7%
KIIT University, Bhubaneswar	55	17.2%
NIT Rourkela	58	18.2%
Silicon Institute of Technology, Bhubaneswar	27	8.5%
SOA University, Bhubaneswar	42	13.2%
VSSUT, Burla	48	15%
Total	319	100%

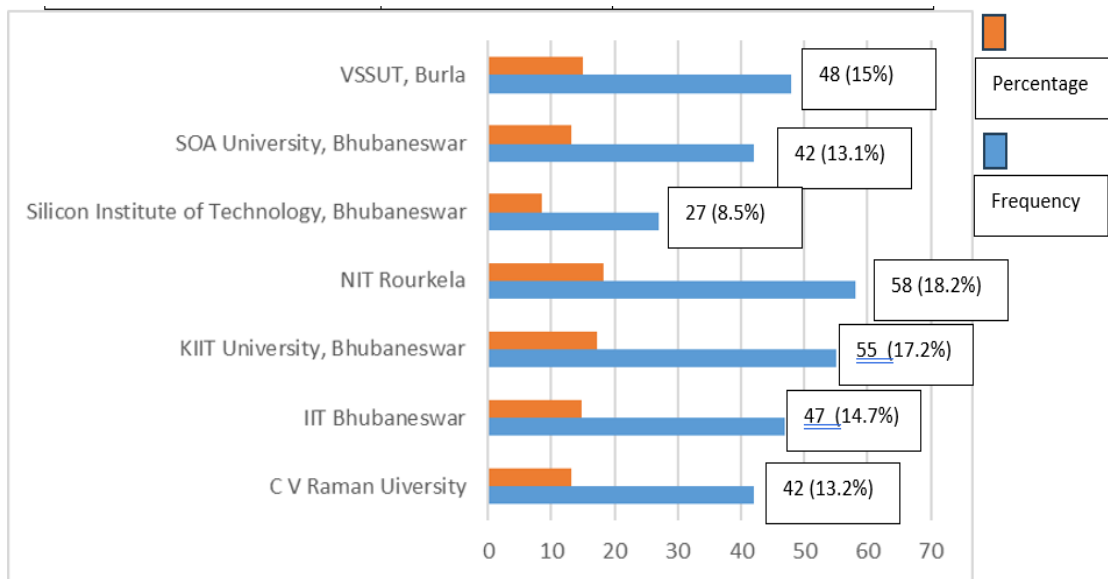


Figure 7: Response Distribution by Institution

4.3.5. Distribution by University Type

The respondents' distribution by types of university is presented in Table 21 and Figure 8. Based on the collected data, 165 respondents, or 51.7 percent, were affiliated with private universities, while 154 respondents, accounting for 48.3 percent, were from public universities. This shows that the participation from both sectors was nearly balanced, with a slightly higher representation from private universities. The total number of respondents was 319.

Table 21: Distribution by University Type

Types of University	Frequency	Percent
Private University	165	51.7%
Public University	154	48.3%
Total	319	100%

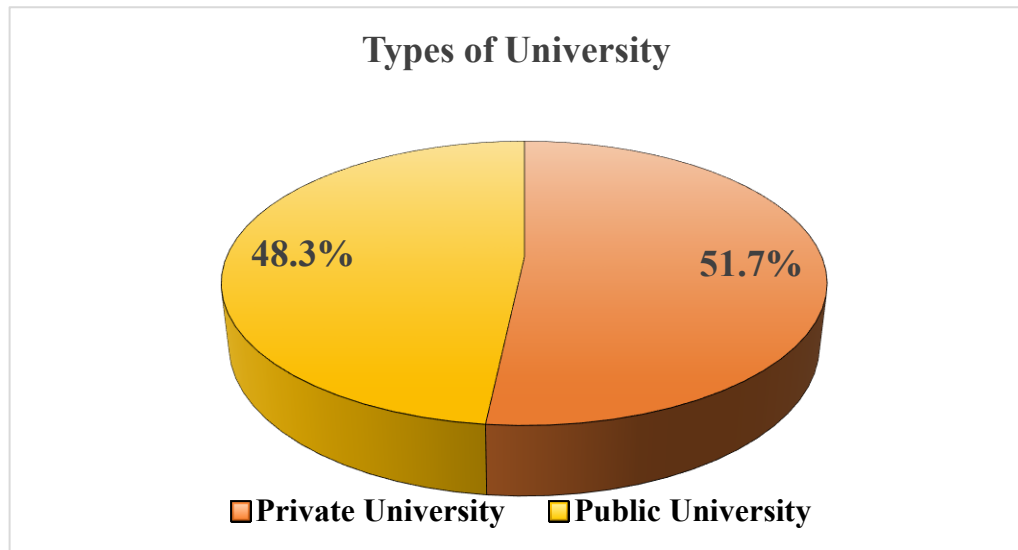


Figure 8: Distribution by University Type

4.3.6. Distribution by Departments

The respondents' distribution by department where they work or conduct research is presented in Table 22 and Figure 9. According to the data, the majority of respondents—50 individuals, or 15.7 percent—belonged to the Computer Science department. Mechanical Engineering followed this with 31 respondents (9.7%) and Electrical Engineering with 30 respondents (9.4%). Departments such as Physics (11.3%), Electronics and Communication (7.5%), and Basic Science (7.2%) also had significant representation. Conversely, fewer respondents came from departments like Economics, MBA, and Production Engineering, each with only 1 respondent (0.3%). The total number of respondents was 319.

Table 22: Distribution by Departments

Name of the Departments	Frequency	Percent
Architecture	7	2.2
Basic Science	23	7.2
Biotechnology	3	0.9
Ceramic Engineering	4	1.3
Chemical Engineering	5	1.6
Chemistry	14	4.4
Civil Engineering	20	6.3

Computer Science	50	15.7
Economics	1	0.3
Electrical Engineering	30	9.4
Electronics and Communication	24	7.5
English	4	1.3
Humanities and Social Sciences	22	6.9
Library and information science	5	1.6
Life Science	16	5
Management	2	0.6
Mathematics	17	5.3
MBA	1	0.3
Mechanical Engineering	31	9.7
Mining Engineering	3	0.9
Physics	36	11.3
Production Engineering	1	0.3
Total	319	100

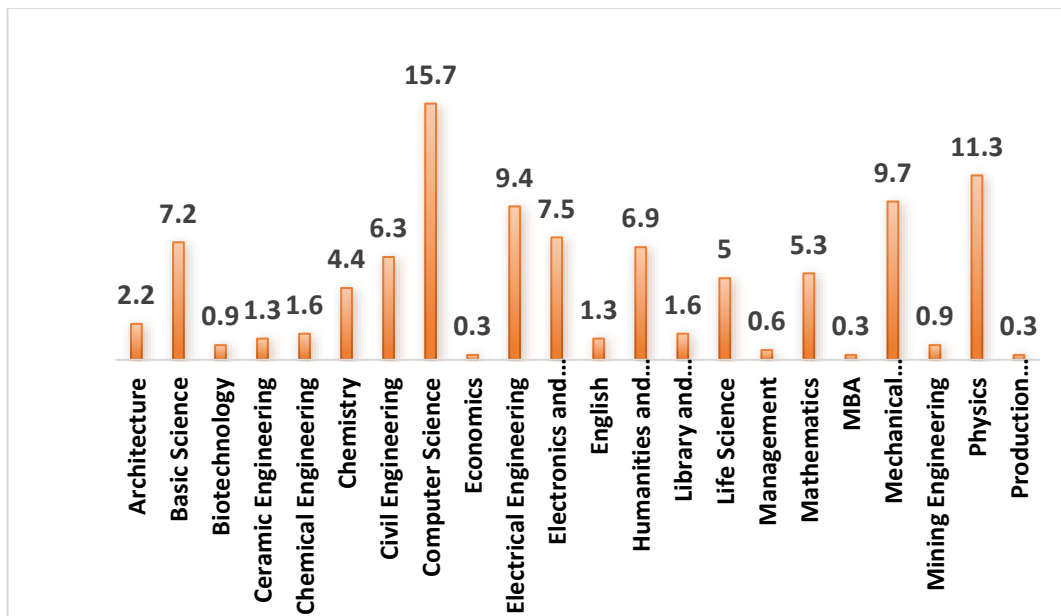


Figure 9: Distribution by Departments

4.3.7. Distribution by Teaching/Research Experience

The respondents' distribution based on their years of teaching or research experience is illustrated in Table 23. According to the data collected, the majority of respondents—59 individuals, or 18.5 percent—reported having 3 years of experience. Additionally, 52 (16.3%) had 2 years, and 33 (10.3%) had 1 year of experience. Furthermore, 27 (8.5%) of the respondents had 4 years of experience. Other notable figures include 16 (5%) respondents with 7 years, 15 (4.7%) with 6 years, and 14 each (4.4%) with either 5 or 15 years of experience. A small number of participants reported having long tenures, including 10 (3.1%) with both 8 and 14 years, and various others reporting from 0 to over 30 years of experience. The lowest frequencies—1 respondent each (0.3%)—were recorded for 19, 23, 27, 29, 33, and 37 years. In total, 319 respondents participated in the survey.

Table 23: Year of Experience in Teaching/Research

Teaching/Research Experience	Frequency	Percent
0	9	2.8
1	33	10.3
2	52	16.3
3	59	18.5
4	27	8.5
5	14	4.4
6	15	4.7
7	16	5
8	10	3.1
9	5	1.6
10	9	2.8
11	2	0.6
12	6	1.9
13	2	0.6
14	10	3.1
15	14	4.4
16	7	2.2
17	3	0.9
18	2	0.6
19	1	0.3
20	4	1.3
21	2	0.6
22	3	0.9
23	1	0.3

24	2	0.6
25	2	0.6
27	1	0.3
28	3	0.9
29	1	0.3
30	2	0.6
33	1	0.3
37	1	0.3
Total	319	100

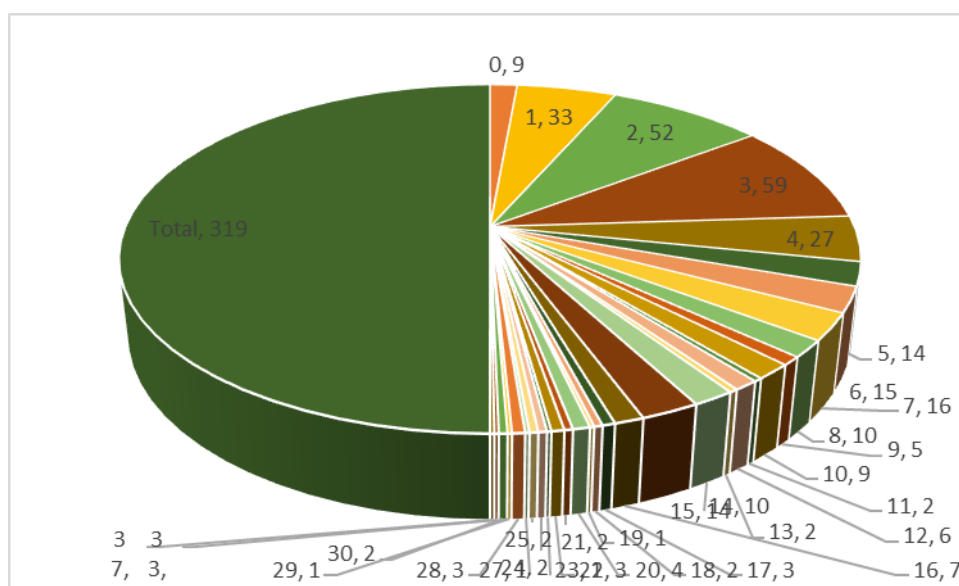


Figure 10: Year of Experience in Teaching/Research

4.3.8. Library Access by Respondents

The respondents' distribution based on their frequency of library access is presented in Table 24 and Figure 11. According to the data collected, the majority of respondents—124 individuals, or 38.9 percent—reported visiting the library occasionally. Additionally, 79 (24.8%) of the participants stated that they accessed the library once in a month, while 33 (10.3%) each visited the library either once in a fortnight or once in a week. A smaller portion, 17 respondents (5.3%), indicated accessing the library daily, and an equal number reported not accessing the library at all. Lastly, 16 individuals (5%) reported visiting the library twice in a week. The total number of respondents in this category was 319.

Table 24: Frequency of Library Access by Respondents

Library Access Frequency	Frequency	Percent
Daily	17	5.3
Not at all	17	5.3
Occasionally	124	38.9
Once in a fortnight	33	10.3
Once a Month	79	24.8
Once a Week	33	10.3
Twice in a week	16	5
Total	319	100

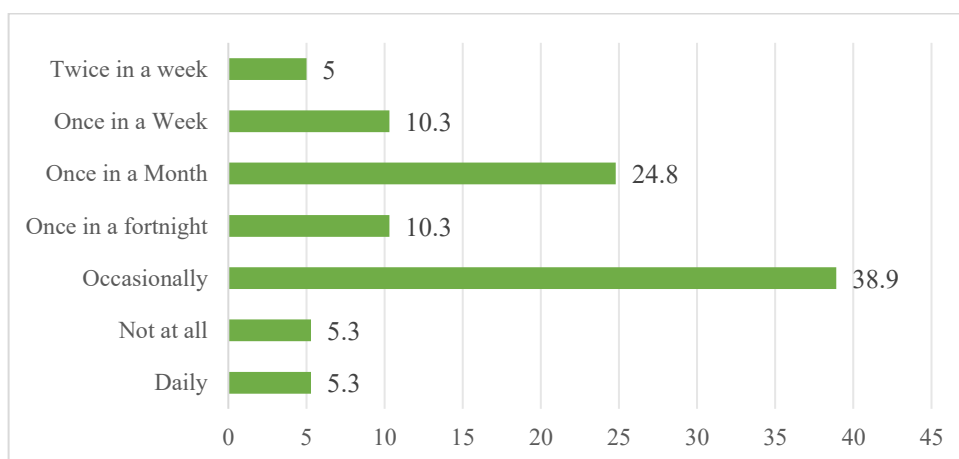


Figure 11: Frequency of Library Access by Respondents

4.3.9. Visit to Library by Respondents

The respondents' distribution based on their purpose of visiting the library is illustrated in the Table 25 and Figure 12. As per the data collected, the majority of respondents—174 individuals—visited the library for general reading, which includes books, magazines, journals, newspapers, and project/dissertation-related materials. Furthermore, 152 respondents mentioned that their visits were primarily for literature collection, while 126 individuals used the library to access research support tools. A significant number, 116 respondents, reported visiting the library for writing research articles and completing project assignments. Additionally, 90 participants attended workshops and training programmes organised by the library, and 85 respondents

visited for issuing or returning library books. A smaller group of 66 individuals sought research assistance from library staff, 22 respondents used the library for printing or Xeroxing educational content, and 70 individuals indicated other purposes for their visits.

Table 25: Purpose of Visit to the Library by Respondents

Purpose of Visit to Library	Frequency
For general reading (Books, magazines & Journals, Newspapers and project & dissertation)	174
Issue and return library book	85
Literature collection	152
Get research assistance from library staff	66
Print or Xerox educational content	22
Writing research article and project assignment	116
Use research support tools	126
Attend workshop and training programme organised by library	90
Any Other Purpose	70

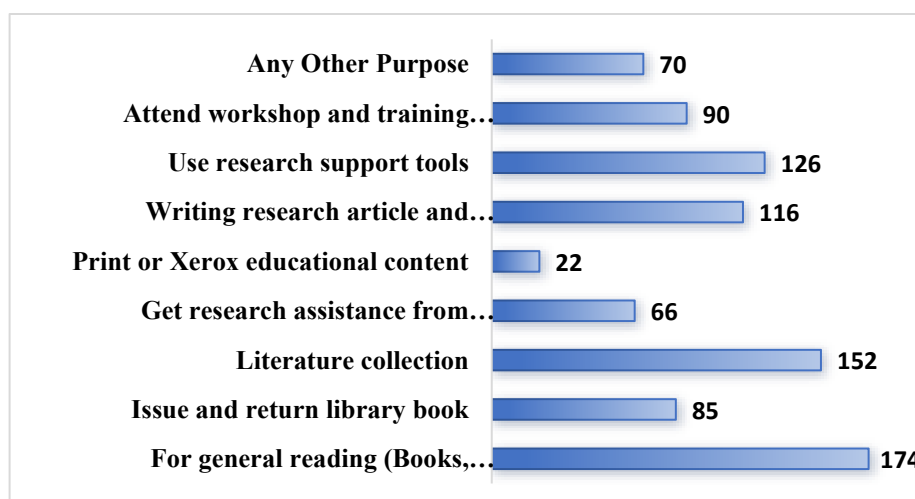


Figure 12: Purpose of Visit to the Library by Respondents

4.3.10. Outreach Programme Participation

The respondents' participation in various academic programs such as workshops, expert talks, orientation sessions, seminars, and training programs is reflected in the

Table 26 and Figure 13. Out of the total respondents, 164 (51.4%) reported that they had not attended any workshops, while 155 (48.6%) had attended at least one. Regarding expert talks, a majority of 230 respondents (72.1%) stated that they did not participate, whereas 89 (27.9%) had attended such sessions. When it came to orientation programs, the responses were nearly balanced, with 162 individuals (50.8%) indicating they had not attended, and 157 (49.2%) reporting participation. In terms of seminars, 206 respondents (64.6%) mentioned non-participation, and 113 (35.4%) confirmed attendance. Lastly, for training programs, 237 respondents (74.3%) stated they had not taken part, whereas only 82 (25.7%) had attended these sessions.

Table 26: Participation in Library Outreach Programs on RSS

	Category	Frequency	Percent
Workshop	No	164	51.4
	Yes	155	48.6
	Total	319	100
Expert Talk	No	230	72.1
	Yes	89	27.9
	Total	319	100
Orientation	No	162	50.8
	Yes	157	49.2
	Total	319	100
Seminar	No	206	64.6
	Yes	113	35.4
	Total	319	100
Training	No	237	74.3
	Yes	82	25.7
	Total	319	100

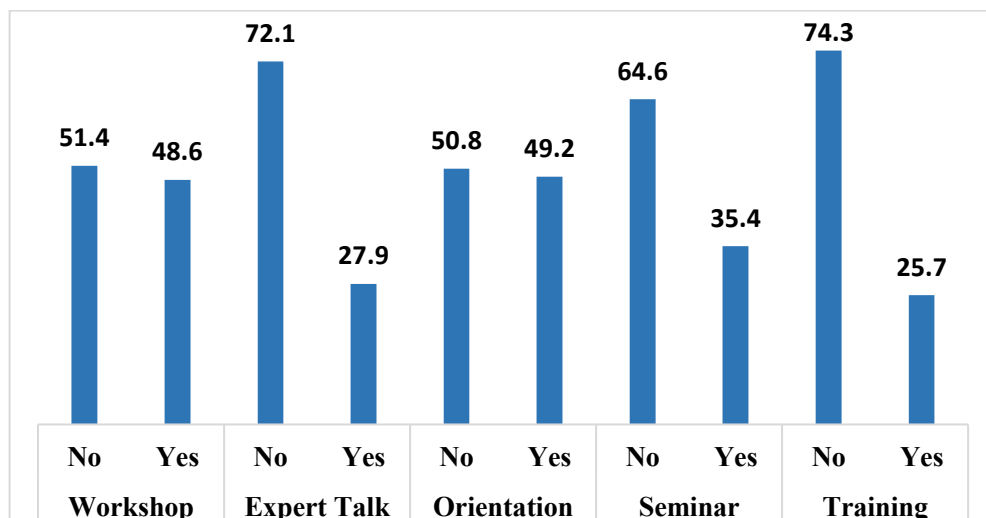


Figure 13: Participation in Library Outreach Programs on RSS

4.3.11. Distribution by Number of Outreach Programme Attended

The respondents' participation in library outreach programs related to research support services is presented in this Table 27 and Figure 14. The data reveals that a significant majority of the respondents, 227 (71.2%), had attended 1 to 5 such programs. A smaller portion, 32 respondents (10%), reported attending 6 to 10 outreach programs. Additionally, 5 respondents (1.6%) stated they had attended more than 10 programs. On the other hand, 55 individuals (17.2%) indicated that they had not attended any outreach programs at all.

Table 27: Distribution by Number of Outreach Programme Attended

Number of Library Outreach Programs on Research Support Services Attended	Frequency	Percent
1-5	227	71.2
6-10	32	10
More than 10	5	1.6
Nil	55	17.2
Total	319	100

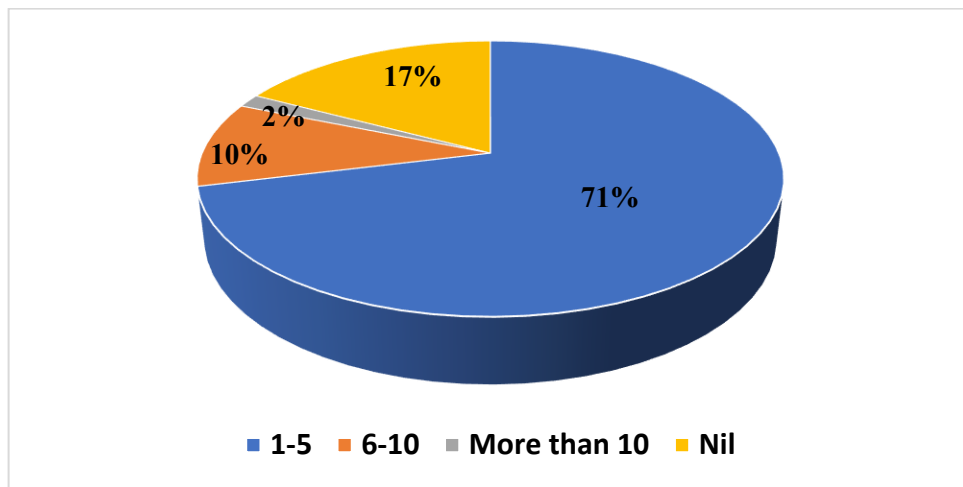


Figure 14: Distribution by Number of Outreach Programme Attended

4.3.12. Distribution by Different Outreach Programme

The Table 28 and Figure 15 outlines respondents' engagement with various research support services offered by libraries. A significant proportion, 223 respondents (69.9%), reported using anti-plagiarism software, while 96 (30.1%) had not. Only 62 participants (19.4%) had experience in handling data analysis tools, whereas a large majority, 257 (80.6%), had not. Similarly, 86 (27%) utilized reference management tools, and 73 (22.9%) maintained referencing style manuals, leaving 233 (73%) and 246 (77.1%) who did not use these tools respectively. Regarding awareness of research funding or grant assistance, only 55 respondents (17.2%) were informed, while 264 (82.8%) were not. On the topic of research publication and ethics, the responses were almost evenly divided, with 166 (52%) being aware and 153 (48%) not. Engagement with research databases was reported by 120 participants (37.6%), with the remaining 199 (62.4%) not engaging. A greater number, 195 (61.1%), reported browsing online journals, while 124 (38.9%) did not. Access to open access online resources was almost equally split, with 161 respondents (50.5%) having access and 158 (49.5%) not. A low percentage, 55 respondents (17.2%), were oriented with dedicated websites or links for research support services, whereas 264 (82.8%) were not. Lastly, usage of institutional repository resources was reported by 78 participants (24.5%), and 241 (75.5%) had not used such resources.

Table 28: Participation in Various RSS Offered by the Library

Participation in Various Research Support Services Offered by the Library (Training, Workshop, Orientation, etc.)	Category	Frequency	Percent
Usage of Anti-Plagiarism Software	No	96	30.1
	Yes	223	69.9
	Total	319	100
Handling Data Analysis Tools	No	257	80.6
	Yes	62	19.4
	Total	319	100
Use of Reference Management Tools	No	233	73
	Yes	86	27
	Total	319	100
Maintaining Referencing style manuals	No	246	77.1
	Yes	73	22.9
	Total	319	100
Aware of Research funding/grant assistance	No	264	82.8
	Yes	55	17.2
	Total	319	100
Understanding Research publication and ethics	No	153	48
	Yes	166	52
	Total	319	100
Surfing of Research Databases	No	199	62.4
	Yes	120	37.6
	Total	319	100
Browsing Online Journal	No	124	38.9
	Yes	195	61.1
	Total	319	100
Access to Open Access online resources	No	158	49.5
	Yes	161	50.5
	Total	319	100
Orientation on Dedicated Website/Link for RSS	No	264	82.8
	Yes	55	17.2
	Total	319	100
Usage of Institutional Repositories resources	No	241	75.5
	Yes	78	24.5
	Total	319	100

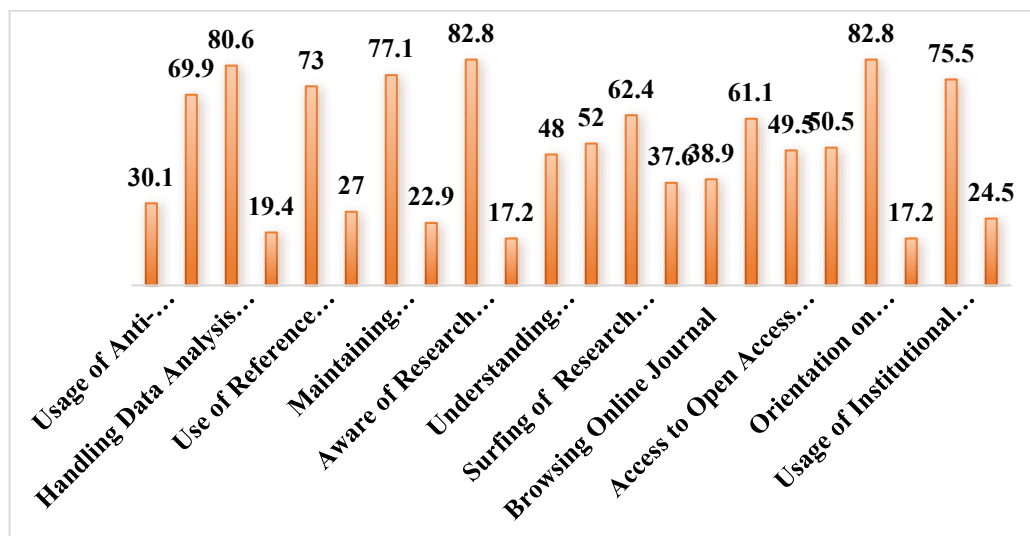


Figure 15: Participation in Various RSS Offered by the Library

4.3.13. Familiarization with Anti-Plagiarism Software

The Table 29 and Figure 16 presents the level of familiarity of respondents with various anti-plagiarism software tools. iThenticate appears to be relatively less familiar to respondents, with 181 (56.7%) indicating no familiarity, 74 (23.2%) reporting partial familiarity, and 64 (20.1%) claiming to be very familiar with it. In contrast, Turnitin is the most widely recognized tool, with 131 (41.1%) of the respondents being very familiar, 94 (29.5%) partially familiar, and only 94 (29.5%) not familiar at all. Urkund has limited recognition, as 252 (79%) respondents were not familiar with it, while 50 (15.7%) were partially and just 17 (5.3%) were very familiar. Among grammar-integrated tools, Grammarly was the most familiar, with 199 (62.4%) being very familiar, 80 (25.1%) partially, and only 40 (12.5%) not at all familiar. On the other hand, tools like Plag Tracker and Plagscan were among the least recognized, with 90% and 85.3% of respondents respectively having no familiarity with them. Very few were either partially (5% each for Plag Tracker and 10.3% for Plagscan) or very familiar (5% and 4.4% respectively). Similarly, Scribbr was not well known, as 280 (87.8%) respondents were not familiar with it, while only 22 (6.9%) were partially and 17 (5.3%) were very familiar. These results suggest a significant variation in familiarity with different plagiarism detection tools, with Turnitin and

Grammarly standing out as the most widely known and used among the surveyed group.

Table 29: Familiar with Anti-Plagiarism Software

Familiar with antiplagiarism software	Category	Frequency	Percent
i-Thenticate	Not at all familiar	181	56.7
	Partially familiar	74	23.2
	Very much familiar	64	20.1
	Total	319	100
Turnitin	Not at all familiar	94	29.5
	Partially familiar	94	29.5
	Very much familiar	131	41.1
	Total	319	100
Urkund	Not at all familiar	252	79
	Partially familiar	50	15.7
	Very much familiar	17	5.3
	Total	319	100
Grammarly	Not at all familiar	40	12.5
	Partially familiar	80	25.1
	Very much familiar	199	62.4
	Total	319	100
Plag Tracker	Not at all familiar	287	90
	Partially familiar	16	5
	Very much familiar	16	5
	Total	319	100
Plagscan	Not at all familiar	272	85.3
	Partially familiar	33	10.3
	Very much familiar	14	4.4
	Total	319	100
Scribbr	Not at all familiar	280	87.8
	Partially familiar	22	6.9
	Very much familiar	17	5.3
	Total	319	100

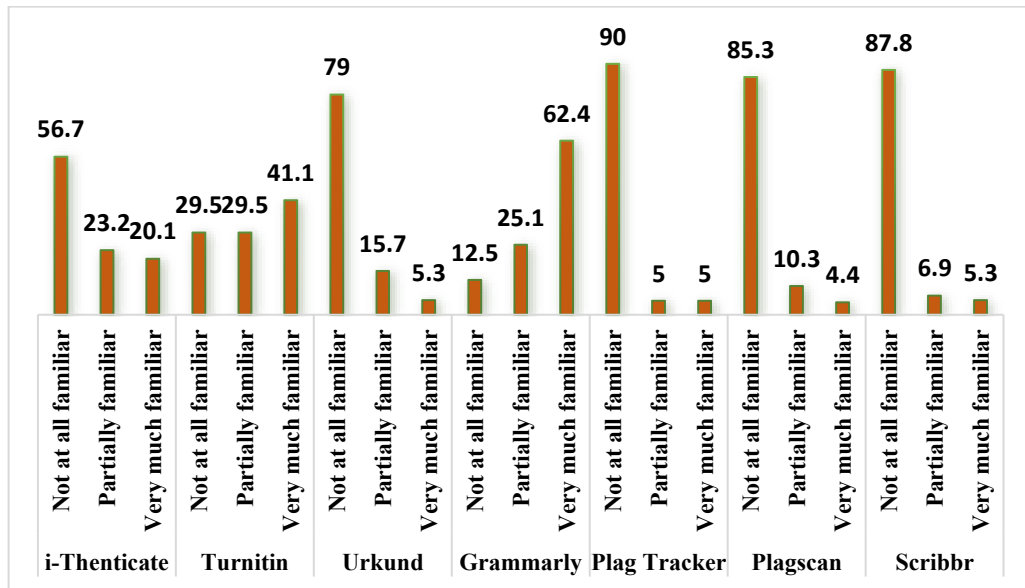


Figure 16: Familiar with Anti-Plagiarism Software

4.3.14. Knowledge of Reference Management Tools

Table 30 and Figure 17 provide insights into the respondents' familiarity with various reference management tools. Mendeley emerged as the most recognized and used tool among participants, with 150 (47%) reporting they were very familiar, 113 (35.4%) partially familiar, and only 56 (17.6%) not familiar with it. In contrast, tools like Zotero and EndNote were less familiar to respondents, with 57.7% and 63.3% respectively indicating no familiarity. Only 14.7% and 15.4% of the respondents were very familiar with Zotero and EndNote, respectively, while a modest number were partially familiar. Other reference tools showed even lower levels of recognition. For instance, RefWorks was not familiar to 267 (83.7%) respondents, and only 13 (4.1%) were very familiar with it. Similarly, CiteULike was unfamiliar to a vast majority (87.1%), with a mere 2.5% of respondents claiming high familiarity. BibTeX, however, showed relatively greater recognition among specialized tools, with 82 (25.7%) very familiar, though still 186 (58.3%) were unfamiliar with it. Finally, RIS format knowledge was limited among the participants, as 283 (88.7%) were not familiar, and only 16 (5%) reported high familiarity. These findings indicate a clear preference and wider usage for Mendeley, with limited exposure to other reference management tools among the research community surveyed.

Table 30: Knowledge of Reference Management Tools

Reference Management Tools	Category	Frequency	Percent
Mendely	Not at familiar	56	17.6
	Partially familiar	113	35.4
	Very much familiar	150	47
	Total	319	100
Zotero	Not at familiar	184	57.7
	Partially familiar	88	27.6
	Very much familiar	47	14.7
	Total	319	100
Endnote	Not at familiar	202	63.3
	Partially familiar	68	21.3
	Very much familiar	49	15.4
	Total	319	100
Refwork	Not at familiar	267	83.7
	Partially familiar	39	12.2
	Very much familiar	13	4.1
	Total	319	100
CiteULike	Not at familiar	278	87.1
	Partially familiar	33	10.3
	Very much familiar	8	2.5
	Total	319	100
BibTex	Not at familiar	186	58.3
	Partially familiar	51	16
	Very much familiar	82	25.7
	Total	319	100
RIS	Not at familiar	283	88.7
	Partially familiar	20	6.3
	Very much familiar	16	5
	Total	319	100

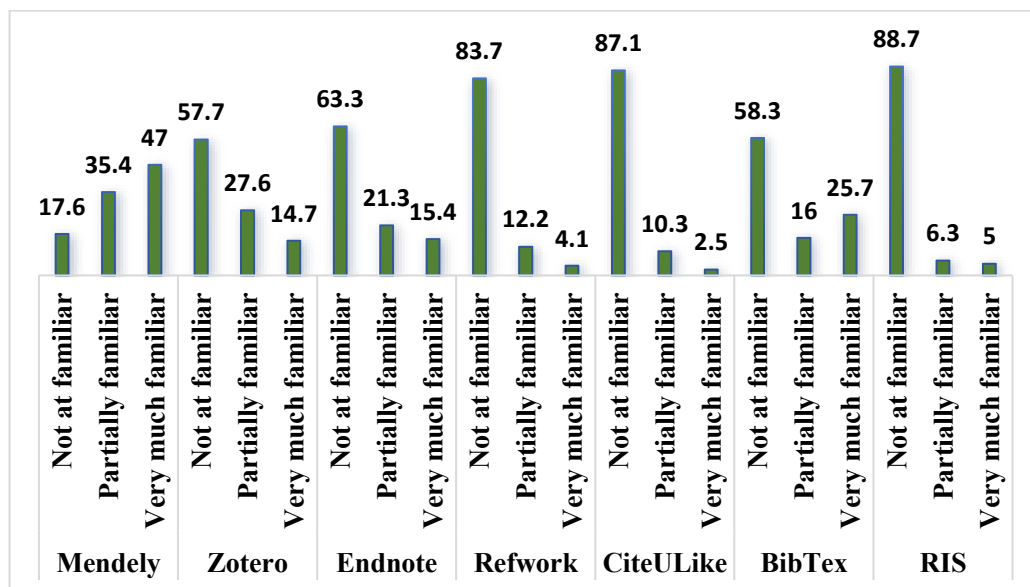


Figure 17: Knowledge of Reference Management Tools

4.3.15. Adherence to Referencing Style

Table 31 and Figure 18 indicate a diverse use of referencing styles among the respondents. The APA (American Psychological Association) style is the most commonly used, with 218 respondents indicating its usage, suggesting its dominance across various academic disciplines. Other frequently used styles include the Chicago style with 148 users and the Oxford style with 140 respondents selecting it. The MLA (Modern Languages Association) format was also used by a significant portion, accounting for 138 users. A smaller group, 33 respondents, reported using the Chicago or Turabian style, indicating familiarity with its variation often used in theses and dissertations. Additionally, 39 participants indicated the use of other styles, highlighting the presence of niche or discipline-specific citation preferences. These findings reflect a broad awareness and application of multiple referencing styles within the academic community surveyed, with APA clearly being the most dominant.

Table 31: Adherence to Referencing Style

Referencing style	Frequency
APA (American Psychological Association)	218
MLA (Modern Languages Association)	138
Chicago	148
Chicago or Turabian style	33
Oxford style	140
Other	39

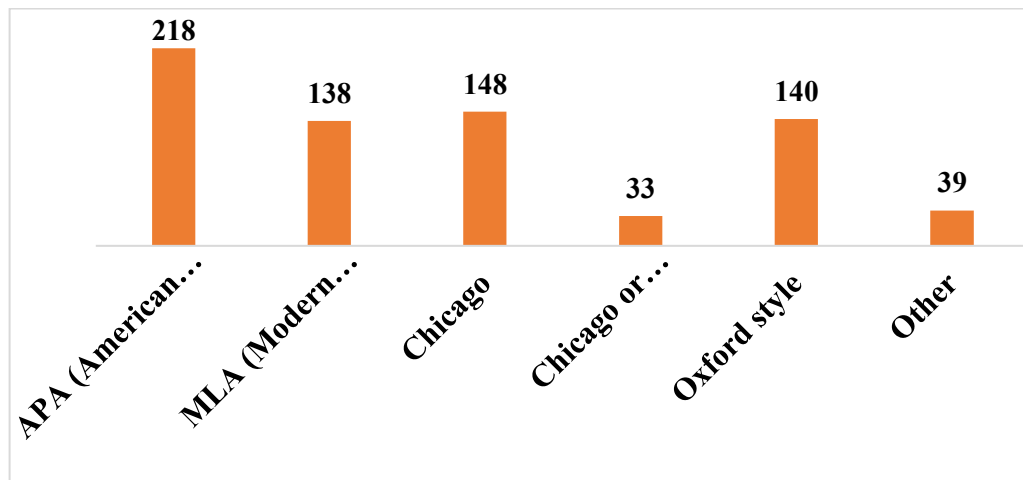


Figure 18: Adherence to Referencing Style

4.3.16. Comfort with Data Analysis Tools

Table 32 and Figure 19 show the familiarity and comfort among respondents with different data analysis tools. MS Excel emerges as the most widely used and comfortably handled tool, with 233 respondents (73%) reporting they are comfortable using it, while only 3.1% are not at all comfortable. SPSS shows moderate usage, with 14.1% feeling comfortable and 26.6% partially comfortable, but a majority (59.2%) indicating no comfort with it. Usage of more advanced or programming-based tools like R and Stata appears limited, with 79.6% and 90% of respondents respectively not at all comfortable. Only 6.6% feel comfortable using R, and an even smaller 1.9% for Stata. Python shows relatively higher engagement compared to R and Stata, with

21.6% of respondents comfortable using it and 28.8% partially comfortable. However, 49.5% still report no comfort in using Python. In the “Any other” category, only 7.2% reported comfort, while 85.9% expressed no comfort. These findings suggest that while basic tools like MS Excel are widely adopted, there is limited proficiency with more complex statistical or programming-based data analysis tools among the respondents.

Table 32: Comfort Level with Data Analysis Tools

Data Analysis Tools	Category	Frequency	Percent
MS Excel	Comfortable	233	73
	Not at all Comfortable	10	3.1
	Partially Comfortable	76	23.8
	Total	319	100
SPSS	Comfortable	45	14.1
	Not at all Comfortable	189	59.2
	Partially Comfortable	85	26.6
	Total	319	100
R	Comfortable	21	6.6
	Not at all Comfortable	254	79.6
	Partially Comfortable	44	13.8
	Total	319	100
Stata	Comfortable	6	1.9
	Not at all Comfortable	287	90
	Partially Comfortable	26	8.2
	Total	319	100
Python	Comfortable	69	21.6
	Not at all Comfortable	158	49.5
	Partially Comfortable	92	28.8
	Total	319	100
Any other	Comfortable	23	7.2
	Not at all Comfortable	274	85.9
	Partially Comfortable	22	6.9
	Total	319	100

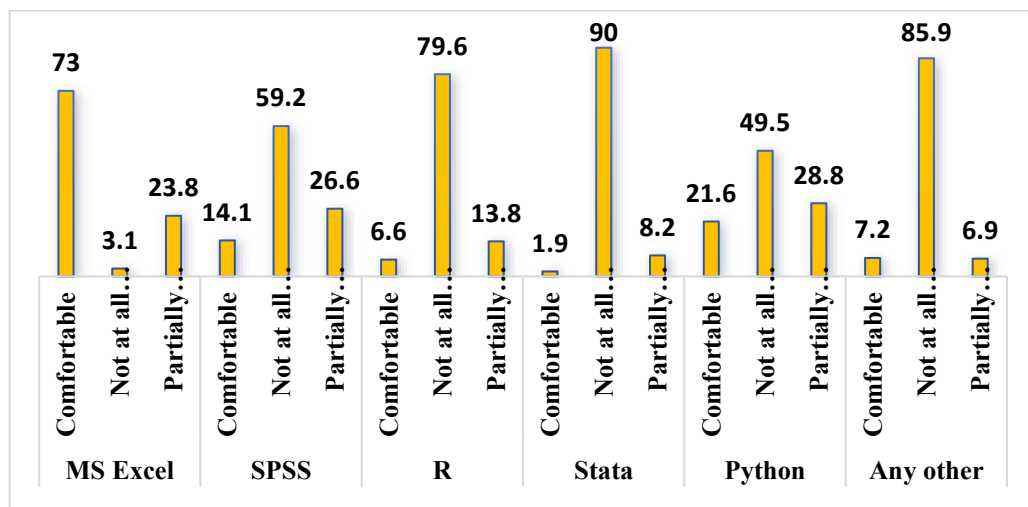


Figure 19: Comfort Level with Data Analysis Tools

4.3.17. Distribution by Library Facilities

Table 33 and Figure 20 highlight the institutional library's preparedness in supporting research-related activities. A large majority of respondents (80.9%) confirmed the presence of a dedicated section for handling research support tools, indicating that most libraries have designated spaces focused on aiding research efforts. Additionally, 68.3% reported that their institutions have dedicated staff specifically for research support services, underscoring the human resource commitment toward assisting researchers. Furthermore, 73% of respondents stated that their libraries provide a dedicated website or online link for research support services, reflecting a growing trend of digital facilitation. These findings collectively suggest that institutional libraries are making substantial infrastructural and personnel-based efforts to support academic research, though there remains room for improvement in expanding these facilities to ensure complete coverage.

Table 33: Availability of Facilities in the Institutional Library

Facilities in the Institutional Library	Category	Frequency	Percent
Dedicated section for handling research support tools	No	61	19.1
	Yes	258	80.9
	Total	319	100
Dedicated staff for research support service	No	101	31.7
	Yes	218	68.3
	Total	319	100
Dedicated library website link for research support	No	86	27
	Yes	233	73
	Total	319	100

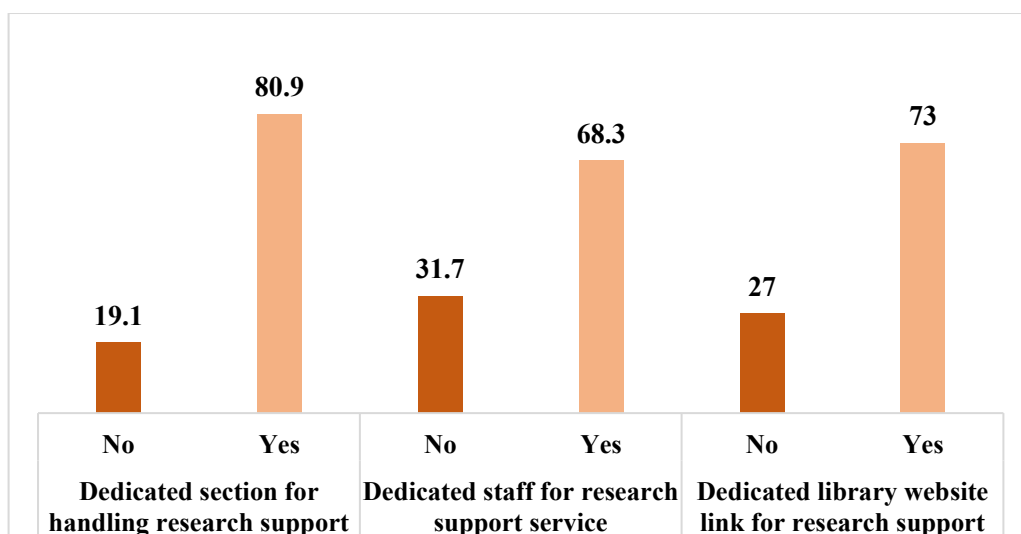


Figure 20: Availability of Facilities in the Institutional Library

4.3.18. Impact of RSS on Academic Performance

Table 34 and Figure 21 reveal a strongly positive perception of the research support services offered by institutional libraries. A substantial majority of respondents (82.8%) indicated that the impact of these services has been positive, demonstrating their value and effectiveness in aiding academic and research activities. A smaller portion (16%) reported a neutral impact, possibly reflecting limited usage or

awareness, while only 1.3% of respondents perceived the impact as negative. These findings emphasize the crucial role that well-structured and well-implemented research support services play in fostering a productive research environment and enhancing scholarly output.

Table 34: Impact of the RSS on academic performance

Impact of the research support services	Frequency	Percent
Negative	4	1.3
Neutral	51	16
Positive	264	82.8
Total	319	100

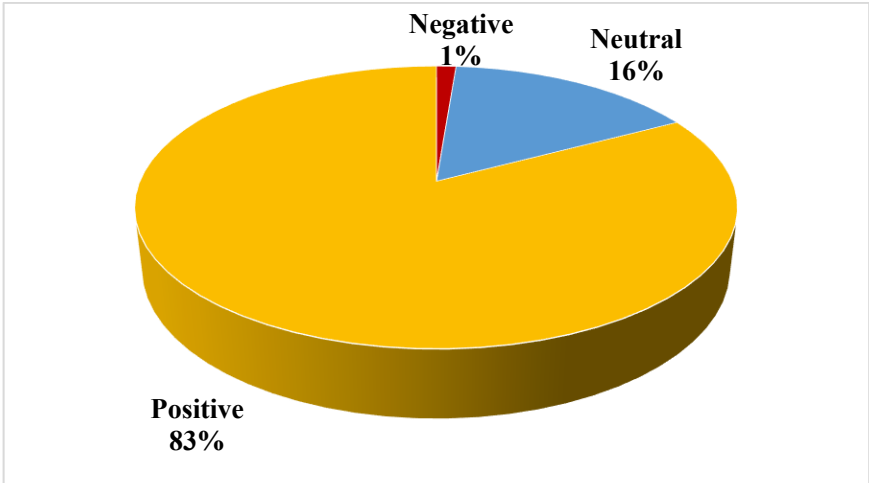


Figure 21: Impact of the RSS on academic performance

4.3.19. Impact of RSS on Research Publication

Table 35 and Figure 22 indicate that research support services have had a notable influence on the quality and quantity of research publications among users. Nearly half of the respondents (48.9%) acknowledged a significant improvement in both quality and quantity of their publications due to these services. Additionally, 21.9% observed a marked improvement in quality alone, while 11.3% reported enhancement in the quantity of their output. A smaller segment of participants (9.7%) were unsure about the impact, and 8.2% did not perceive any significant improvement. These findings

affirm that research support services contribute meaningfully to enhancing research performance, particularly in improving the overall standard and volume of scholarly work.

Table 35: Impact of RSS on Research Publication

Impact of Research Support Services on Research Publication	Frequency	Percent
Yes, Significant improvement in quantity	36	11.3
Yes, Significant improvement in quality	70	21.9
Yes, Significant improvement in both quality and quantity	156	48.9
Not Sure	31	9.7
No, Significant improvement	26	8.2
Total	319	100

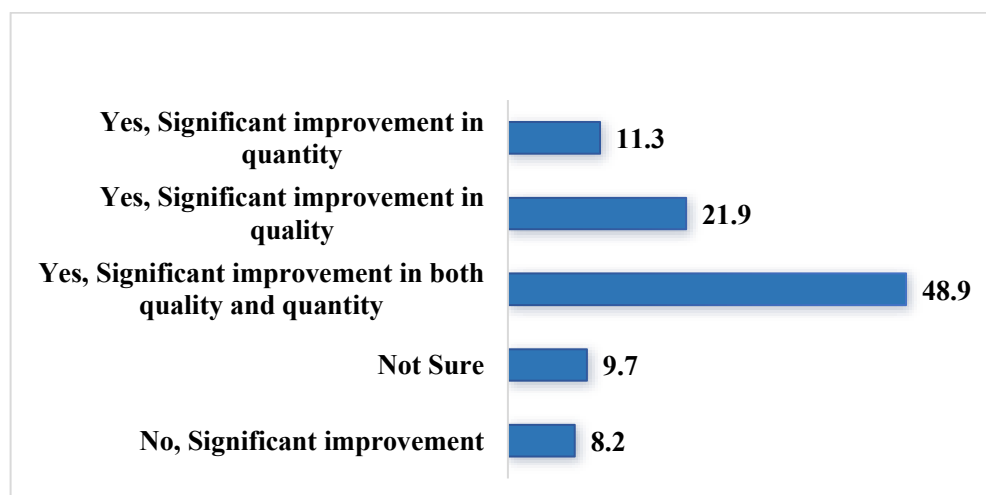


Figure 22: Impact of RSS on Research Publication

4.3.20. Management of Collected Literature

Table 36 and Figure 23 reveal diverse methods adopted by researchers for managing their literature collections. A large proportion (79.9%) prefer to store literature in storage devices such as USB drives or external hard disks, making it the most common method. This is followed by storing files directly on system hard drives, a practice

adopted by 56.1% of respondents. Printing and storing physical copies is still relatively common, with 43.3% of participants relying on this traditional approach. Importantly, 54.5% reported the use of reference management tools like Zotero, Mendeley, or EndNote, indicating a significant shift toward digital and systematic management of academic resources. These insights demonstrate a growing tendency among researchers to adopt efficient and technology-based practices for organizing and accessing their literature.

Table 36: Methods of Managing Literature Collection

Manage Literature Collection	Category	Frequency	Percent
Store in a Storage device	No	64	20.1
	Yes	255	79.9
	Total	319	100
Store in the System hard disc	No	140	43.9
	Yes	179	56.1
	Total	319	100
Print and store	No	181	56.7
	Yes	138	43.3
	Total	319	100
Use Reference Management tools i.e.Zotero/Mendeley/EndNote etc.	No	145	45.5
	Yes	174	54.5
	Total	319	100

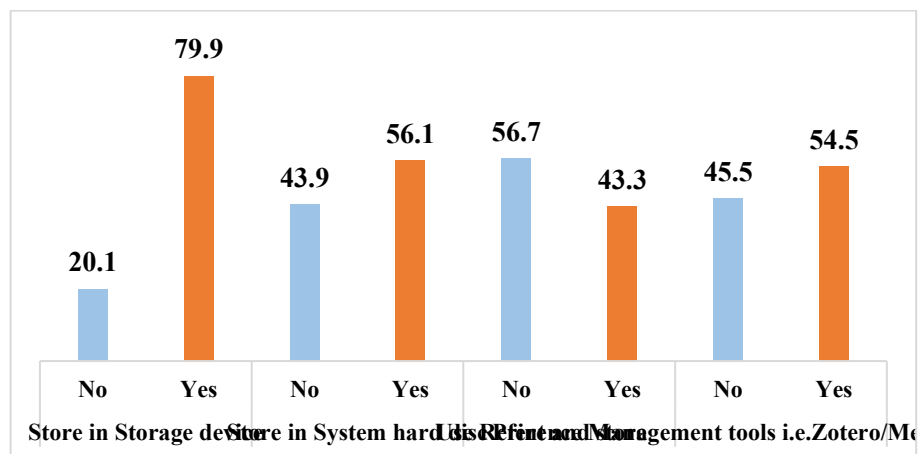


Figure 23: Methods of Managing Literature Collection

4.3.21. Distribution of Behaviour of Literature Collection

Table 37 and Figure 24 show that the majority of respondents (275 out of 319, or approximately 86.2%) indicated that they search literature independently, reflecting a high level of self-reliance and digital literacy in navigating research resources. A smaller yet notable group (90 respondents) relies on the library for literature searching, highlighting the continued importance of institutional support. Additionally, 95 respondents depend on peers or colleagues for accessing or locating research materials. These findings suggest that while autonomy in literature searching is prevalent, collaborative and institutional support still play meaningful roles in the research process.

Table 37: Distribution of Behaviour of Literature Collection

Search Literature	Frequency
Independently	275
Dependent upon Library	90
Depend upon peers/colleagues	95

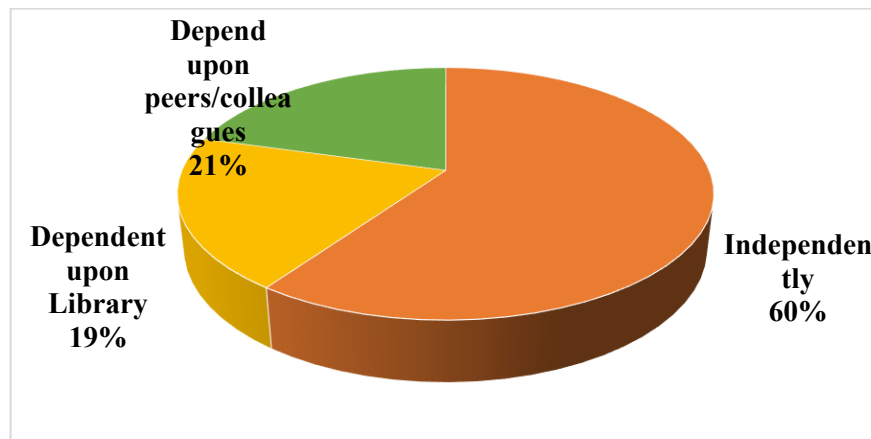


Figure 24: Distribution of Behaviour of Literature Collection

4.3.22. Distribution by Article Citing Behaviour

Table 38 and Figure 25 indicate that the majority of respondents (89%, or 284 out of 319) reported that they always cite authors when using someone else's work, indicating a strong adherence to academic integrity and ethical research practices. A small proportion (10%, or 32 respondents) stated they sometimes cite sources, suggesting occasional lapses or uncertainty in citation norms. Alarming, a very minimal fraction (0.9%, or 3 respondents) admitted to never citing authors, pointing to a potential gap in awareness or disregard for proper scholarly conduct. These findings emphasise the need for continuous training and reinforcement of ethical citation practices within academic institutions.

Table 38: Frequency of Citing Authors/Sources in Research Papers

Cite author/s	Frequency	Percent
Always	284	89
Never	3	0.9
Sometimes	32	10
Total	319	100

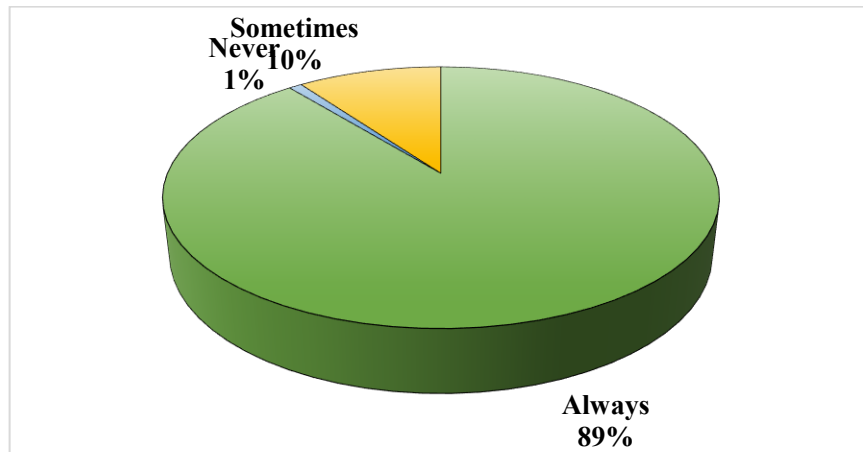


Figure 25: Frequency of Citing Authors/Sources in Research Papers

4.3.23. Receive of Financial Grant

Table 39 and Figure 26 reveal that only 25.4% of the respondents (81 out of 319) have received research grants, highlighting a relatively low level of grant acquisition among the academic community surveyed. In contrast, a significant majority, 74.6% (238 respondents), reported not having received any research grants. This suggests potential challenges in accessing funding opportunities, a lack of awareness or training in grant writing, or limited institutional support. These findings underline the need for increased efforts by institutions and libraries to provide researchers with guidance, tools, and workshops focused on securing research funding.

Table 39: Received Research Grant (from Internal/External Agency)

Research Grant	Frequency	Percent
No	238	74.6
Yes	81	25.39
Total	319	100

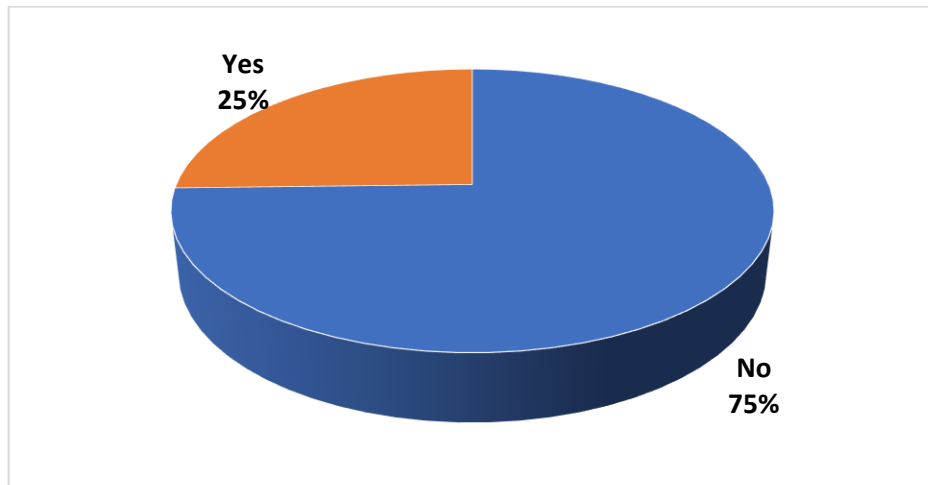


Figure 26: Received Research Grant (from Internal/External Agency)

4.3.24. Financial Grant Receive Source

Table 40 and Figure 27 show the source of information about research grants. Among the 319 respondents, a majority (238 respondents) marked “Not applicable,” which aligns with the earlier finding that 74.6% have not received any research grants. Among those who have received or sought grant-related information, the most common source was the grant agency’s website, cited by 55 individuals, indicating that direct engagement with funding bodies is a key strategy. Departmental communication was the next most utilised channel (46 responses), followed by both library sources and paper advertisements (24 each). Interestingly, social media platforms were also reported by 21 participants as a source of grant information, reflecting the growing role of digital platforms in research dissemination. These insights suggest that while digital access is increasingly important, institutional support remains a crucial pathway for accessing funding opportunities.

Table 40: Source of Information for Research Grant

Information about Research Grant	Frequency
Through Library	24
Through Department	46
Through paper advertisement	24
Through Social Media Site	21
Through Grant agency's website	55
Not applicable	238

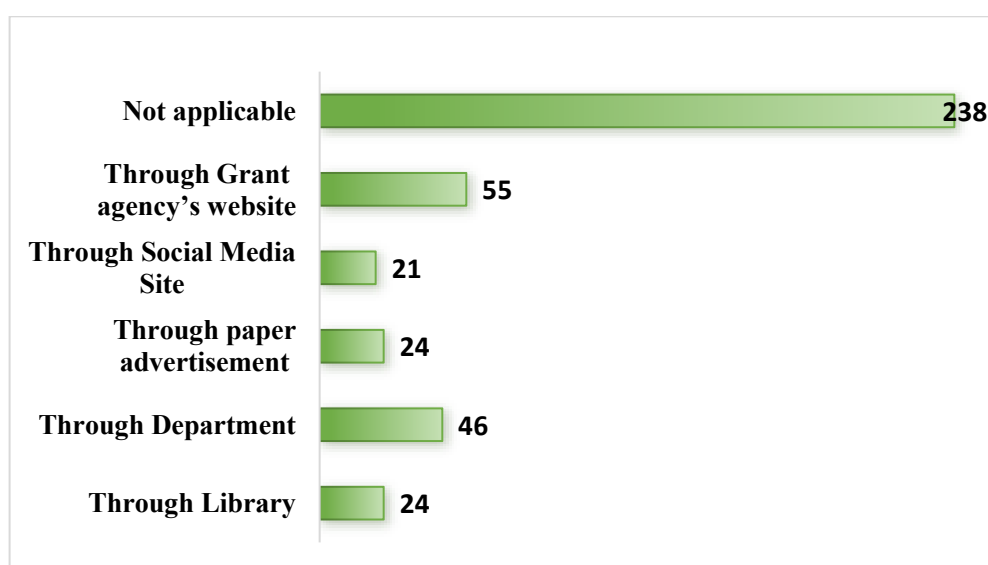


Figure 27: Source of Information about Research Grant

4.3.25. Distribution by Search Strategy

Table 41 and Figure 28 reveal that keyword search is the most commonly used strategy among respondents, with 244 individuals employing this method to retrieve documents. Author search also ranks high, utilised by 184 respondents, indicating a preference for targeted retrieval when known authors are involved. Interestingly, 115 individuals reported using random search, highlighting a significant portion of users who may not employ structured techniques in their research. More advanced strategies, such as Boolean logic (63 respondents) and phrase search (45 respondents), are comparatively less frequent, while truncation search is the least used, with only 10

users. Notably, 70 respondents reported using all of the search strategies, suggesting a subset of highly information-literate users capable of applying a comprehensive approach to document retrieval. Overall, while basic methods dominate, there is an evident opportunity for improving awareness and training in advanced search techniques.

Table 41: Search Strategy Used to Retrieve Documents

Search Strategy used to retrieve documents	Frequency
Keyword search	244
Author search	184
Boolean logic	63
Truncation search	10
Phrase search	45
Random Search	115
All of the Search strategy	70

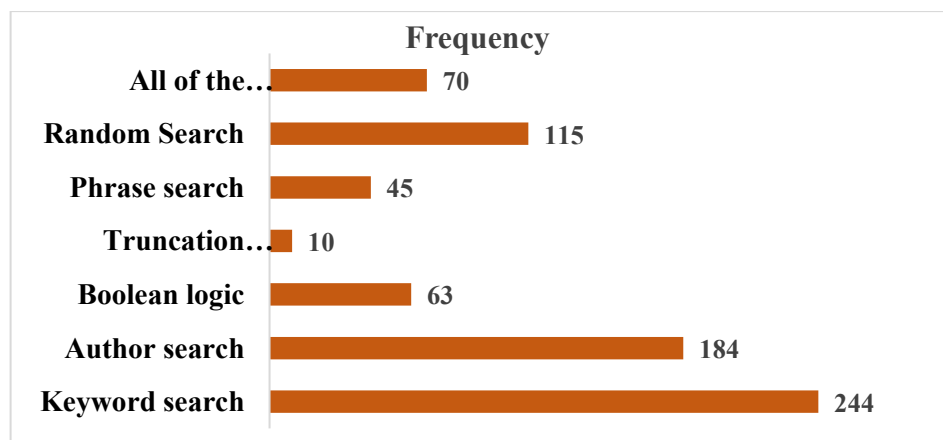


Figure 28: Search Strategy Used to Retrieve Documents

4.3.26. Sources of Data Collection

Table 42 and Figure 29 show that the majority of respondents prefer accessing documents for literature review through online databases and journals, with 50.2% (160 respondents) indicating this as their primary source. Additionally, 44.8% (143 respondents) utilise both library collections and online databases, demonstrating a balanced approach in leveraging multiple resources. In contrast, only 2.8% (9 respondents) rely exclusively on library collections, suggesting a decline in the use of

physical resources for literature review. A small minority, 2.2% (7 respondents), reported not using either source. These findings highlight a strong preference for digital resources, while also emphasising the importance of maintaining hybrid access to support diverse research practices.

Table 42: Sources of Data Collection

Retrieve document for literature review	Frequency	Percent
From Library Collection	9	2.8
From online databases & Journals	160	50.2
Both of the above	143	44.8
None of them	7	2.2
Total	319	100

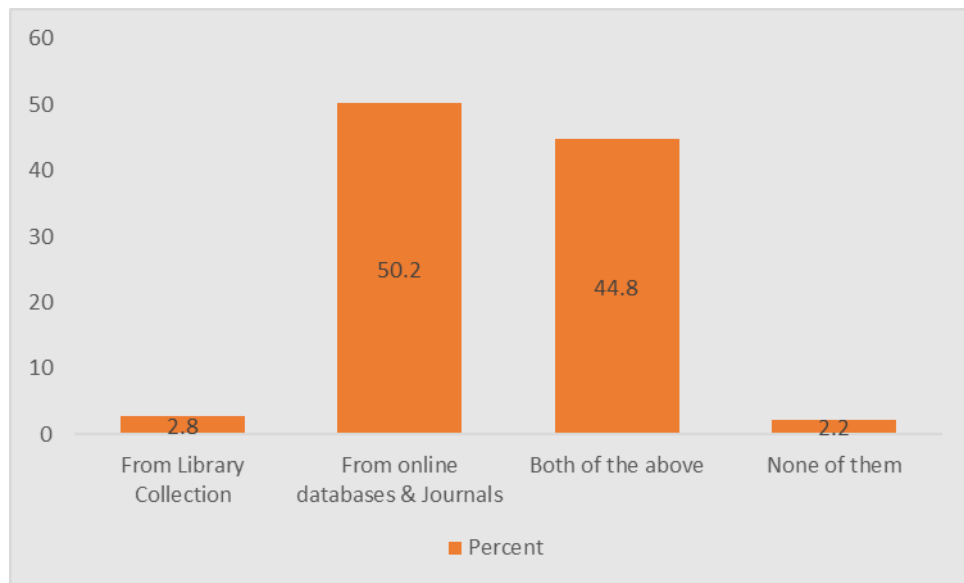


Figure 29: Sources of Data Collection

4.3.27. Competency of Online Database Surfing

Table 43 and Figure 30 reveal a generally high level of comfort among respondents in using research support services. A significant majority, 63.9% (204 respondents), reported being very comfortable, indicating strong confidence and familiarity with these services. Meanwhile, 35.7% (114 respondents) expressed being partially

comfortable, suggesting that while they are engaged with the services, there may still be areas requiring further support or training. Only 0.3% (1 respondent) indicated being not at all comfortable, highlighting that discomfort with research support services is extremely rare. Overall, the data suggests that most users have a positive and confident experience when interacting with research support services.

Table 43: Competency of Online Database Surfing

Comfort Level	Frequency	Percent
Not at all comfortable	1	0.3
Partially comfortable	114	35.7
Very much comfortable	204	63.9
Total	319	100

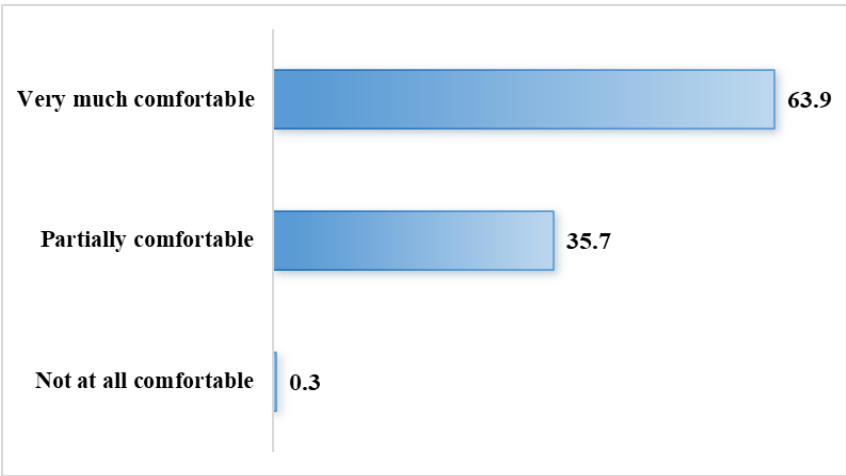


Figure 30: Competency of Online Database Surfing

4.3.28. Data Analysis Competency

Table 44 and Figure 31 show that the majority of respondents reported a high level of competency in utilising research support services and tools. Notably, 51.1% (163 respondents) rated their competency as very good, followed by 28.8% (92 respondents) who considered themselves excellent. Additionally, 17.6% (56 respondents) rated their competency as good, indicating a solid foundation with room

for improvement. A small fraction, 2.5% (8 respondents), described their competency as average, suggesting limited confidence or skill. These results reflect a generally strong proficiency among respondents in using research-related tools and resources, with most identifying themselves as highly capable.

Table 44: Level of Competency in Research Data Analysis

Level of Competency	Frequency	Percent
Excellent	92	28.8
Average	8	2.5
Very Good	163	51.1
Good	56	17.6
Total	319	100

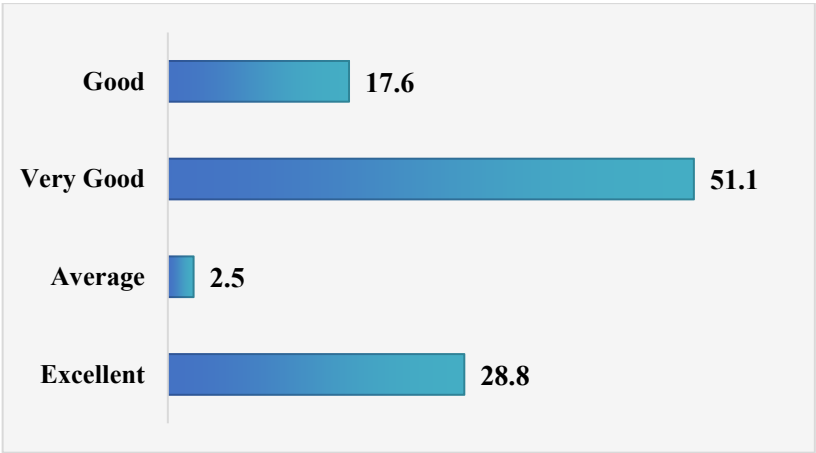


Figure 31: Level of Competency in Research Data Analysis

4.3.29. Growth of Publication

Table 45 and Figure 32 reveal a predominantly positive perception of publication growth among the respondents. A significant majority, 67.1% (214 respondents), indicated that their publication output had profoundly increased, suggesting a strong correlation between institutional support and research productivity. Meanwhile, 24.5% (78 respondents) reported that their publication growth remained static, implying

either a plateau in output or external limiting factors. Only 4.4% (14 respondents) felt that their publication activity had profoundly decreased, and a minimal 4.1% (13 respondents) were not aware of any change in their publication growth. Overall, the findings suggest a generally optimistic outlook regarding research output among the majority of participants.

Table 45: Assessment of Publication Growth

Publication Growth	Frequency	Percent
Not aware	13	4.1
Profoundly decrease	14	4.4
Profoundly increase	214	67.1
Static	78	24.5
Total	319	100

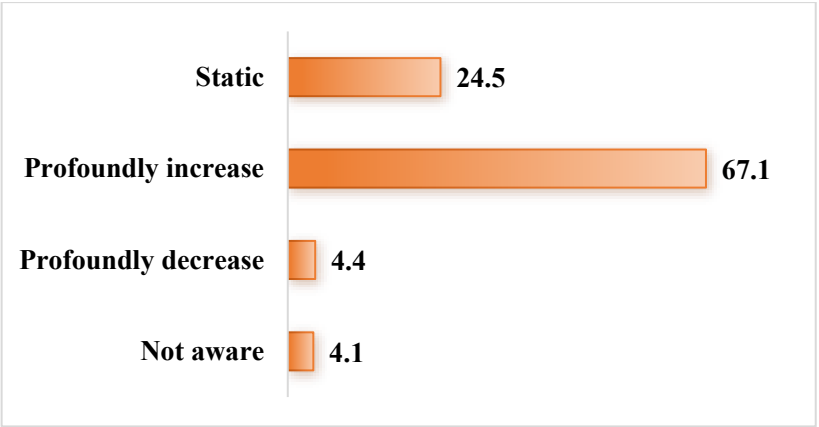


Figure 32: Assessment of Publication Growth

4.3.30. Seminar/Conference Publication

Table 46 and Figure 33 show a wide range in the number of papers presented by the respondents, reflecting diverse levels of academic engagement. The largest group, 39.5% (126 respondents), reported presenting 1–5 papers, suggesting early to moderate levels of research dissemination. A notable 13.8% (44 respondents) had presented more than 30 papers, indicating a highly active research profile. Other

segments include 13.2% with 6–10 papers, 9.4% with 11–15 papers, 6.6% with 16–20 papers, 4.4% with 26–30 papers, and 3.4% with 21–25 papers. Interestingly, 9.7% (31 respondents) reported no paper presentations, which could include early-career researchers or those not involved in active academic dissemination. Overall, the data reflect a spectrum of research involvement across the academic community.

Table 46: Papers Presented in Seminars and Conferences

No. of papers presented	Frequency	Percent
1-5	126	39.5
6-10	42	13.2
11-15	30	9.4
16-20	21	6.6
21-25	11	3.4
26-30	14	4.4
More than 30	44	13.8
NIL	31	9.7
Total	319	100

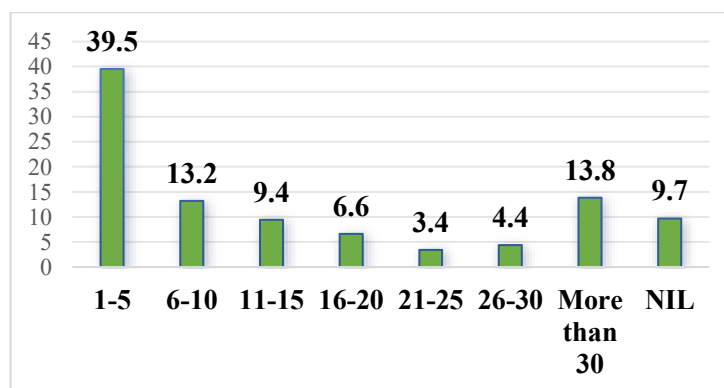


Figure 33: Papers presented in Seminars and Conferences

4.3.31. Publication in Peer-Reviewed/UGC Care list Journals

Table 47 and Figure 34 distribution of publication records among respondents indicate varying levels of research productivity. A significant portion, 36.7% (117 respondents), have published between 1–5 papers, suggesting that many are at the initial stages of academic publishing or contribute occasionally. A considerable 17.6% (56 respondents) reported no publications, possibly indicating early-career researchers, non-publishing professionals, or those focused on teaching or

administrative roles. At the other end of the spectrum, 12.85% (41 respondents) have published more than 30 papers, showcasing substantial research involvement and output. The remaining respondents are distributed as follows: 11.6% have 6–10 publications, 8.8% have 11–15, 6% have 16–20, 3.1% have 21–25, and 3.4% have 26–30 publications. These findings illustrate a broad spectrum of publication activity, ranging from inactive to highly prolific contributors.

Table 47: Publication in Peer-Reviewed/ UGC Care list Journals

No. of publication	Frequency	Percent
1-5	117	36.7
6-10	37	11.6
11-15	28	8.8
16-20	19	6
21-25	10	3.1
26-30	11	3.4
More than 30	41	12.85
NIL	56	17.6
Total	319	100

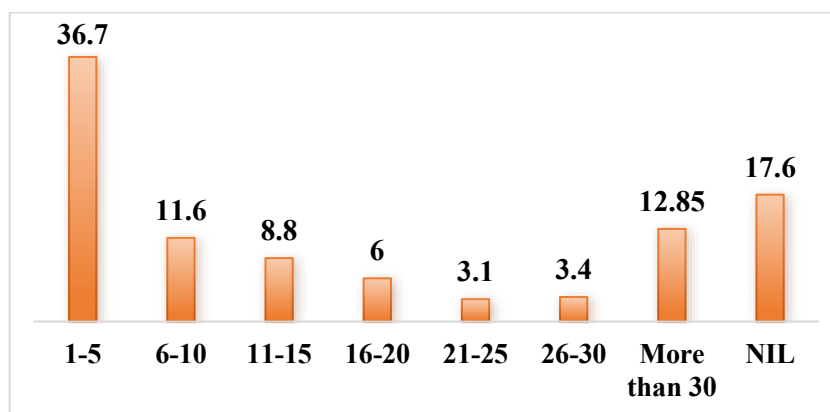


Figure 34: Publication in Peer-Reviewed/ UGC Care list Journals

4.3.32. Proficiency in Data Management

Table 48 and Figure 35 show that the majority of the participants, 54.2% (173 respondents), rated their proficiency as "Very Good," followed by 23.2% (74 respondents) who considered themselves "Good" in managing data. An additional 18.5% (59 respondents) rated their skills as "Excellent," indicating strong confidence in handling research data effectively. Meanwhile, only a small fraction rated their

proficiency lower, with 3.1% (10 respondents) identifying as "Average" and just 0.9% (3 respondents) as "Below Average." These findings suggest that the overall proficiency level in data management among the surveyed population is commendably high, which is crucial for ensuring research accuracy, reproducibility, and effective data utilization.

Table 48: Proficiency in Data Management

Proficiency in Data Management	Frequency	Percent
Average	10	3.1
Below average	3	0.9
Excellent	59	18.5
Good	74	23.2
Very Good	173	54.2
Total	319	100

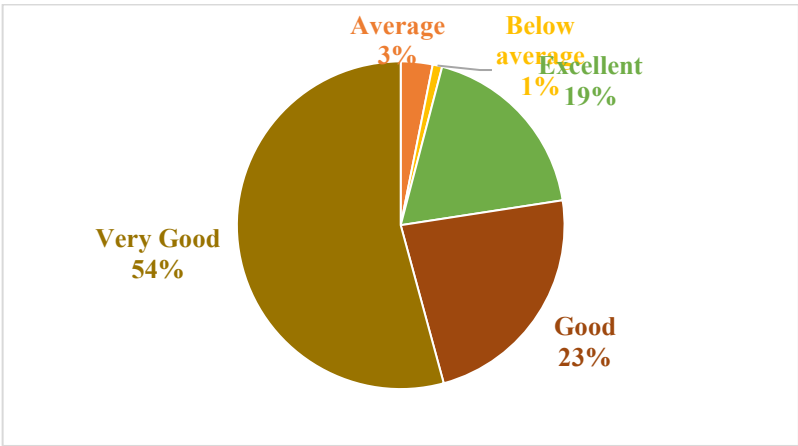


Figure 35: Proficiency in Data Management

4.3.33. Competency in Designing Research Questionnaire

Table 49 and Figure 36 show a varied distribution of comfort levels among respondents when it comes to preparing questionnaires. A majority, 59.2% (189 respondents), reported being "Partially Comfortable," indicating a moderate level of confidence in questionnaire design. Meanwhile, 38.9% (124 respondents) stated they

are "Very Much Comfortable" with preparing questionnaires, reflecting a strong level of familiarity and ease with the process. Only a small proportion, 1.9% (6 respondents), reported being "Not at all Comfortable," suggesting limited experience or confidence in this area. Overall, the findings indicate that while most respondents have at least some comforts with preparing questionnaires, there is still room for improvement through training or support to increase the number of highly confident individuals.

Table 49: Competency in Designing Research Questionnaire

Comfort Level in Preparing Questionnaire	Frequency	Percent
Not at all Comfortable	6	1.9
Partially Comfortable	189	59.2
Very Much Comfortable	124	38.9
Total	319	100

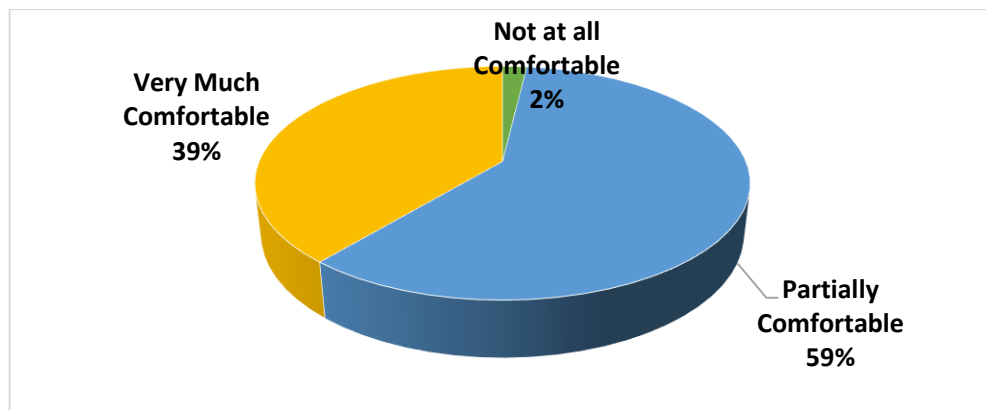


Figure 36: Competency in Designing Research Questionnaire

4.3.34. Rating of Library Website

Table 50 and Figure 37 show that the respondents' ratings of the library website reveal a generally positive perception. A significant majority, 52.7% (168 respondents), rated the website as "Very Good," suggesting a high level of satisfaction with its design, usability, or content. Another 19.7% (63 respondents) rated it as "Excellent,"

indicating exceptional user experience. Additionally, 16.6% (53 respondents) found it to be "Good," reflecting a satisfactory experience. On the lower end of the scale, 9.7% (31 respondents) rated the website as "Average," and only 1.3% (4 respondents) rated it as "Below Average." These results indicate that the library website is well-received overall, with over 88% of respondents giving it a rating of "Good" or higher.

Table 50: Rating of Library Website in Research Requirements

Rating of Library Website	Frequency	Percent
Average	31	9.7
Below Average	4	1.3
Excellent	63	19.7
Good	53	16.6
Very Good	168	52.7
Total	319	100

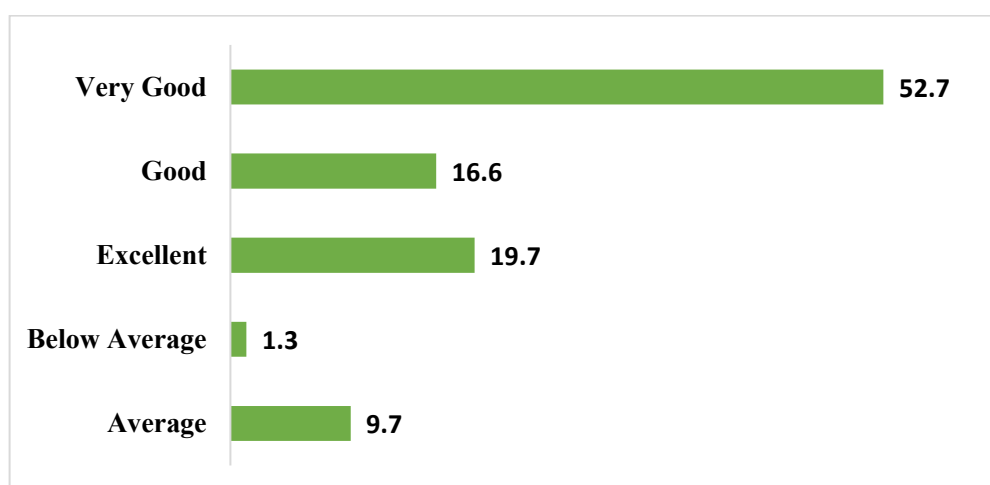


Figure 37: Rating of Library Website in Research Requirements

4.3.35. Overall Rating of Institutional RSS

Table 51 and Figure 38 show that the overall rating of the research support services by respondents demonstrates a highly favourable assessment. A majority of 48% (153 respondents) rated the services as "Above Average," while 31.3% (100 respondents) marked them as "Excellent," indicating that nearly four out of five respondents found the services to be highly satisfactory. Furthermore, 17.6% (56 respondents) provided

an "Average" rating, suggesting room for improvement in some areas. Only a small fraction of participants expressed dissatisfaction, with 2.8% (9 respondents) rating the services "Below Average" and just 0.3% (1 respondent) rating them as "Poor."

Table 51: Overall Rating of Institutional RSS

Overall Rating	Frequency	Percent
Excellent	100	31.3
Above Average	153	48
Average	56	17.6
Below Average	9	2.8
Poor	1	0.3
Total	319	100

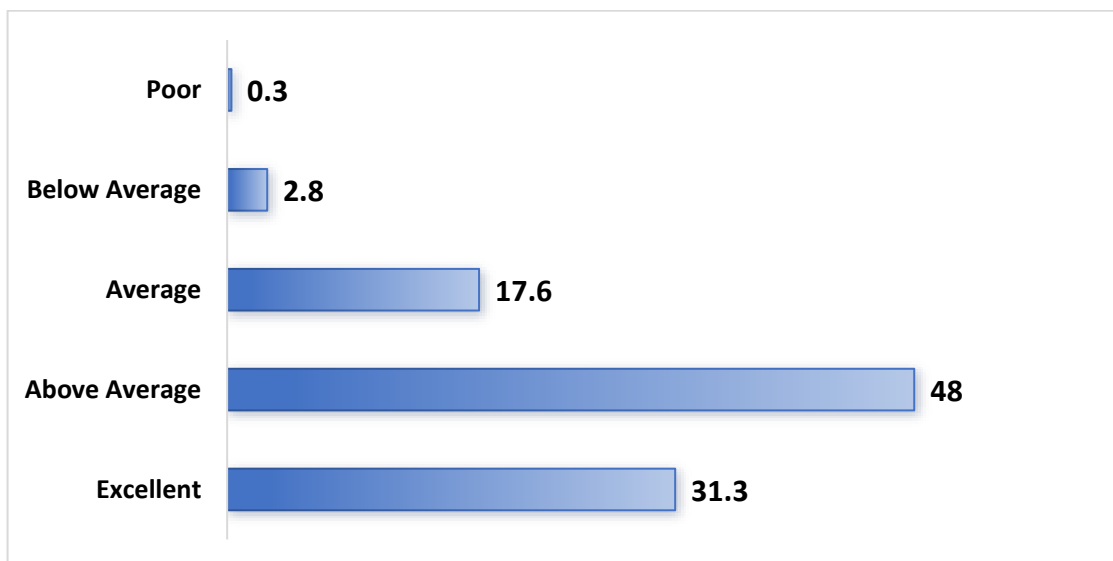


Figure 38: Overall Rating of Institutional RSS

PART- II

RESPONSE ANALYSIS OF LIBRARIANS

4.4. Analysis of Data: Librarians

Part II of the data analysis presents the responses collected from the heads of libraries of the selected technical institutions. The analysis in Part II was carried out using Jamovi (version 2.6.26) tool to compute variable counts, percentages, and cumulative percentages. Additionally, Microsoft Excel was employed to generate graphical representations of the data. This section spans from Table 52 and Figure 38 to Table 73 and Figure 55.

4.4.1. Distribution by Designation/Position

Distribution of respondents based on their position or designation is shown in Table 52 and Figure 39. The majority (43%) fall under the “Any Other” category, followed by Librarians, constituting 29% of the sample. Deputy Librarians and Assistant Librarians each account for 14% of the respondents. From the response received, the ‘Any Other’ category reflects Director of Library (1), Chief Librarian (1) and Senior Librarian (1). The cumulative percentage shows that 71.4% of the participants are either Librarians or from other designations, while the inclusion of Deputy and Assistant Librarians completes the respondent pool to 100%. This distribution reflects a diverse representation of library professionals, which supports balanced perspectives in the study.

Table 52: Frequency of Position/Designation

Position/Designation	Counts	% of Total	Cumulative %
Librarian	2	28.6%	28.6%
Any Other	3	42.9%	71.4%
Deputy Librarian	1	14.3%	85.7%
Assistant Librarian	1	14.3%	100.0%
Total	7	100.0%	100.0%

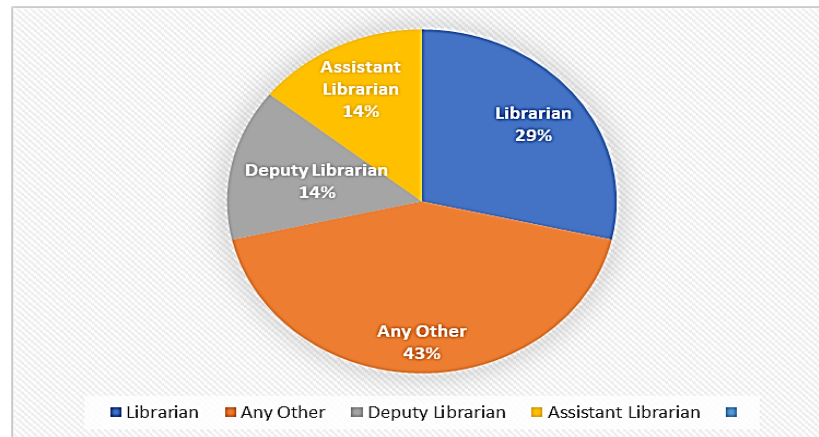


Figure 39: Frequency of Position/Designation

4.4.2. Frequency distribution of Age

Table 53 and Figure 40 show the age-wise distribution of respondents. The largest proportion of participants belongs to the 61–65 years and 41–45 years age groups, each constituting 28.6% of the total sample. Respondents in the 36–40 years, 46–50 years, and 51–55 years categories each account for 14.3%. The cumulative percentage indicates that 85.7% of respondents are aged 41 years and above, suggesting that the study sample predominantly comprises experienced professionals, which may influence their perspectives on research support services.

Table 53: Frequency distribution of Age

Age	Counts	% of Total	Cumulative %
61-65	2	28.5%	28.5%
51-55	1	14.3%	42.8%
46-50	1	14.3%	57.1%
41-45	2	28.6%	85.87%
36-40	1	14.3%	100%
Total	7	100.0%	100.0%

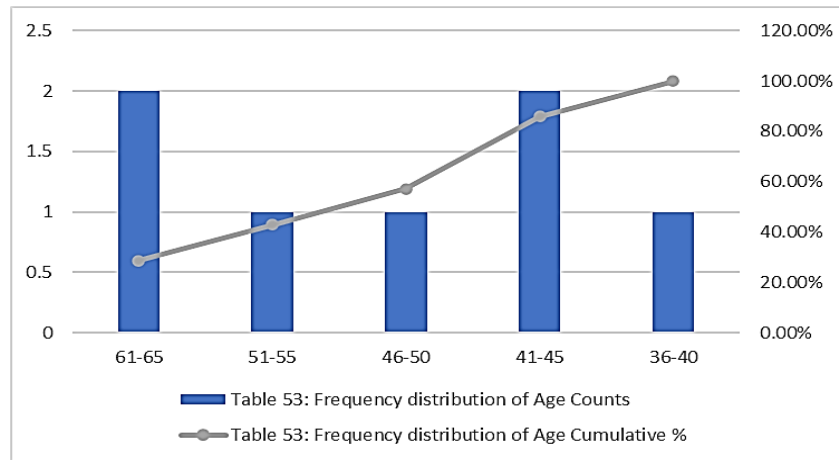


Figure 40: Frequency distribution of Age

4.4.3. Frequencies of Year of Experience

Experience brings productivity and opens more avenues for growth in every professional sector. An experienced librarian can enhance services through accumulated knowledge and expertise, while younger library and information science (LIS) professionals contribute with energy and the latest technological advancements to improve services. The study, reflected in Table 54 and Figure 41, shows that the present head of the library possesses a minimum of 16 years of service experience and a maximum of 48+ years of experience. So, experience and knowledge are beneficial to service effectiveness.

Table 54: Frequencies of Year of Experience

Years of Experience	Counts	% of Total	Cumulative %
48+	1	14.3%	14.3%
27	2	28.5%	42.8%
20+	1	14.3%	57.1%
18	1	14.3%	71.4%
17	1	14.3%	85.7%
16	1	14.3%	100.0%

Years of Experience	Counts	% of Total	Cumulative %
Total	7	100.0%	100.0%

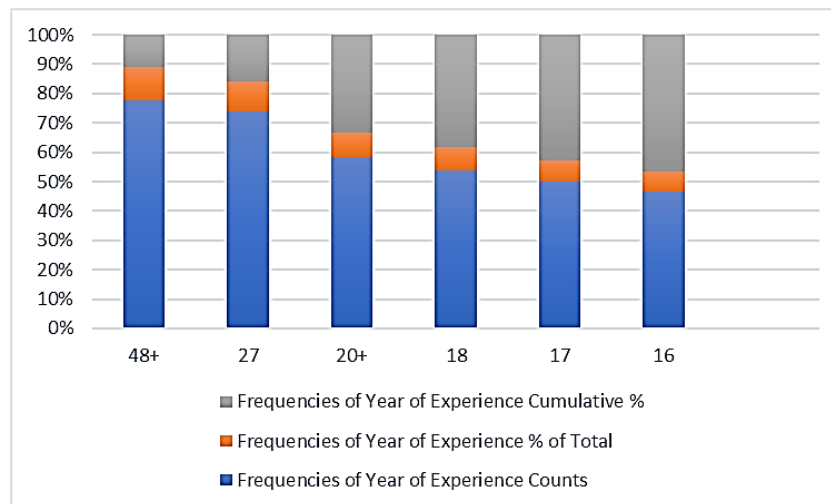


Figure 41: Frequencies of Year of Experience

4.4.4. Frequencies of library Research Support Services

The technical institutions selected deserved to be the top 7 technical institutions in the Engineering category as per NIRF, especially for research initiatives. In the present finding, Table 55 and Figure 42 demonstrate 100 per cent RSS implementation by libraries.

Table 55: Frequencies of Library's Research Support Services

Extending Research Support Services	Counts	% of Total	Cumulative %
Yes	7	100.0%	100.0%
No	0	0.0%	100.0%

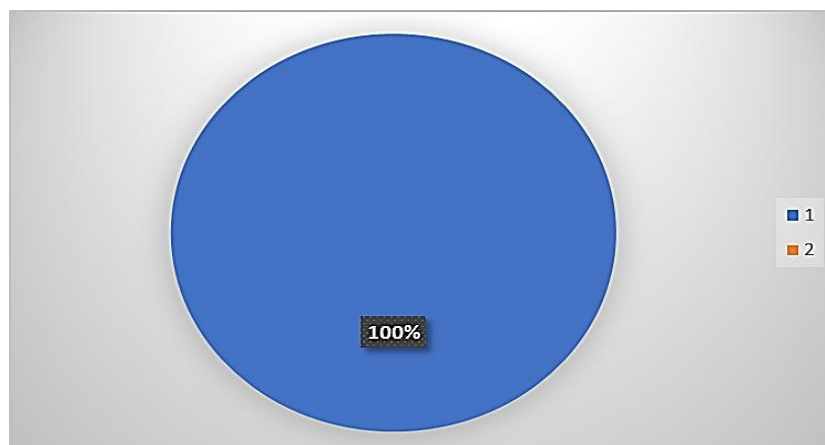


Figure 42: Frequencies of library's Research Support Services

4.4.5. Mode of Research Support Services

The data presented in Table 56 and Figure 43 clearly highlight that all seven participating institutions (100%) reported delivering RSS through a combination of both offline and online modes. The finding suggests that, although offline mode is effective, online mode is equally compelling; therefore, a blended approach is universally adopted, ensuring accessibility and flexibility for researchers by integrating digital and in-person support mechanisms.

Table 56: Frequencies of the mode of RSS being offered

Mode of Research Support Services	Counts	% of Total	Cumulative %
Online	0	0.0%	0.0%
Offline	0	0.0%	0.0%
Both	7	100.0%	100.0%

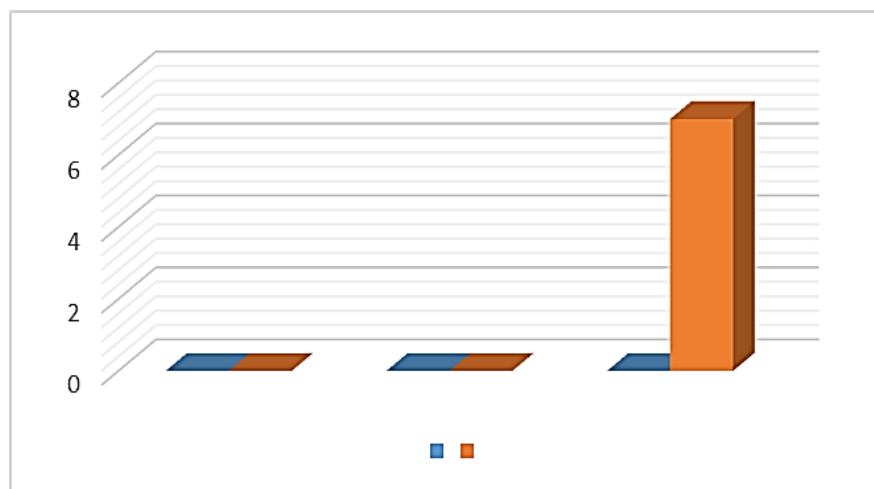


Figure 43: Frequencies of the mode of RSS being offered

4.4.6. Kind of Research Support Services

Table 57 and Figure 44 show the different types of research support services offered by the surveyed libraries. 'Literature Search' services are most common and effective RSS stands at the top with 100% implication. The services, such as 'Research Publication' and 'Testing Plagiarism', were equally extended by six institutions, with a total percentage of 85.7% each. 'Research Data Management' and 'Research Writing Skills' stand at 71.4%, followed by 'Data Analysis' (57.1%). The study noted here indicates that only financial grant assistance is implemented at one institution, with a share percentage of 14.2%.

Table 57: Kind of Research Support Services

Kind of Research Support Services	Counts	% of Total
Research Data Management Assistance	5	71.4%
Testing of Plagiarism	6	85.7%
Research Writing Skills	5	71.4%
Research Publication	6	85.7%
Literature Search	7	100.0%

Kind of Research Support Services	Counts	% of Total
Research Data Analysis	4	57.1%
Financial aid Assistance	1	14.2%

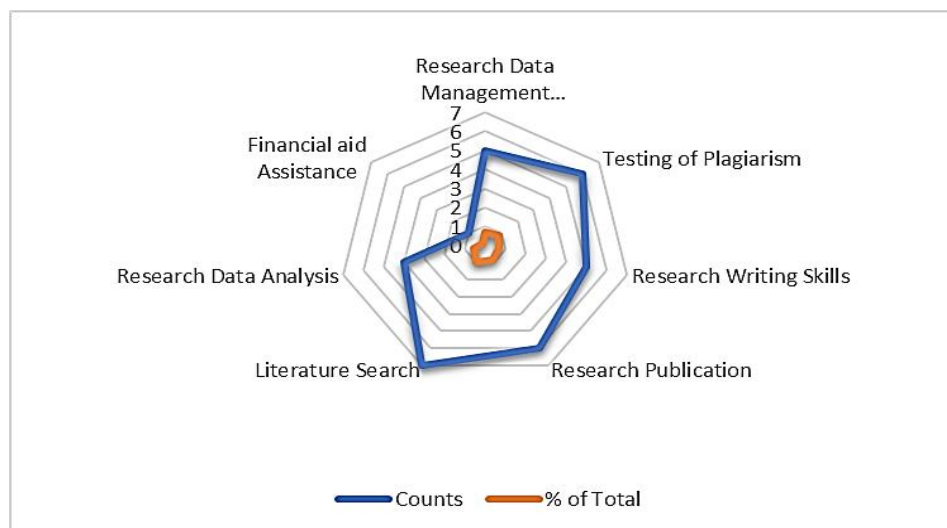


Figure 44: Kind of Research Support Services

4.4.7. Types of RDM Tools in Practice

Handling of research data with safety and security is a great concern for every researcher. Table 58 and Figure 45 present the distribution of 'Research Data Management Tools' used in the libraries. Although both free and paid software packages are flourishing on the internet, Mendeley is the most commonly used tool, adopted by 57.14% of the respondents. Next to Mendeley, other popular data management tools, such as Zotero and EndNote, are also used, each by 42.8% of the participating libraries. Additionally, 14.3% reported using other tools beyond these three.

Table 58: Frequencies of Research Data Management Tools

Research Data Management Tools	Counts	% of Total
Mendeley	4	57.14%
Zotero	3	42.8%
EndNote	3	42.8%
Any Other	1	14.3%

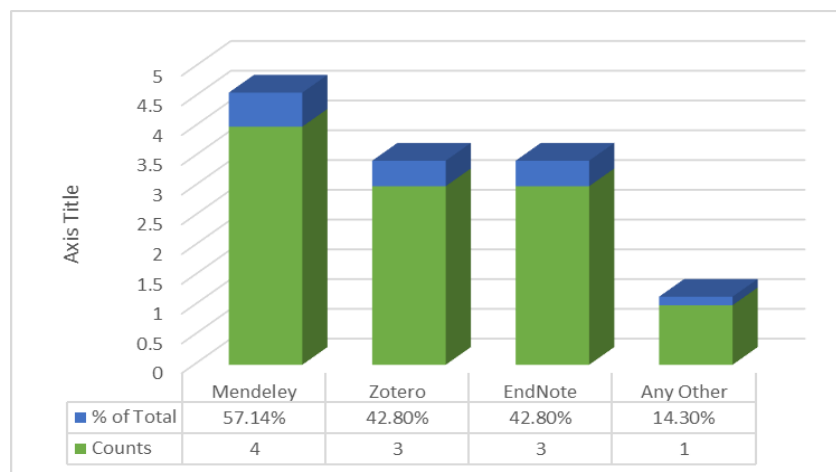


Figure 45: Frequencies of Research Data Management Tools

4.4.8. Distribution of Database Service

Table 59 and Figure 46 show the frequency of database service by the institutions under study. The result clarifies that ScienceDirect is the most preferred database, as all libraries (100.0%) have a subscription to it. Among all other database services, Google Scholar and Web of Science share an equal percentage of 85.7%, each followed by Scopus (71.4%), JSTOR (71.4%), and CAS (71.4%). Academic Search and ResearchGate are also used in more than fifty percent of institutions (57.1%). PubMed is the choice of 28.6% institutions. Out of these prime databases, 14.3% have other database services such as OpenDoar, Embase, CINAHL, and Any Other available databases.

Table 59: Frequencies of Database Service

List of Databases	Counts	% of Total
Google Scholar	6	85.7%
Scopus	5	71.4%
OpenDoar	1	14.3%
Academic Search	4	57.1%
Science Direct	7	100.0%
Web of Science	6	85.7%
JSTOR	5	71.4%
Research Gate	4	57.1%
PubMed	2	28.6%
CAS (Chemical Abstract Service)	5	71.4%
Embase	1	14.3%
CINAHL	1	14.3%
Any Other	1	14.3%

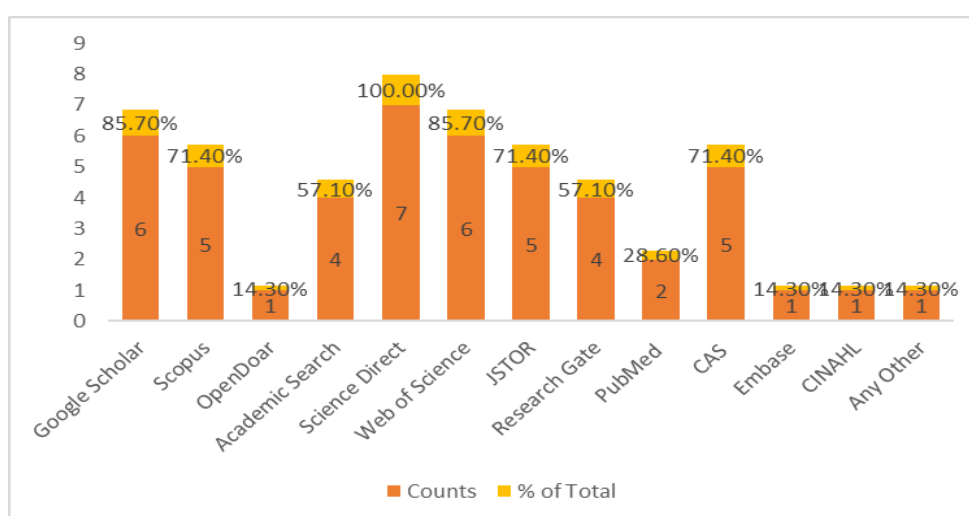


Figure 46: Frequencies of Database Service

4.4.9. Tools for Anti-Plagiarism Service

Keeping in mind the importance of clean content presentation for paper publication, plagiarism is a major concern for all academics. Facility over-testing of similarity services is distributed in Table 60 and Figure 47. It is explored that out of the availability of different anti-plagiarism software, Turnitin occupies the highest position of choice with 60.0%. Ouriginal and iThenticate are also in practice in 10% of institutions. There are some other anti-plagiarism software used by 20.0% institutions for similarity checking.

Table 60: Frequencies of anti-plagiarism software Services

Anti-plagiarism software	Counts	% of Total
Turnitin	6	85.7%
iThenticate	1	14.3%
Orkund/Ouriginal	1	14.3%
Any Other	2	28.6%

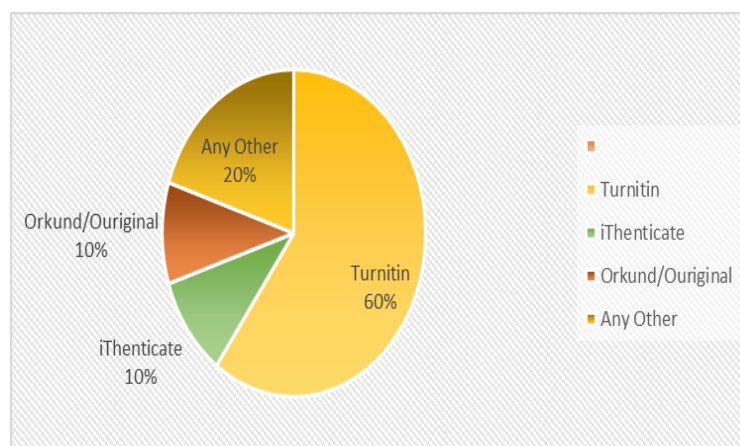


Figure 47: Frequencies of anti-plagiarism software Services

4.4.10. Strength of Trained Library Staff

Table 61 and Figure 48 state that 85.70% of libraries have designated and experienced staff, who review the submitted papers by the academic community and process them with anti-plagiarism software to generate a similarity report. Only 14.3% libraries do not have the designated staff to perform the said task.

Table 61: Frequencies of Trained Library Staff

Is there any trained staff assigned for testing plagiarism?	Counts	% of Total	Cumulative %
Yes	6	85.7%	85.7%
No	1	14.3%	100.0%

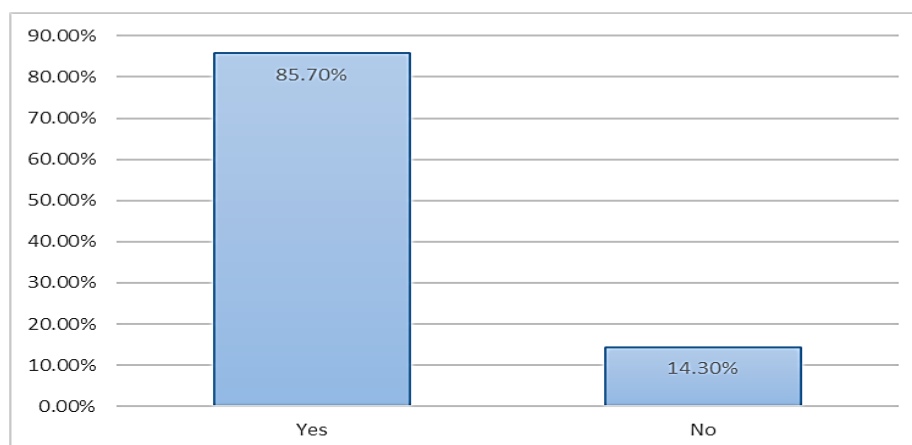


Figure 48: Frequencies of Trained Library Staff

4.4.11. Requisite Skills of LIS Professionals

Skills matter a lot in providing effective support, in this regard Table 62 and Figure 49 describe that 57.10% LIS professionals possess requisite skills, whereas 42.90% library have given their consent that not all but only a few of their staff have the required skills to support the RSS.

Table 62: Frequencies of Requisite Skills of LIS Professionals

Do all the staff of the library possess the requisite skills to handle Research Support Services?	Counts	% of Total	Cumulative %
Yes	4	57.1%	57.1%
Only Few	3	42.9%	100.0%

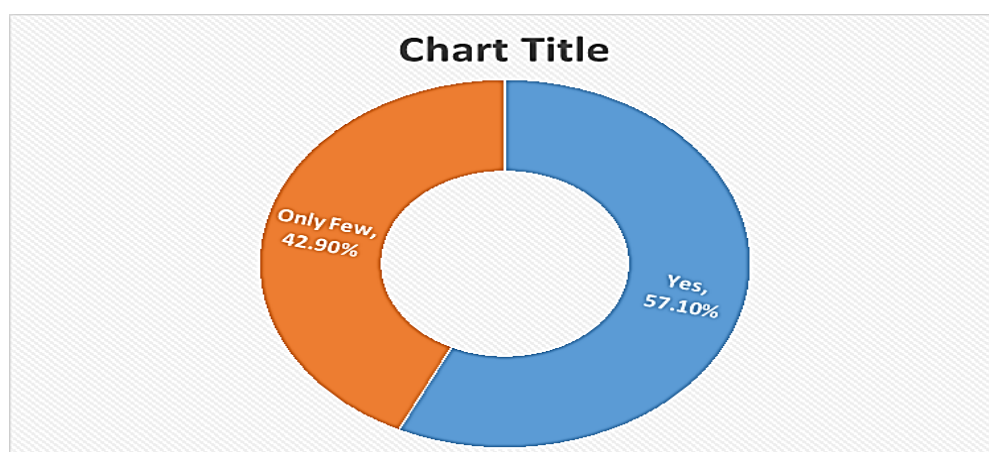


Figure 49: Frequencies of Requisite Skills of LIS Professionals

4.4.12. Types of Tools for Data Analysis

Table 63 and Figure 50 show that the data analysis tools are being practised in the institutions under study. It shows SPSS and MS Excel are two such data analysis tools dominating 71.4% each in selected libraries. More technical and programming data analysis, such as R and Python, is used by 14.3% libraries. Out of these, other data analysis tools are used by 28.6% libraries.

Table 63: Frequencies of Data Analysis Services

Data Analysis Tools	Counts	Percentage %
SPSS	5	71.4%
MS Excel	5	71.4%
'R'	1	14.3%

Python	1	14.3%
Any Other	2	28.6%

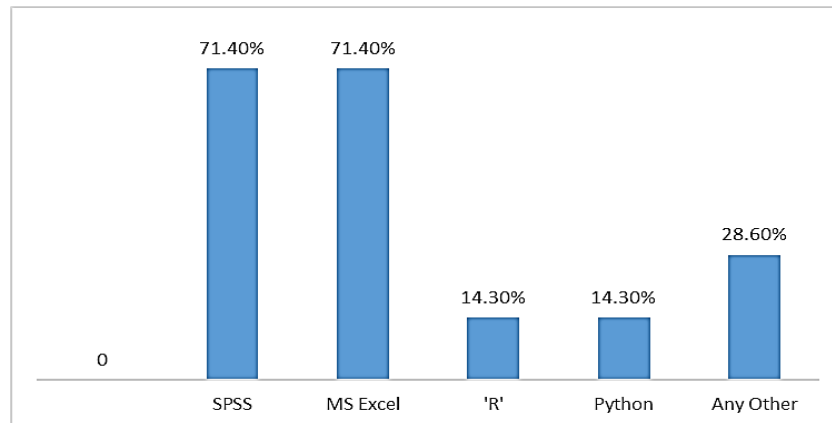


Figure 50: Frequencies of Data Analysis Services

4.4.13. Research Writing Support

In Table 64 and Figure 51, assistance for writing a research paper is demonstrated. As per the responses, the table reflects that 57.10% institution has the service to extend support for research paper writing, and 42.9% libraries have not yet initiated such services for the research group.

Table 64: Frequencies of Research Writing Support

Does your library provide research writing support to scholars?	Counts	% of Total	Cumulative %
Sometime	3	42.9%	42.9%
Yes	4	57.1%	100.0%

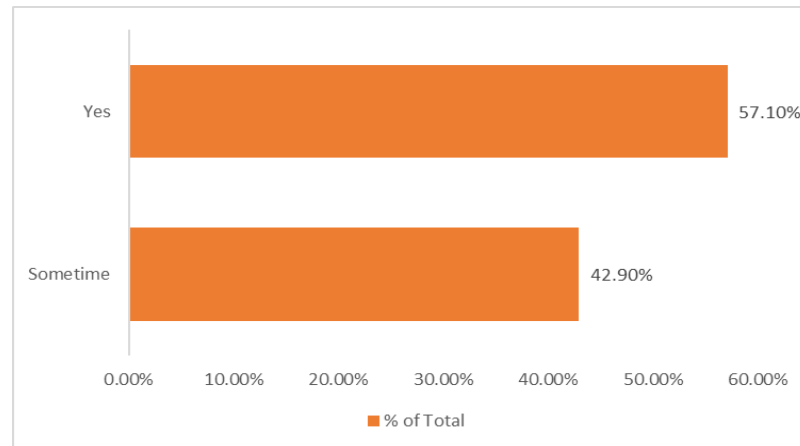


Figure 51: Frequencies of Research Writing Support

4.4.14. Financial Assistance Support

Many of the researchers are not enjoying the high level of financial stability. However, they have an eagerness to conduct quality research in their respective areas. Generally, they possess ideas, but it requires a lot of financial support. At this stage, the library or institution's responsibility is to ignite researchers' interest, to apply to available platforms to get financial assistance. In this regard, the effort of the library is summarized from the responses received, and output is shown in Table 63 and Figure 52, that 57% very frequently assist. 14.3% agree only 'sometimes' they are supportive to researcher in this regard. 14.3% agreed they do not at all support researchers in the areas of financial assistance. 15% given their consent that though they do not frequently provide financial assistance in a mass group, on demand they serve it.

Table 65: Frequencies of Financial Assistance Support

How frequently do you make scholars aware of national and international financial assistance/ project assistance?	Counts	% of Total	Cumulative %
Very frequently	4	57.1%	57.1%
On Demand	1	14.3%	71.4%
Not at all	1	14.3%	85.7%
Sometime	1	14.3%	100.0%

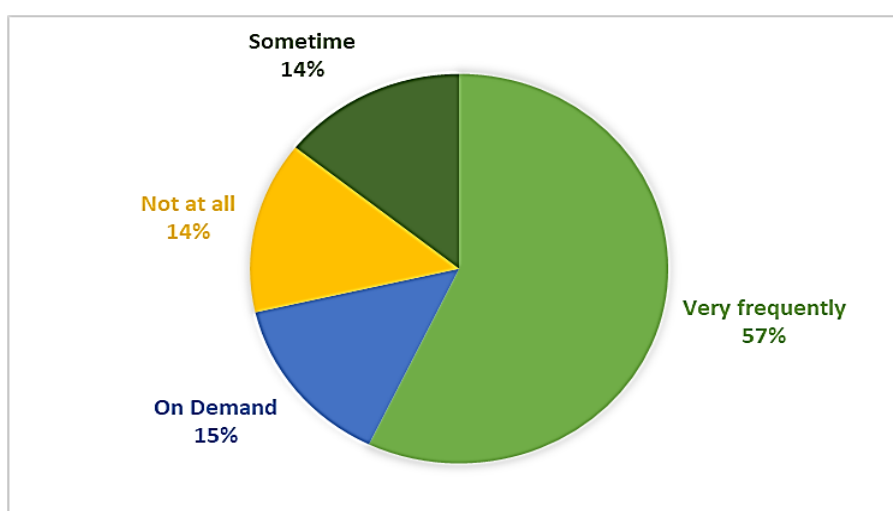


Figure 52: Frequencies of Financial Assistance Support

4.4.15. Distribution of Outreach Programme

Table 66 and Figure 53 show the distribution of outreach programmes undertaken by the different libraries to promote the availability of RSS in libraries. It shows that workshops, orientations, Training, seminars, and Expert talks are commonly used outreach programmes. In the study, it is found that ‘Orientation’ is the most adopted outreach programme by the LIS professional with 100.0%, followed by Workshop and Expert Talk, both with 71.40%. The seminar is another outreach programme avenue

undertaken by 42.80%. Surprisingly, no library is following the Training session as one of the outreach programmes to raise awareness of the RSS among libraries.

Table 66: Distribution of Outreach Programme

How do you make researchers aware of various libraries' Research Support Services?	Counts	% of Total
Workshop	5	71.4%
Orientation	7	100%
Seminar	3	42.8%
Training	0	0.0%
Expert Talk	5	71.4%

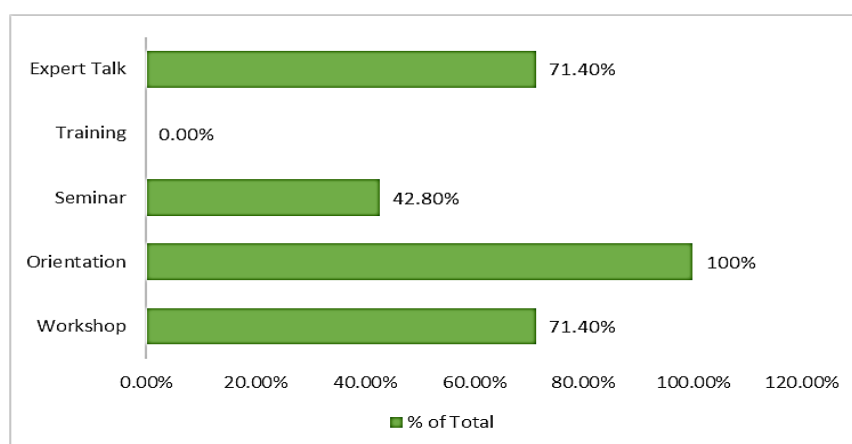


Figure 53: Distribution of Outreach Programme

4.4.16. Outreach Programme Organised

Table 67 and Figure 54 present data on the number of outreach programmes organised by the institutions under study, which is related to the findings in Table 66 and Figure 53. The analysis reveals that:

- 28.5% of libraries have organised three outreach programmes.
- 14.3% of libraries have conducted six outreach programmes.

- Another 14.3% have organised 20–25 outreach programmes.
- 14.3% of respondents mentioned conducting three outreach programmes in 2025.
- Additionally, 14.3% of respondents stated that *all participants are aware of Research Support Services (RSS)*.

This distribution highlights that while some libraries conduct a limited number of outreach activities, a few organise a significantly higher number, indicating variations in institutional engagement levels.

Table 67: Frequencies of Outreach Programme Organised

Outreach Programme	Range	Counts	Percentage %
3	2	28.5%	28.5%
6	1	14.3%	42.8%
20-25	1	14.3%	57.1%
3 in 2025	1	14.3%	71.4%
All are aware about RSS	1	14.3%	85.7%

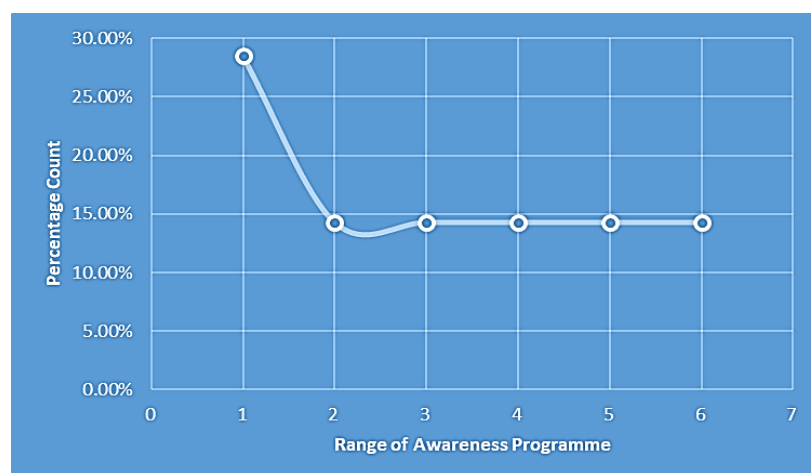


Figure 54: Frequencies of Outreach Programme Organised

4.4.17. Research Paper Writing Assistance

The data shown in Table 68 and Figure 55, that Grammarly is the most widely used research paper writing tool, reported by 100% (7 respondents) of the participants. EndNote is the second most preferred tool, used by 57.2% (4 respondents). Other tools have comparatively lower usage: Quillbot and Any Other (such as alternative writing aids) are each used by 28.6% (2 respondents), while Zotero is used by only 14.3% (1 respondent).

This pattern suggests that while Grammarly has universal adoption among respondents, reference management tools like EndNote and Zotero, as well as paraphrasing tools like Quillbot, have more selective usage.

Table 68: Frequencies of Paper Writing Assistance

Research Papers Writing Tools	Counts	% of Total
Grammarly	7	100.0%
Quillbot	2	28.6%
Zotero	1	14.3%
EndNote	4	57.2%
Any Other	2	28.6%

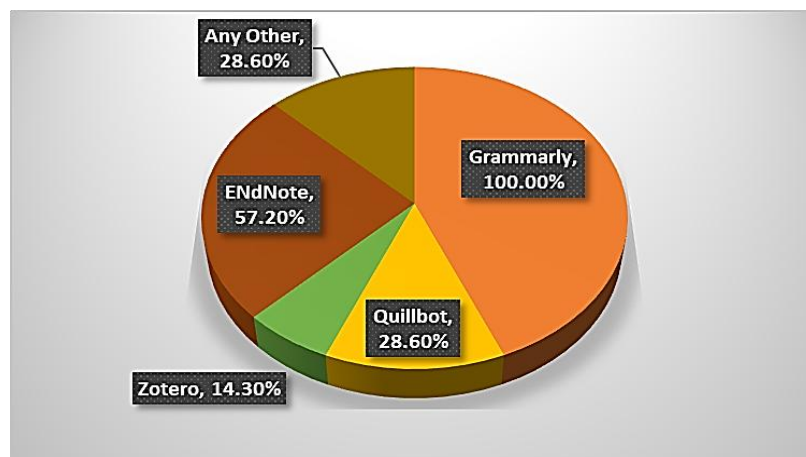


Figure 55: Frequencies of Paper Writing Assistance

4.4.18. Issues and Challenges in Implementing RSS

The findings of Table 69 and Figure 56 indicate that a majority of respondents (57.1%, 4 respondents) have *sometimes* faced issues and challenges in implementing Research Support Services (RSS). Around 28.6% (2 respondents) reported that they have *not at all* encountered such challenges, while a smaller proportion (14.3%, 1 respondent) stated that they face these issues *frequently*.

The cumulative percentage shows that 85.7% of respondents have either *sometimes* or *never* faced difficulties, whereas only a small minority (14.3%) experience frequent challenges. This implies that although implementation challenges exist, they are not a constant or widespread barrier for most respondents.

Table 69: Frequencies of issues and challenges in implementing RSS

Have you ever faced issues and challenges in implementing RSS	Counts	% of Total	Cumulative %
Sometime	4	57.1%	57.1%
Not at all	2	28.6%	85.7%
Frequently	1	14.3%	100.0%

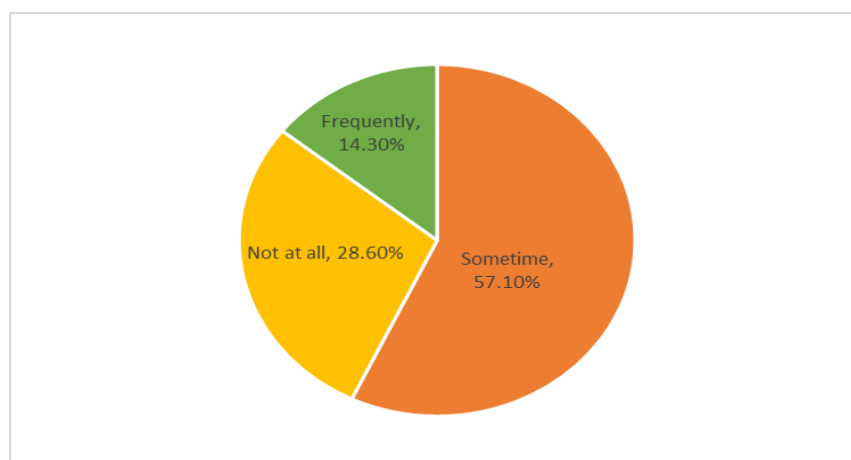


Figure 56: Frequencies of issues and challenges in implementing RSS

4.4.19. Areas of Challenges Faced

The analysis shows that staff-related challenges are the most commonly reported, mentioned by 57.2% (4 respondents) of participants. Technical challenges, financial challenges, and difficulties in collaborating with external agencies are each reported by 28.6% (2 respondents). Infrastructure challenges and other unspecified challenges are also reported by 14.3% (1–2 respondents). Additionally, 14.3% (1 respondent) indicated that they face *no challenges* in implementing RSS.

Table 70: Areas of Challenges Faced by LIS Professionals

Areas of Challenge?	Counts	% of Total
Staff Challenges	4	57.2%
Technical Challenges	2	28.6%
Infrastructure Challenges	1	14.3%
Financial Challenges	2	28.6%
Challenges in collaboration with external agencies	2	28.6%
Any Other	2	28.6%
No Challenges	1	14.3%

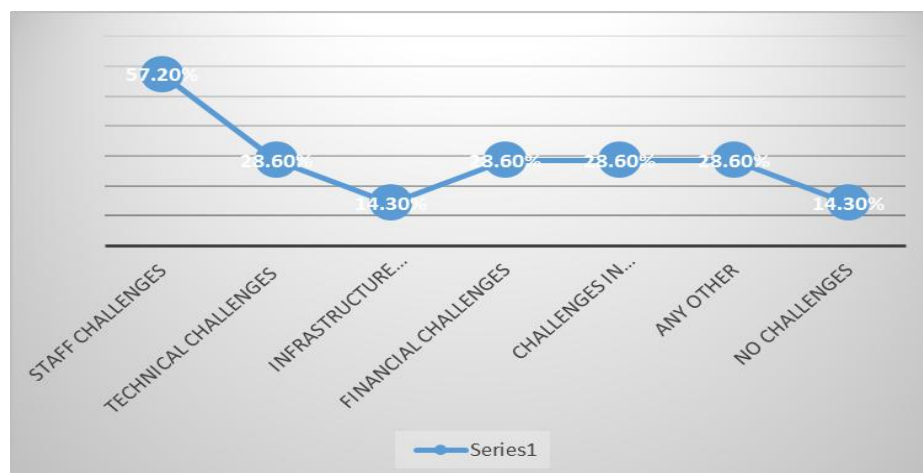


Figure 57: Areas of Challenges Faced by LIS Professionals

4.4.20. Distribution of LIS Professional Competency

Table 71 and Figure 58 show the competency status of library staff in handling Research Support Services (RSS). It is observed that 42.9% of libraries reported that all of their staff possess the required competencies, whereas a larger proportion, 57.1%, indicated that only some of their staff possess the necessary competencies. The cumulative percentage further confirms that a majority of libraries face partial skill limitations among staff.

Table 71: Competency Distribution of LIS Professionals

Competency Status	Counts	% of Total	Cumulative %
All Possess required competencies	3	43%	43%
Some of the staff possess required competencies	4	57%	100.0%

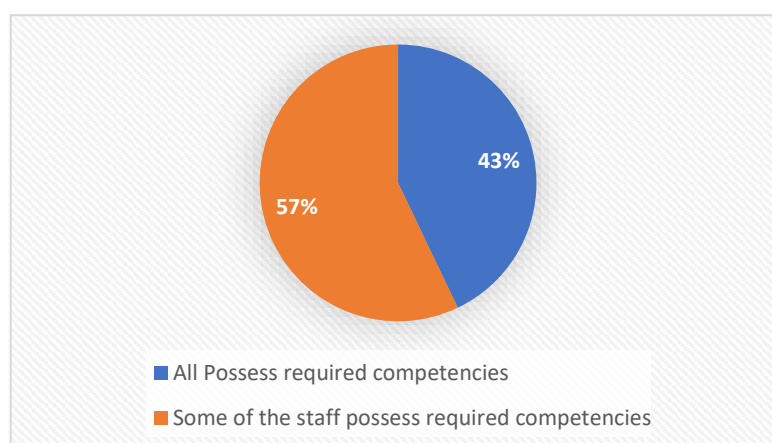


Figure 58: Competency Distribution of LIS Professionals

4.4.21. Distribution by Designated Space for RSS

The data reveal that a large majority of respondents (85.7%) reported having a designated space for implementing Research Support Services (RSS) in their institution. Only 14.3% indicated that no such space is available.

Table 72: Frequencies of designated space for implementing RSS

Designated space for implementing RSS.	Counts	% of Total	Cumulative %
Yes	6	85.7%	85.7%
No	1	14.3%	100.0%

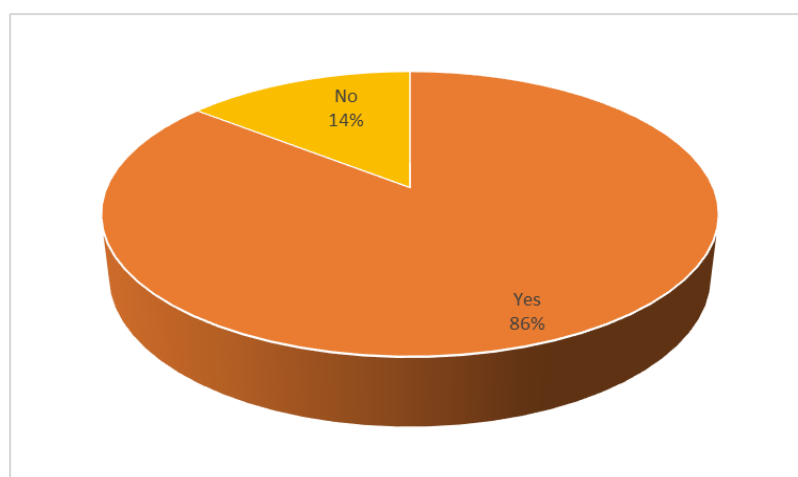


Figure 59: Frequencies of designated space for implementing RSS

4.4.22. Staff Strength of the Library

The results indicate that 57.1% of respondents (4 respondents) believe their library has *sufficient staff strength* to effectively implement Research Support Services (RSS). Conversely, 42.9% (3 respondents) reported that the existing staff strength is *not sufficient*.

This suggests that while a slight majority perceive their staffing levels as adequate, a significant proportion still face human resource limitations, which could impact the consistent delivery and quality of RSS.

Table 73: Frequencies of Staff strength of the library

Staff strength of library is sufficient in implementing RSS ?	Counts	% of Total	Cumulative %
No	3	42.9%	42.9%
Yes	4	57.1%	100.0%

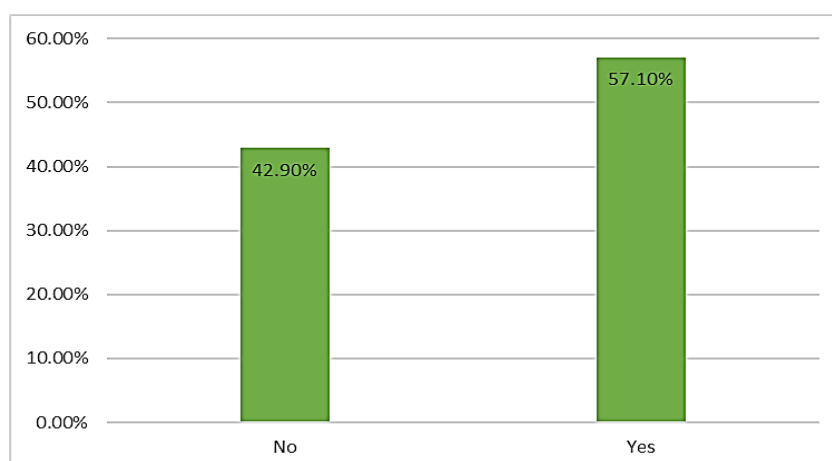


Figure 60: Frequencies of Staff strength of the library

4.4.23. Satisfaction over RSS distribution

The findings show that a majority of respondents (57.1%, 4 respondents) rated the Research Support Services (RSS) in their library as *excellent*. About 28.6% (2 respondents) rated the services as *very good*, while only 14.3% (1 respondent) rated them as *poor*.

This indicates that overall user satisfaction with RSS is high, with more than four-fifths (85.7%) of respondents giving ratings in the *excellent* or *very good* categories.

The small proportion of negative feedback highlights isolated areas that may require service improvement.

Table 74: Frequencies of Library's Satisfaction on RSS

How do you rate research support services of you library ?	Counts	% of Total	Cumulative %
Excellent	4	57.1%	57.1%
Very Good	2	28.6%	85.7%
Poor	1	14.3%	100.0%

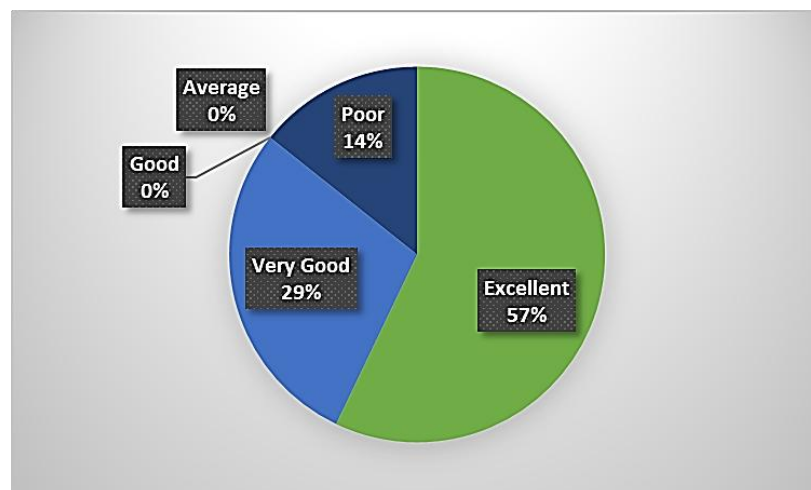


Figure 61: Frequencies of Library's Satisfaction with RSS

4.5. Testing of Hypothesis

Hypothesis testing is a vital process in scientific inquiry that uses statistical methods to evaluate assumptions. Testing of the hypothesis is employed for the independent variable or the dependent variable. The present study adopted both variables to test the proposed assumption. At the initiation stage of this study, the scholar has developed three hypotheses, which are tested using the chi-square test method of hypothesis testing, based on the sample data collection and reflection on the decision given below.

4.6. Result of Tested Hypothesis

H1- There is no significant difference in extending research support services to the students in public and private technical institutions' libraries.

The chi-square test was applied to examine whether there is a significant difference in extending research support services to students in the libraries of public and private technical institutions. The calculated chi-square value was 1.66 with 6 degrees of freedom. The associated p-value was 0.948, which is far greater than the standard significance level of 0.05. This result indicates that the difference in research support services between public and private technical institutions' libraries is not statistically significant. Hence, the null hypothesis stating that there is no significant difference in extending research support services is retained, and the alternative hypothesis is not supported. The finding suggests that both types of institutions provide research support services at a comparable level. Hence, null Hypothesis is failed to reject.

H2- There is no significant difference in resource subscription for research support services in public and private engineering institutions.

The chi-square test was conducted to examine the association between the selected variables a. *Types of University* and b. *Kind of Resources Subscribed*. The study shows the various resources subscribed to by selected private and public technical institutions of Odisha to improve access to quality literature for research. The study examined this subscription status and tested the hypothesis using the Chi² statistical approach $\chi^2 = \sum \frac{(O-E)^2}{E}$. The result found Chi² value is 4.742857143, with 12 degrees of freedom (df) and a p-value of 0.966020833. Hence, the p-value is greater than 0.05, so we find no significant difference exhibited in resource subscription between private and public technical institutions.

So, the null Hypothesis “*There is no significant difference in resource subscription for research support services in public and private engineering institutions*” is failed to reject.

H3-There is no significant difference in research support competencies of LIS professionals in public and private institutions.

A Chi² test was performed between the types of university and whether all the staff of the library possess the requisite competencies to handle all the research tools that are being provided. There was no statistically significant relationship between the types of university and whether all the staff of the library possess the requisite competencies to handle all the research tools provided. $\chi^2(1) = 0.19, p = .659$.

The calculated p-value of .659 was above the defined significance level of 5%. The Chi² test was therefore not significant, and the null hypothesis “There is no significant difference in research support competencies of LIS professionals in public and private institutions” is failed to reject.

4.7. Conclusion

The analysis phase of a research project plays a crucial role in achieving its objectives. It enables the researcher to understand the circumstances and behaviours of the phenomena under study, and to interpret the findings in light of the core objectives of the research. Through systematic data analysis, the researcher can derive meaningful insights and formulate relevant suggestions based on the patterns and trends observed. Accordingly, the subsequent section of this study presents the suggestions derived from the overall interpretation and analysis of the collected data.

4.8. References

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CHAPTER 5

FINDINGS, SUGGESTIONS AND CONCLUSION

5.1. INTRODUCTION

In this section, an objectives-oriented conclusion has been made based on the importance of research support services in seven technical institutions of Odisha. This section particularly discusses the overall findings of the study and the impact of RSS extended through the library. Also in this section, the researcher tried to reflect the RSS status in these selected institutions aligned with the study objectives by concluding the reflective impression through response analysis. The finding would be a guiding force for the administrative group, librarians, faculty researchers, policy makers, and other stakeholders in designing and formulating RSS in general or even particular to their respective institutions.

5.2. FINDINGS ON APPROVED RESEARCH OBJECTIVES

At the beginning of the research proposal submitted to Mizoram University, the objectives were approved by the Departmental Review Committee and other university boards. Based on these proposed five broad objectives, the findings are discussed in detail.

5.2.1. Objective 1: Evaluate the effectiveness of research support services on the academic performance of the researcher in selected technological institutions of Odisha.

To enumerate the findings of objective 1, questions asked to respondents from questions 11 to 17 of Section D: '*Effectiveness of Research Support Services*' from the questionnaire were considered. According to the responses, the findings are presented below:

- I) As RSS is regarded as one of the weapons for improving comprehensive skills in the production of qualitative and quantitative research, the study discovers that researchers experience a considerable increase in academic performance after getting RSS (Table 34).

- II) While the survey discovered that some individuals identified increases in quality and others in quantity, the majority of respondents reported visible progress or improvement in both (quantity and quality) following research help. As a result, it is possible to conclude that with the assistance of research support, there has been a significant increase in the quality and quantity of publications. (Table 35).
- III) The respondent uses almost all of the facilities equally for storing and managing literature and data. According to replies on reference management software such as Zotero, Mendeley, and EndNote, more than half of the scholarly community (54.5%) prefers online reference management tools for storage, review, and citation (Table 36).
- IV) Surprisingly, 60% of academics use internet databases and journals independently, as well as institutional repositories for literature collection. As a result, researchers feel more comfortable working independently with databases and repositories (Table 37).
- V) Consistent citation procedures not only promote academic honesty but also improve the legitimacy and trustworthiness of research findings. The study reflects integrity and research ethics, with 89% of researchers always citing the literature they refer to. This demonstrates that the majority of researchers understand the importance of properly crediting original sources (Table 38).
- VI) Table 39 demonstrates that 75% of respondents had not received research funding at the time the data were gathered. However, 25% of the researchers acquired research grants through advertisements, awareness campaigns, and assistance in submitting research proposals provided by their departments or directly by funding agencies.

The findings from objective one clearly demonstrate that research support services play a pivotal role in enhancing the overall development of the research community in academic institutions. Hence, there is an effectiveness of Research Support Services.

5.2.2. Objective 2: Assess the satisfaction of the researcher regarding various research support services.

To assess the researcher's satisfaction with RSS, the responses received through the questionnaire from 20 to 29 are analysed. As per the response, the findings align with Objective 2, as given below:

- I) The Majority of respondents (63.9%) have shown that they are not at all affected by any difficulties in retrieving literature from online databases and journals. It shows that they are aware of the search strategy associated with these databases and journal portals to retrieve relevant information (Table 43).
- II) To determine data analysis competency, the survey found that 28.8% are excellent, 51.1% are very good, and 17.6% are competent; only 2.5% have issues with data analysis. However, many new scholars have reacted, despite having little prior research experience and possibly lacking library research help. As a result, in proposing deductive research methodologies, everyone is satisfied with their data analysis skills (Table 44).
- III) There is no hesitation to express here the growth of the publication of researchers. As earlier, it is also revealed in Table 35 that the publication growth in terms of quality & quantity is remarkable. To assess the publication growth, in question number 22, the respondent highlights the substantial growth of research publications. 67.1% agreed they have profoundly increased their publication. Definitely, RSS brings remarkable growth in research publication (Table 45).
- IV) Growth of publications in different seminars and conferences is also visible; however, the number varies from 1-5 to more than 30. Only a marginal percentage of 9.7% have not yet published any seminar or conference papers. Again, this 9.7% belongs to responses of newly admitted PhD scholars, who have less than a year of experience; otherwise, RSS has helped in the publication of seminar or conference papers (Table 46)

- V) Along with the seminar publication, there is also a significant support of RSS observed in research paper publication in reputed peer-reviewed journals and UGC care list journals, or registered journals from databases like Scopus, Web of Science, IEEE Explore, ASME, ASCE, etc. Almost every researcher has published at least one publication, except for a very small percentage of 17.6% (Table 47).
- VI) As libraries play a crucial role in supporting the research community, the services they provide are vital. In today's technological age, libraries remain accessible to their users through various features and services implemented via their websites. The study found that user satisfaction with library website services in the selected technical institutions reached a cumulative percentage of 89%, based on responses from researchers and faculty, with ratings ranging from "Good" to "Very Good" and "Excellent (Table 50). The cumulative response indicates a high level of satisfaction; hence, the library website is very effective in providing RSS.
- VII) Analysis of the researchers' responses indicates that the library's research support in their institutions is reasonably effective and meets the researchers' satisfaction, with a cumulative 79.3% of the results rated as "Excellent" or "Above Average (Very Good)" (Table 51).

5.2.3. Objective 3: Find out the competencies of library professionals in providing research support services.

A well-competent professional is always an asset to their organisation. Through skills, expertise, and experience, they maintain a high level of professional recognition. In the context of facilitating research support services, present-day library professionals face several challenges. These challenges range from handling advanced tools, staying aware of research publications and current research trends, maintaining publication relations, and developing organisational and time-management skills, among others. Objective 3 of the present study focuses on the skills and competencies possessed by LIS professionals for the smooth delivery of research support services (RSS). The

findings for this objective are presented here, based on the responses received from the LIS professionals of the institutions under study. The findings are as follows:

- I) Technology plays a vital role in present-day research activities. To study the libraries' challenges in extension of research support, it is found that the technical expertise of LIS professionals is a major concern. Hence, though the majority of libraries possess LIS professionals with sound technical expertise, still almost 30% have to focus on the technical knowledge of their staff (Table 70).
- II) Infrastructure provides a better scope and opportunity for effective service dissemination. The study comparing staff competency found that 85.7% of technical institutions' libraries hold designated spaces suitable for staff competency development and research support (Table 72).
- III) According to the analysis, more than 40% of libraries believe that just a small number of their employees have the necessary expertise to handle Research Support Services. This reflects a large competency gap, which may impede the effective delivery of such services to researchers (Table 62).
- IV) Above all, the library staff play a very crucial role in materialising the services effectively introduced for research enhancement. The study found that not all library professionals possess the required level of competency. Almost 45.0% staff (43.0%) consent that their staff need more competency in handling RSS (Table 71).

5.2.4. Objective 4: List out the outreach and promotional endeavours of libraries for research support services.

Along with fulfilling academic needs, responsibility is vested in the library to strengthen research endeavours in the institution and enhance the competencies and skills among the researchers to carry out research seamlessly. With complete and in-depth knowledge or awareness of research requirements and recent trends associated

with it, a researcher can undoubtedly achieve their goals. Therefore, it is a significant responsibility of the library to keep researchers informed periodically about advanced research standards. In this context, the measures taken by the library to keep researchers updated and their impact are explained here. After thoroughly examining the responses received from librarians, faculty, and research scholars, the analysis yielded findings that correspond to objective 4, as described below.

- I) The library conducts outreach programmes to keep researchers updated on various research developments. This is evident from the responses presented in Table 25. Sixty-six respondents reported visiting the library to receive research assistance, and ninety respondents participated in various outreach programmes organised by the library (Table 25).
- II) Notably, under the outreach programme, the library has been organising workshops, training sessions, orientations, seminars, and expert talks, which the respondents have attended. Among these, orientations on RSS are organised by all libraries (100.0%), followed by workshops (71.4%), which were identified as the most effective outreach programmes undertaken by the library (Table 26).
- III) Most respondents (71.2%) attended between one and five outreach programmes, as reflected in Table 27 of the data analysis section. Hence, it is explored that the library outreach programme is in practice.
- IV) Although various research support activities are covered through outreach programmes, the workshop on the usage of anti-plagiarism software was attended by 69.9% of respondents, followed by sessions on strategies to browse online journals (61.1%), understanding research publication and ethics (52%), and retrieving information from open-access online resources (50.5%). These findings suggest that researchers are focusing more on research article publication and intend to stay updated regarding publication practices and trends.

- V) The study reveals, based on the analysis of responses from librarians, research scholars, and faculty, that every library has access to Grammarly software, and six out of seven libraries also have Turnitin anti-plagiarism software. Correspondingly, 62.4% of respondents reported being very familiar with Grammarly, while 41.1% are familiar with Turnitin. Therefore, it can be inferred that the libraries in the selected technical institutions have effectively oriented researchers about these widely used anti-plagiarism software tools (Tables 29 & 60).
- VI) The management of collected resources and data is crucial from the researcher's perspective. This study found that, although several effective reference management tools are available, Mendeley is the most preferred tool among researchers. According to the librarians' responses, six out of seven libraries use Mendeley for reference management. It can be assumed that the libraries recognise Mendeley as an effective tool, which likely explains why most scholars have also chosen Mendeley for managing their references (Table 30).
- VII) There is a chance of acceptance of research publications by publishers, provided proper referencing and other recommended criteria are met. To assess researchers' knowledge and experience with referencing styles, the study examined citation preferences and found that APA style is the most commonly used, with 218 out of 319 respondents adopting it. This is followed by Chicago, Oxford, and MLA styles, with 148, 140, and 138 users, respectively. The findings indicate that APA is the predominant referencing style among the majority of researchers (Table 31).
- VIII) Every study remains focused on its analysis section, where data collection is evaluated using different statistical analysis tools based on the researcher's appropriateness. The analysis may focus on quality, quantity, or both. In this objective, to examine the conduct of outreach programmes by the library, responses from respondents were analysed. It was found that Microsoft Excel is the primary statistical analysis tool preferred by respondents, with 73%

reporting high comfort in using it. This indicates that despite the availability of advanced tools such as SPSS, R, Python, and Stata, Microsoft Excel remains the most prominent choice among researchers and librarians for imparting training or organising workshops on it (Table 32).

- IX) Facilities of the library, analysed in Table 33, through which it is assumed that the conduct of the outreach programme is functional. According to the analysis, 80.9% experienced a dedicated section for RSS, 68.3% got assistance from a skilled dedicated staff, and 73% benefited from the library website. So, the finding reveals that the library offers dedicated staff, sections, and updated resource links to materialise RSS (Table 33).

5.2.5. Objective 5: Find out various challenges and problems faced by library professionals for the implementation of research support services.

- I) Challenges create obstacles to the efficient implementation of services. The study revealed that there are problems that vary from institution to institution. Some libraries have no concerns or challenges, while others face challenges in some areas related to RSS. Again, the survey discovered that a few institute libraries are experiencing frequent troubles and challenges (Table 69).
- II) The study also highlights that human resource (library staff) issues remain the dominant barrier. In contrast, technical, financial, and collaboration-related challenges affect a more minor but notable proportion of respondents (Table 70).
- III) The cumulative percentage related to designated space for providing RS confirms that over four-fifths of institutions have allocated physical space for RSS activities, reflecting institutional commitment towards structured research support. However, the absence of such space in some institutions may limit the effectiveness and accessibility of these services (Table 72).

5.2.6. Objective 6: Design a model of a quality research support system for research scholars.

The library must always have a blueprint prepared to run the RS services properly and demonstrate their effectiveness. However, the research papers published earlier had focused on the RSS model (Vemuri, 1982; Santharooban, 2022), a standard, structured, or proper plan needs to be developed for smooth and effective implementation of RSS. In this study, by analysing the responses of both parties (research scholars and faculty on one side and the library on the other side), a comprehensive research model is being proposed. As the study is conducted for technical institutions that mostly have university-level status, the model would be a helpful and guiding force for all higher educational institutions and research institutions in terms of providing research support services.

- **PROPOSED MODEL FOR RSS**

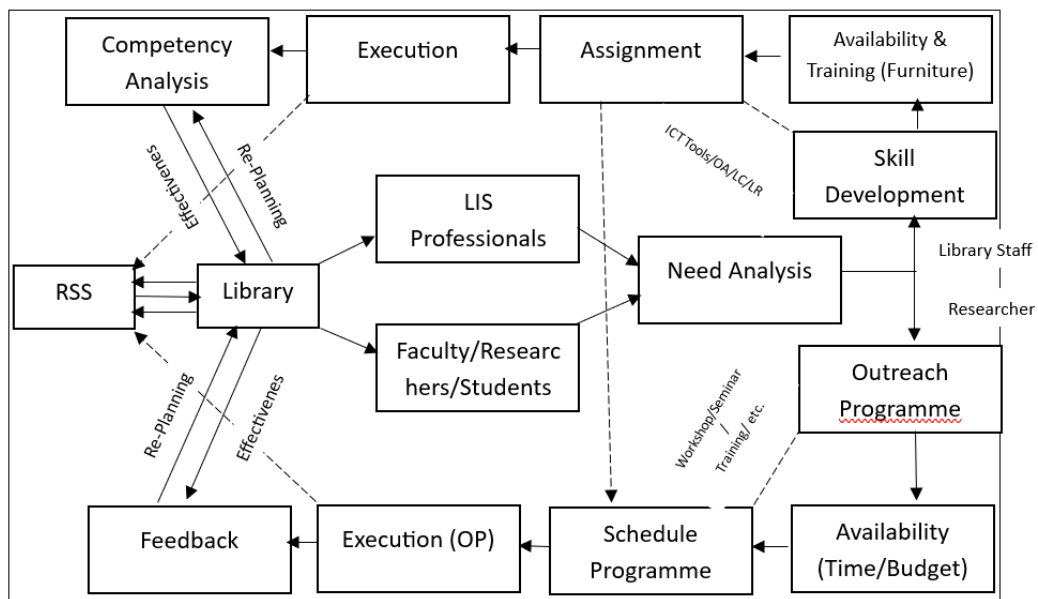


Figure 62: Research Support Services Model

DESCRIPTION OF THE RESEARCH SUPPORT SERVICES MODEL

The model illustrates the systematic process through which libraries provide Research Support Services (RSS) to faculty, researchers, and students.

A. Library as the Central Hub

- The library acts as the connecting point between RSS, LIS professionals, and faculty/researchers/students.
- It initiates the cycle by identifying the needs of researchers and aligning them with institutional resources.

B. Need Analysis

- A core step where both library staff and researchers participate in assessing specific requirements for research support.
- Inputs come from LIS professionals and end-users (faculty/researchers/students).

C. Outreach Programme

- Based on the need analysis, libraries organise workshops, seminars, training, orientations, and expert talks.
- These programmes aim to bridge skill gaps and spread awareness of available services.

D. Skill Development & Availability

- Emphasis is placed on skill development of library staff using ICT tools, OAA (Open Access Archives), and CLR (Current Literature Resources).
- Proper availability of infrastructure (furniture, ICT, time, and budget) is ensured to support RSS delivery.

E. Assignment & Execution

- Roles and responsibilities are assigned to staff, followed by execution of planned services.
- This ensures smooth operation of outreach and support activities.

F. Scheduling of Programmes

- Programmes are scheduled systematically, considering researcher availability and institutional timelines.

G. Feedback & Competency Analysis

- After execution, feedback from researchers is collected and analysed.
- The feedback is linked to competency analysis to evaluate whether staff possess adequate skills.
- Based on findings, re-planning occurs to enhance service quality and address limitations.

H. Effectiveness and Continuous Improvement

- The model emphasises a feedback loop, where effectiveness is reviewed and services are restructured.
- This ensures continuous improvement of RSS in terms of staff capacity, infrastructure, and researcher satisfaction.

5.3. SUGGESTION

In this section, several recommendations for promoting research support services, mainly for technical institutions, are provided to enhance research activities and improve the overall performance of the researcher and the institution as a whole. The suggestions are made based on responses received, analysed, and findings. Suggestion part covered with two sub-sections, i.e., 1. Suggestions Received from Respondents and 2. Suggestion based on Findings. Hence, the suggestions are listed under their subheading below:

5.3.1. SUGGESTIONS RECEIVED FROM RESPONDENTS

During data collection, respondents have given their suggestions to improve RSS, which are as follows:

- A special scholar room needs to be developed with 24/7 availability.

- The library has limited space considering the number of students and faculty. Therefore, the library needs more space and computers to support its digital library.
- Nowadays, the quality of images produced in research matters significantly. Image editing and creation software, such as CorelDRAW, should be beneficial.
- The library needs to maintain a repository for public sharing of theses.
- Need a subscription to more quality journals.
- In the library, all the journal sites should be available for all students or researchers without any external fees. The institutions should provide their email addresses so that researchers can access all those sites easily.
- Give some contingency to research scholars for the enhancement of the research idea.
- The institution will take care of implementing a research helpdesk.

5.3.2. SUGGESTION BASED ON ANALYSIS

Here, the suggestions are made on a priority basis as per the data analysis and findings of the study:

➤ Improvement in Library Infrastructure

To strengthen research support services, libraries must address issues related to inadequate infrastructure, dedicated space, and a shortage of staff. This can be achieved by bringing the issue to the attention of the higher authority, upgrading facilities with modern technologies, ensuring continuous staff training, and recruiting skilled professionals. Such measures will enhance service delivery, improve user satisfaction, and position the library as a vital partner in the research ecosystem.

➤ CPD Programme to Improve Staff Skills

To strengthen research support services, LIS professionals must possess the requisite skills and competency to deal with researchers' problems in research activities. To

ensure the effectiveness of RSS in the institution, the competency of staff must be developed by organising a continuous development programme (CPD) for library staff.

➤ **Consortium-based Subscription**

Due to the financial constraints, institutions' libraries often fail to facilitate their users' access to online resources and databases. To overcome this, libraries can negotiate consortia-based subscriptions, promote open-access resources, and provide remote access facilities. Such initiatives will ensure wider accessibility, strengthen research support services, and enhance the quality of research output.

➤ **Need-based Outreach Programme**

Awareness of research support services is often more important than their mere availability. It is essential that researchers are well-informed about the library's Research Support Services (RSS). To achieve this, libraries should frequently conduct outreach programs (Orientation, Training, Workshops, Seminars, Expert Talks, etc.) that are designed based on a need-based analysis.

➤ **Facilitating Modern Data Analysis Tools**

While many researchers use MS Excel for data analysis, in the present day, advanced tools like Python, SPSS, Power BI, and R are treated as market-dominating tools for their greater accuracy, efficiency, and advanced statistical techniques. Procuring such software would enhance library research support services and also empower researchers with modern analytical capabilities.

➤ **Dissemination of Research Grant Information**

Research grants are crucial for supporting high-quality research, enabling scholars to access essential resources, conduct fieldwork, and disseminate their findings. Libraries can enhance research support services by providing information on the scope of funding, assisting with research proposal writing, and offering valuable guidance on research grant application processes. They can also conduct expert orientation sessions, thereby fostering a strong research culture and enhancing institutional research productivity.

5.4. SUGGESTIONS FOR FURTHER STUDIES

After going through the present research, it is realised that numerous scopes exist to conduct further research on the topic of Research Support Services. Some of the scopes of the studies are suggested below:

- A Comparative Study between different HEIs of Odisha
- Impact of RSS on the Academic Performance between the states' universities.
- A Comparative Study of RSS on Higher Educational Institutions.
- Impact of RSS on interdisciplinary and collaborative Research.
- Competency Analysis of LIS professionals on Research-intensive Tools

5.5. CONCLUSION

The actual application of Research Support Services (RSS), along with the proactive participation of Library and Information Science (LIS) experts, has the potential to improve the research environment in Odisha's technical institutions significantly. Because research activities are such an important factor in determining an institution's rankings and academic reputation, RSS must be strengthened. This study underlines the importance of modern research tools, researchers' capabilities, library facilities, and library staff expertise in determining the quality of research output.

A lack of expertise or proficiency with modern tools frequently causes unneeded delays and obstacles in research. Applications such as Mendeley, Zotero, and EndNote for research data management; Grammarly and QuillBot for writing assistance; Drillbit, iThenticate, and Plagscan for plagiarism detection; and SPSS, Python, and R for statistical analysis provide enormous value to researchers at all stages. The efficient use of these resources not only ensures quality proposals but also adds to high-quality publications, seminars, and conference outcomes.

Finally, the provision of robust RSS, along with trained library workers, promotes higher-quality research, increases publication visibility, improves institutional reputation, and helps researchers' career progression through increased recognition and citation.

This study, which focuses on the primary Research Support Services (RSS) of technical institutions in Odisha, emphasises the importance of libraries, research tools, and professional abilities in promoting quality research. The study sheds light on how to boost research ecosystems by looking at researchers' knowledge, staff skills, and the availability of current facilities. The findings will assist not only technical institutions in Odisha but also act as a model for other technical institutions throughout India. The findings can benefit higher education institutions (HEIs) in general by increasing research output, institutional rankings, and worldwide awareness.

The library plays an important role in improving Research Support Services by serving as a facilitator, enabler, advisor, innovator, and supporter of academic activity. As a facilitator, it provides access to critical resources and tools; as an enabler, it trains and educates researchers; as a guide, it assists them in navigating research complexities; as an innovator, it adopts cutting-edge technologies and practices; and as a supporter, it ensures ongoing assistance. Collectively, these functions establish the library as a critical component in boosting research quality and encouraging academic accomplishment.

Research Support Services (RSS) are crucial for fostering academic achievement and worldwide awareness. Higher education institutions (HEIs) must prioritise the development of comprehensive library-based RSS to assist staff, researchers, and students with their intellectual efforts. Faculty and researchers should actively employ modern research tools, plagiarism detection software, and data management systems to boost the quality and credibility of their work. Students should view the library as more than just a resource centre, but as a collaborator in their research. The academic community may use RSS effectively to drive innovation, improve publication quality, and contribute considerably to institutional growth.

APPENDICES

QUESTIONNAIRE

RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY

Respected Respondents,

I am Biswa Bag, PhD scholar, Mizoram University, pursuing a study on **“RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY”**. The study is being carried out under the guidance of Prof. Pravakar Rath (Dept. of Library and Information Science, Mizoram University).

You are requested to kindly respond to the questionnaire below to complete my study successfully. I personally take the accountability not to disclose any data (personal or official) on any form of public platform. I am fully abided by the research ethics, so your response shall be used for academic purposes only and for the completion of my research project. Your response and valuable time are praise in advance.

Thanking you.

Biswa Bag
Research Scholar
Library and Information Science
Mizoram University

SECTION A: PERSONAL INFORMATION

1. Name of the Respondent: Prof/Dr/Mr/Mrs/Ms__ -

2. Position/ Designation: _____

Professor

☐

Associate Professor

☐

Assistant Professor

☐

Research Scholar

☐

3. Age :

20-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐
41-45 ☐ 46-50 ☐ 51-55 ☐ 56-60 ☐ Above 60 ☐

4. Gender: Male ☐ Female ☐

5. Name of the Technical Institution Affiliated/Enrolled to –

6. Type of University? Public ☐ Private ☐

7. Name of the Department Working/pursuing Research:

8. Year of Teaching/Research Experience:

SECTION B: BASIC INFORMATION

1. How frequently do you access your library?

Daily ☐ Once in a week ☐ Twice in a Week ☐
Once in a fortnight ☐ Once in a Month ☐ Occasionally ☐
Not at all ☐

2. What is the purpose of your visit to the library?

Sl. No.	Purpose	Yes	NO
1	For general reading (Books, magazines & Journals, Newspapers and projects & dissertations)		
2	Issue and return a library book		
3	Literature collection		
4	Get research assistance from library staff		
5	Print or Xerox educational content		
6	Writing research article and a project assignment		
7	Use research support tools		
8	Attend the workshop and training programme organised by the library		
9	Any Other Purpose		

SECTION C: AWARENESS OF LIBRARY RESEARCH SUPPORT SERVICES

3. Have you attended any of the following outreach programmes, organised by your library on various library Research Support Services?

Sl. No.	Outreach Programme	Yes	No
1	Workshop		
2	Orientation		
3	Training		
4	Expert Talk		
5	Seminar		
6	Any Other		

4. Number of library outreach programs on Research Support Services you have attended as of the date?

a) 1-5 b) 6-10 c) More than 10

5. Kind of Research Support Services, have you participated in the library's training/workshop/orientation program?

Sl. No.	Research Assistance Area	Yes	No
1	Usage of Anti-Plagiarism Software		
2	Use of Reference Management Tools		
3	Handling Data Analysis Tools		
4	Maintaining referencing style manuals		
5	Aware of Research funding/grant assistance		
6	Understanding Research publication and ethics		
7	Surfing of Research Databases		
8	Browsing Online Journal		
9	Access to Open Access online resources		
10	Orientation on Dedicated Website/Link for RSS		
11	Usage of Institutional Repositories resources		

6. How much are you familiar with the following anti-plagiarism software?

Anti-Plagiarism Software	Very much Familiar	Partially familiar	Not at all Familiar
i-Thenticate			
Turnitin			

Urkund			
Grammarly			
Plag Tracker			
Plagscan			
Scribbr			

7. Respond to your knowledge regarding the following Reference Management Tools?

Reference Management tools	Very much Familiar	Partially familiar	Not at all Familiar
Mendely			
Zotero			
Endnote			
Refwork			
CiteULike			
BibTex			
RIS			
Any Other			

8. Which among the following standard referencing styles is being followed by you?

Standard Referencing Style	Yes	No
APA		
MLA		
Chicago		
Chicago or Turabian style		
Oxford style		
Any Other		

9. Tick the data analysis tools you are comfortable with.

Data Analysis Tools	Comfortable	Partially Comfortable	Not Comfortable
MS-Excel			
SPSS			
R			
Stata			
Python			
Any Other			

10. Do you find the following facility in your institutional library?

Library facility	Yes	No
Dedicated section for handling research support tools		
Dedicated staff for research support service		
Dedicated library website link for research support		

SECTION D: EFFECTIVENESS OF RESEARCH SUPPORT SERVICE

11. How do you rate the impact of the research support services on your academic performance?

a) Positive ☐ b) Negative ☐ c) Neutral ☐

12. Have you noticed any significant improvement in the quality and quantity of your research publications after getting research support services?

- a. Yes, Significant improvement in quality ☐
- b. Yes, Significant improvement in quantity ☐
- c. Yes, Significant improvement in both quality and quantity ☐
- d. No, Significant improvement ☐
- e. Not Sure ☐

13. How do you manage your literature collection for further reference and citation?

Storage facility	Yes	No
Literature stored in a Storage device		
Literature store in the System hard disc		
Literature Printed and stored		
Use Reference Management tools, i.e. Zotero/Mendeley/EndNote, etc.		

14. How do you search literature from online databases & Journals, and Institutional repositories?

- a. Independently ☐
- b. Dependent upon the Library ☐
- c. Depend upon peers/ colleagues. ☐

15. How often do you cite the author/s from whom you have taken content/ referred to the sources for your research papers?

Always ☐ Never ☐ Sometime ☐

16. Have you received any research grants from any internal/external agency?

a. YES ☐

b. NO ☐

17. If yes, how do you get the information for a research grant?

Mode of Receiving Information	Yes	No
Through Library		
Through Department		
Through paper advertisement		
Through the Social Media Site		
Through the Grant agency's website		

LITERATURE SEARCH:-

18. Which among the following search strategies is used to retrieve documents from online databases?

a- Keyword search ☐ b-Author search ☐ c-Boolean logic ☐

d-Truncation search ☐ e-Phrase search ☐ f-Random search ☐

g-All of the Search strategy ☐

19. Which among the following sources is/are the most comfortable to retrieve documents for a literature review?

a) From online databases & Journals ☐ b) From Library Collection ☐

c) Both of them ☐ d) None of them ☐

SECTION E: RESEARCHER SATISFACTION

20. How comfortable are you in searching literature from the online databases and journals?

Very much comfortable ☐ Partially comfortable ☐ Not at all comfortable ☐

21. Select your competency in research data analysis.

Excellent ☐ Very Good ☐ Good ☐ Average ☐ Below Average ☐

22. How do you rate your publication growth?

Profoundly increase ☐ Profoundly decrease ☐ Static ☐ Not aware ☐

23. Have you received any financial aid from external agencies?

Yes ☐ No ☐

24. How do you rate your data management skills using the web tools?

Excellent ☐ Very Good ☐ Good ☐ Average ☐ Below Average ☐

25. How comfortable are you in preparing a questionnaire for research data collection?

Very Comfortable ☐ Partially comfortable ☐ Not at all Comfortable ☐

26. No. of papers submitted/presented in different seminars and conference proceedings?

NIL	☐	1-5	☐	6-10	☐	11-15	☐
16-20	☐	21-25	☐	26-30	☐	More than 30	☐

27. No. of publication in peer-reviewed/ UGC Care list Journals?

NIL	☐	1-5	☐	6-10	☐	11-15	☐
16-20	☐	21-25	☐	26-30	☐	More than 30	☐

28. How do you rate your library website in meeting your research requirements?

Excellent ☐ Very Good ☐ Good ☐ Average ☐ Below Average ☐

29. Please rate the overall quality of the research support services you have received from your institution's library.

- ☐ Poor ☐
- ☐ Below Average ☐
- ☐ Average ☐
- ☐ Above Average ☐
- ☐ Excellent ☐

30. Any other suggestions, please...

Respondent's Signature

THANK YOU SO MUCH

QUESTIONNAIRE FOR LIBRARIANS

RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY

Respected Respondents,

I am Biswa Bag, a PhD scholar at Mizoram Central University, pursuing a study on “RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY”. The study is being conducted under the guidance of Prof. Pravakar Rath (Department of Library and Information Science, Mizoram University). You are requested to kindly respond to the questionnaire below to complete my study successfully. I personally take the accountability not to disclose any data (personal or official) on any form of public platform. I am fully abided by the research ethics, so your response shall be used for academic purposes and for the completion of my research project only. Your response and valuable time are appreciated in advance.

Thanking you.

Biswa Bag
Research Scholar
Library and Information Science
Mizoram University

DEMOGRAPHIC INFORMATION

1. Name of the Respondent: Dr/Mr/Mrs/Ms__ - _____
2. Position/ Designation: _____
(Librarian/Deputy Librarian/ Assistant Librarian)
3. Age: 20-25/ 26-30/ 31-35/36-40/ 41-45/ 46-50/ 51-55/ 56-60/ 61-65
4. Gender: Male/ Female_____
5. Name of Technical Institution - _____
6. Year of Experience: _____

RESEARCH SUPPORT SERVICES PROVIDED BY THE LIBRARY

7. Is your institution's library extending Research Support Services for researchers & staff?

A- Yes

B- No

8. If yes, what is the mode of Research Support Service being offered?

A. Online

B. Offline

C. Both

9. What kind of Research Support Services are offered by your library?

A. Research Data Management Assistance

E. Research Publication

B. Financial aid assistance

F. Literature search

C. Testing of plagiarism

G. Research data Analysis

D. Research writing skill

10. Which among the following Research Data Management tools are provided to scholars?

A. Mendeley

C. EndNote

B. Zetere

D. Sciwheel

E. Any other

11. Please select the list of databases that are being facilitated to researchers, scholars, and faculty.

A. Scopus

F. Web of Science

J. CAS

B. Google Scholar

G. JSTOR

K. Embase

C. OpenDoar

H. Research Gate

L. CINAHL

D. Academic Search

I. Pubmed

M. Any other

E. Science Direct

12. Select the anti-plagiarism software used for similarity testing in your library.

A. iThenticate

B. Turnitin

C. Orkund/OuriginaL

D. Any Other

13. Is there any trained staff assigned for testing plagiarism?

A. Yes

B. No

14. Select the research data analysis tools offered for researchers and staff.

A. SPSS

B. 'R'

C. MS Excel

D. Python

E. Any Other

15. Do all the staff of the library possess the required skills to handle the Research Support Service?
- A. Yes B. Only a Few B. No
16. Does your library provide research writing support to scholars?
- A. Yes B. No C. Some time
17. How frequently do you make scholars aware of national and international financial assistance/project assistance?
- A. Very frequently B. Sometimes C. On demand D. Not at all
18. How do you make researchers aware of various libraries' Research Support Service?
- A. Workshop B. Orientation C. Seminar D. Expert Talk
19. Number of workshops conducted to raise awareness among research scholars about RSS?
- Ans. _____
20. Select the tools that facilitate research paper writing assistance.
- A. Grammarly D. End Note
B. Zotero F. Ref-n-write
C. Quillbot G. Any other
21. Have you ever faced issues and challenges in implementing RSS?
- A. Frequently B. Sometimes C. Not at all
22. Would you kindly identify the area of challenges?
- A. Technical Challenges D. Financial Challenges
B. Staff Challenges E. Infrastructure Challenges
C. Challenges in collaboration with external agencies F. Any Other

23. Whether all the staff of the library possess the required competencies to handle all the research tools is being provided?

- A. All possess required competencies
- B. Some of the staff possess the required competencies
- C. No staff member possesses the required competencies

24. Do you have a designated space for implementing RSS?

- A. Yes
- B. No

25. Is the staff strength of the library sufficient for implementing RSS?

- A. Yes
- B. No

26. How does rate research support the services of your library?

- A. Excellent
- B. Very Good
- C. Good
- D. Average
- E. Poor

Thanking you

Signature of Library Head/In-charge

GLIMPSES OF DATA COLLECTION

To capture the memorable journey of data collection for the study, faculty, research scholars, and librarians are involved. Photographs with them have been taken with their due consent. Though I come across many faculty and research scholars, not all gave their permission for a snap. So, a few of them are preserved here.







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List of Publications

Journal Publications:

1. Bag, B. (2024). Evaluating Strategic Approaches for Enhancing Research Support Services in Asian Higher Educational Institutions. IASLIC Bulletin, 69 (4), 260-270, <https://doi.org/10.5281/zenodo.16942935>.
2. Bag, B. (2024). Research Support System for Higher Educational Institutions: An Introspection. Indian Journal of Information, Library & Society, 37 (3-4), 255-266, <https://doi.org/10.5281/zenodo.16498893>
3. Bag, B. (2025). Research Support Services in Odisha State Universities: An Analysis of Libraries' Preparedness towards Fostering Research Excellence. Indian Journal of Information, Library & Society, 38 (1-2), 186-201, <https://doi.org/10.5281/zenodo.16497906>.

Conference/Seminar/Festschrift Papers:

1. Bag, B (2025). Empowering Libraries Through Blogs: A Dynamic Tool for Content Organisation and Engagement. National Conference on Digital Libraries and Information Systems: Building Universal Opportunities for Learning and Access (March 2-3, 2025). Organised by Berhampur University, Odisha.
2. Bag, B (2024). Enhancing Research Excellence: The Crucial Role of Research Support Services in Academic Libraries. International Seminar on Marching Beyond the Libraries: Leadership, Creativity, and Innovation (Dec 20-21, 2024). Organised by KIIT Deemed to be University, Bhubaneswar, Odisha.
3. Bag, B (2024). Extension of Digital Library Services to Support Students' and Teachers' Academic Excellence in the School Environment. Digital Transformation of Library and Information Centres: Trends and Developments (Oct 31, 2024). Festschrift in honour of Dr. Rabindra K. Mahapatra.

Book Chapter:

1. Bag, B (2025). Research Data Management in the Contemporary Era: Global Challenges, Emerging Issues, and Future Consequences. Advancing Frontiers in Library and Information Science, Vol.1. Royal Global University, Betkuchi, Guwahati, ISBN-9789358345094.

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ABSTRACT

**RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL
INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY**

**AN ABSTRACT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
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**DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE
SCHOOL OF ECONOMICS, MANAGEMENT AND
INFORMATION SCIENCE**

SEPTEMBER, 2025

**RESEARCH SUPPORT SERVICES IN SELECTED TECHNICAL
INSTITUTIONS OF ODISHA: AN EXPLORATORY STUDY**

BY

BISWA BAG

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE

SUPERVISOR: PROF. PRAVAKAR RATH

Submitted

**In partial fulfillment of the requirement of the Degree of Doctor of Philosophy
in Library and Information Science of Mizoram University, Aizawl**

1. INTRODUCTION

'Research' is derived from the French word 'researcher', meaning 'see again' (Dhiman,2015). "Research is the scientific and systematic search for pertinent information on a specific topic" (Kothari,2019). Research is an activity that is highly associated with discovering new knowledge (Uttarakhand Open University, 2001) through critical questioning to uncover new insights to answer complex situations. The primary purpose of the research is to contribute to the welfare of societies. Research institutes of all countries, educational institutes, voluntary organizations, and social philanthropists have been conducting research to improve society in various fields. Through research, a researcher may either confirm his/her in-depth expertise on a subject and circumstance or offer fresh information or an idea that would benefit society. By conducting research, the practitioner develops a thorough and precise understanding of the topic and creates superior, long-lasting solutions for a given problem. By carefully examining the state of its many facets, it has been demonstrated that modern human civilization is entitled to the authority of a perfect society. A nation prioritizing research has achieved significant progress in sustainable development in education, economy, military power, social lifestyle, art, culture, etc. Therefore, the statement that research is the focal point of the nation's overall development is not hyperbole.

The paradigm shift from ancient to modern civilization is the result of self-realization through research. An agrarian society, an industrial society, and an information society are witnesses to any environmental, educational, clinical, biological, transportation, or luxury development that results from continuous research. Research is the only way to progress in various areas, including early problem detection, diagnostic facility enhancement, and a comprehensive approach to sustainable growth. Research plays a crucial part in enhancing the quality of life in society's marginalized communities by encouraging people to mainstream.

Human society feels immensely proud and takes pride in the architectural monuments built 2500-3000 years ago. To our surprise, there was no flow of literature advancement or mechanical development; buildings, temples, stupas, or channels were still scientifically constructed. However, there is no documentary evidence of research

activities from the ancient period. However, the existence of dated architectural buildings/monuments with marvellous engineering presentation and aesthetic painting depiction resulted from rigorous research by the architect.

2. RESEARCH SUPPORT

Support of institutions' students, staff, and research scholars is an integral part of universities. Indeed, it is a decisive factor (Chandran, 2017) for the university-educated community to pursue further education. Scholars' development depends on the services and support provided by the concerned institution. All-around support of universities is helpful for all to excel in their careers and bring name and fame to the parent organisation.

An institution is selected based on many criteria, such as academics, campus culture, scholarship, extracurricular activities, career prospects, etc. Recently, the scope of research promotion has been a key criterion for admission. Extension of institutional support has enhanced enrolment in HEI. As per the report published by the Ministry of Education, the All-India Survey on Higher Education (AISHE) 2021-2022, a massive percentage of enrolment for higher education is listed. Among streams at “the postgraduate level in AISHE 2021-22, the maximum number of students are enrolled in Social Science (21.1%), followed by Science (14.7%). Ph.D. enrolment has increased by 81.2% to 2.12 lakh in 2021-22 compared to 1.17 lakh in 2014-15” (Ministry of Education, n.d.).

As the vast number of PhD enrolments in Indian institutions is increasing, the responsibility of the concerned university is to support quality research. The necessity of research support has been felt due to the explosion of a wide range of information and the interpretation of technology in research. Research support is also required for innovation regarding quality and quantity because a university is selected for enrolment based on its ranking, governed by many national/international agencies and organizations viz- NIRF (National Institutional Ranking Framework), QS (Quacquarelli Symonds) World University Rankings, Atal Ranking of Institution on Innovation Achievements (ARIIA), The World University Ranking, The Asia University Ranking, Times Higher Education Young University Rankings, etc.

Any institution's library plays a crucial role in supporting students in the university. Along with facilitating reading resources, the library possesses the skills and competencies to help research scholars innovate the institution's quality. The NKC (2007) states, "A library is not a building stacked with books – it is a repository and source of information and ideas, a place for learning and inquiry, and for the generation of thought and the creation of new knowledge."

3. SIGNIFICANCE OF THE STUDY

A nation's future development and progress depend on its new strategic innovation. Innovation is the consequence of the dedicated efforts of research stakeholders. Sustainable practice is achieved by applying surveys, experiments, and case studies to the phenomenon. However, research activities in the present scenario have undergone tremendous changes. Information and Communication Technology (ICT) has occupied the customary practice of resource collection, storage, maintenance, analysis, and dissemination of information. Copyright issues are also condemned more severely than previously. Most novice researchers lack pre-existing knowledge of these emerging research-oriented technological skills to complete a project.

A researcher must systematically investigate for new knowledge when conducting research, which is a stressful and challenging procedure. The scientific approach collects data by closely monitoring and contrasting numerous digital and physical sources. Scholars annotate the materials precisely with threats to ensure that background information can be correctly attributed to give credit to the original authors. Good data management can be complex, but it is likely problematic if we do not plan for and remember to record and manage our data as we complete all activities associated with the research project. Occasionally, research becomes incomplete due to missing data or overlooked references, which creates gaps in the overall scholarship. When this occurs, researchers often face the challenge of spending additional time retrieving data from earlier stages of their project. Such repetitions can ultimately lead to delays, heightened stress, and unnecessary expenditure of time and effort. Loss or misplacement of the data may significantly affect the quality and reliability of the end

research outcome, and appropriate data management is therefore crucial to avoid this situation.

One of the primary responsibilities of researchers is gathering information for a literature review. It takes more than just noticing or quantifying a few data points to determine the research gap in a given topic; a thorough analysis of existing literature is crucial. A significant amount of information is required to identify the research gap and complete research-related duties correctly. Several collections primarily hosted in institutional libraries, often based on printed materials such as books, magazines, and journals, offer valuable resources to researchers. Nevertheless, in the case of some physical collections, their data may be limited for answering a study question optimally.

In contrast, online databases and journals present a wider range of data, valuable for more advanced research. They allow researchers to access more relevant material and perform a comprehensive literature review. This comprehensive approach to data capture enables the scholar to establish gaps in the research and develop a powerful thesis. Discovering reliable content and conducting good research involves using digital and physical resources.

Without research, ideas, and support, the researcher may lead to the worst consequences. Hence, in the research process, help and support are needed for the new researcher and faculty members to find various sources of information to analyse and discover the existing gap. Support is required to select the best updated, authentic sources of journals, magazines, databases, reference management tools, plagiarism testing software, authentic sources for publication, etc.

This research problem aims to profoundly investigate the active and effective area of research support services (services, tools, software, and skills) and determine LIS professionals' and researcher communities' awareness and competency in handling and utilizing these services.

The study's consequences will help emerging scholars familiarize themselves with various research support services that require awareness and competence. It will also

help LIS professionals design and adopt more effective service methods to maximize the institution's output in the dynamic research environment.

4. STATEMENT OF THE PROBLEM

It is imperative that the institution and its research scholars and faculty members keep abreast of the rapidly changing educational environment. Policy, curriculum, syllabus, resources, technology, research, etc. At this time, many progressive changes have been seen in the field of research. Educational institutions are ranked based on their performance in research activities. The simplicity of pre-licensing is no longer observed. Pre-licensing agencies take the transparency, honesty, and structure of any investigation very seriously. Open access, digitization, an institutional repository (Web services), Mendeley, Zotero, Endnote (Reference management tools), Turnitin, i-Thenticate, etc. (Plagiarism checking S/w), SPSS, Stata, R (Data analysis tools), APA, MLA, Chicago, etc. (Referencing style) are playing crucial role in cutting-edge research.

All these new changes and emerging concepts are not part of the existing knowledge of the new researchers who intend to carry out a project and are not familiar with the latest ideas for faculty. The researcher develops a great, enthusiastic approach to pursue their research project for professional advancement. They would not have the idea of an ethical issue, reference management, or sources of information, i.e., databases, journals, library resources, and other online sources helpful for their proposed research project. In that circumstance, the institution's concern and library play pioneering roles for research scholars.

Most students choose technical courses after finishing their formal education. Technology has become an integral part of their academic careers. They start to work as researchers, inventors, and build flourishing careers. Nevertheless, bad guidance and support could seduce them into making their goals vanish. Hence, they have to know about the latest and updated advances in research. Advanced research in technological institutions is beneficial in strengthening and enabling the country in the technology field. Therefore, the role of their institution's libraries in research collaboration with technological institutions is vital.

The library of engineering institutions is highly resourceful in meeting the all-around educational demands of the students arising from time to time. Print, electronic, and digital resources are provided to serve the academic requirements of the library's students and faculty. However, the library's research support service is much anticipated. The library cannot be marginalized in boosting the institution's impact factor and strong prestige. Hence, the initiatives of the library and competencies of LIS professionals in extending research support services are needed by institutions to improve academic performance. All these features promoted and motivated the scholar to take up this research problem.

5. OBJECTIVES OF THE STUDY

The proposed study shall be conducted with the following objectives:

1. Evaluate the effectiveness of research support service on the academic performance of the researcher in selected technological institutions of Odisha.
2. Assess the satisfaction of the researcher regarding various research support services.
3. Find out the competencies of library professionals in providing research support services.
4. List out the outreach and promotional endeavors of libraries for the research support service.
5. Find out various challenges and problems faced by library professionals for the implementation of research support services.
6. Design a model of a quality research support system for research scholars.

6. RESEARCH DESIGN

RESEARCH METHODOLOGY

A method is a planned process for achieving a specific objective (Wikipedia, 2022), and "Methodology is the philosophical framework within which the research is conducted or the foundation upon which the research is based" (Brown, 2006). It is on the researcher's part to adopt suitable techniques and tools to help carry out the

research work and find the best answer to the research problem formulated at the beginning.

SAMPLING SIZE AND TECHNIQUES

For obvious reasons, collecting data on the entire population is impossible. In survey research, a representative sample is crucial, which is why population sampling is carried out. A sample is a group of respondents selected to represent the entire population as accurately as possible. A suitable sample establishes the reliability of the data and survey. The precision and rigor of the process are ensured by two metrics that guide the selection of the population size. They are Confidence Intervals (Margin of errors) and Confidence level.

To determine the appropriate sample size that will help the scholars achieve the most satisfactory result, the most popular technique called “Solvin’s Sampling Technique” was applied to this study to select the exact sample size. Solvin's as: $n = N / (1 + (Ne^2))$

Table 2: Execution of Sample Size

$n = 7200 / (1 + (7200 * 0.05^2))$	$n =$ Sample Size $N =$ Sample Population $e =$ Margin of error
$n = 7200 / (1 + 7200 * 0.0025)$	
$n = 7200 / (1 + 18.1575)$	
$n = 7200 / 19.1575$	
$n = 378.9$	
$n = 379$ (Approx.)	

The current research problem involves seven (07) technical institutions in the state of Odisha by using a straightforward random sampling technique with respondents pursuing Ph.D. and faculty members in the various departments of the educational institutions covered under the study. The sample size of the population for data collection is 27 Ph.D. students and 27 faculty members. In total, 54 respondents were covered from each of these institutions. Along with this, the researcher purposefully took one librarian from each institution. The total sample size for data collection is limited to 379 plus 7 librarians.

DATA COLLECTION TECHNIQUES.

To determine the effectiveness of the set objectives, the researcher collects data from the research scholars and faculty members using the following two techniques.

QUESTIONNAIRE METHOD

A standardized questionnaire divided into five sections, namely Section A: Personal Information, Section B: Basic Information, Section C: Awareness on Library Research Support Services, Section D: Effectiveness of Research Support Service, and Section E: Researcher Satisfaction, prepared to cover all aspects and distributed among the research scholars and faculty members (27 from each group) of the institutions, covered under the study for data collection. The questionnaire is also circulated through the dedicated email ID of the research scholars and faculty members of the institutions covered under the study to collect data. A separate questionnaire for Librarians was also prepared to collect responses to explore the current status of RSS and professionals' competencies regarding RSS technology.

INTERVIEW METHOD

In addition to the questionnaire, Librarians of the concerned TIs (Technical Institutions) personally interacted to gather more information and to find out more about their recommendations on how research support services affect teaching-learning, academic and professional growth of faculty, and help Ph.D. students in systematic completion of their research projects.

DATA ANALYSIS AND INTERPRETATION

In order to answer the research questions and accomplish the study's goals, the analysis plan offers insights into the best way to summarize and analyse the vast amount of data that was gathered (Ramachandran, 1993). The data was analysed using SPSS (Statistical Package for Social Sciences) and Jamovi (A tool for data analysis). The data have been subjected to both descriptive and inferential statistical analyses. Descriptive statistics for researchers and faculty are conducted in SPSS, whereas Jamovi is used for librarians' responses to describe and summarize data sets. In contrast, inferential statistics are conducted manually through MS Excel to test the

hypotheses and generalize from a sample to the entire population (Foster, 2001). Tables, charts, and diagrams have accompanied these statistical analyses to make the research more straightforward, unique, inventive, and scientific.

7. RESEARCH GAP

Numerous studies have been conducted on research support services by various eminent scholars worldwide. They have received encouragement from their educational institutions to analyse and evaluate the importance and necessity of expanding research support services for scholars to achieve quality research outcomes and maintain the right/authority of innovation.

After scanning the exhaustive available literature on the said research problem, it is found that no research has been undertaken on the status of research support services of libraries in technical institutions of Odisha and their impact on institutional researchers. This topic is unique, original, and necessary for research scholars and faculty members of higher educational institutions. Therefore, it has encouraged the scholars to fill the gap.

8. FINDINGS ACCORDING TO THE OBJECTIVES OF THE STUDY

At the beginning of the research proposal submitted to Mizoram University, the objectives were approved by the Departmental Review Committee and other university boards. Based on these proposed five broad objectives, the findings are discussed in detail.

Objective 1: Evaluate the effectiveness of research support services on the academic performance of the researcher in selected technological institutions of Odisha.

To enumerate the findings of objective 1, questions asked to respondents from questions 11 to 17 of Section D: 'Effectiveness of Research Support Services' from the questionnaire were considered. According to the responses, the findings are presented below:

- I) As RSS is regarded as one of the weapons for improving comprehensive skills in the production of qualitative and quantitative research, the study discovers that researchers experience a considerable increase in academic performance after getting RSS (Table 34).
- II) While the survey discovered that some individuals identified increases in quality and others in quantity, the majority of respondents reported visible progress or improvement in both (quantity and quality) following research help. As a result, it is possible to conclude that with the assistance of research support, there has been a significant increase in the quality and quantity of publications. (Table 35).
- III) The respondent uses almost all of the facilities equally for storing and managing literature and data. According to replies on reference management software such as Zotero, Mendeley, and EndNote, more than half of the scholarly community (54.5%) prefers online reference management tools for storage, review, and citation (Table 36).
- V) Surprisingly, 60% of academics use internet databases and journals independently, as well as institutional repositories for literature collection. As a result, researchers feel more comfortable working independently with databases and repositories (Table 37).
- V) Consistent citation procedures not only promote academic honesty but also improve the legitimacy and trustworthiness of research findings. The study reflects integrity and research ethics, with 89% of researchers always citing the literature they refer to. This demonstrates that the majority of researchers understand the importance of properly crediting original sources (Table 38).
- VI) Table 39 demonstrates that 75% of respondents had not received research funding at the time the data were gathered. However, 25% of the researchers acquired research grants through advertisements, awareness campaigns, and assistance in submitting research proposals provided by their departments or directly by funding agencies.

The findings from objective one clearly demonstrate that research support services play a pivotal role in enhancing the overall development of the research community in academic institutions. Hence, there is an effectiveness of Research Support Services.

Objective 2: Assess the satisfaction of the researcher regarding various research support services.

To assess the researcher's satisfaction with RSS, the responses received through the questionnaire from 20 to 29 are analysed. As per the response, the findings align with Objective 2, as given below:

- I) The Majority of respondents (63.9%) have shown that they are not at all affected by any difficulties in retrieving literature from online databases and journals. It shows that they are aware of the search strategy associated with these databases and journal portals to retrieve relevant information (Table 43).
- II) To determine data analysis competency, the survey found that 28.8% are excellent, 51.1% are very good, and 17.6% are competent; only 2.5% have issues with data analysis. However, many new scholars have reacted, despite having little prior research experience and possibly lacking library research help. As a result, in proposing deductive research methodologies, everyone is satisfied with their data analysis skills (Table 44).
- III) There is no hesitation to express here the growth of the publication of researchers. As earlier, it is also revealed in Table 35 that the publication growth in terms of quality & quantity is remarkable. To assess the publication growth, in question number 22, the respondent highlights the substantial growth of research publications. 67.1% agreed they have profoundly increased their publication. Definitely, RSS brings remarkable growth in research publication (Table 45).

- IV) Growth of publications in different seminars and conferences is also visible; however, the number varies from 1-5 to more than 30. Only a marginal percentage of 9.7% have not yet published any seminar or conference papers. Again, this 9.7% belongs to responses of newly admitted PhD scholars, who have less than a year of experience; otherwise, RSS has helped in the publication of seminar or conference papers (Table 46)
- V) Along with the seminar publication, there is also a significant support of RSS observed in research paper publication in reputed peer-reviewed journals and UGC care list journals, or registered journals from databases like Scopus, Web of Science, IEEE Explore, ASME, ASCE, etc. Almost every researcher has published at least one publication, except for a very small percentage of 17.6% (Table 47).
- VI) As libraries play a crucial role in supporting the research community, the services they provide are vital. In today's technological age, libraries remain accessible to their users through various features and services implemented via their websites. The study found that user satisfaction with library website services in the selected technical institutions reached a cumulative percentage of 89%, based on responses from researchers and faculty, with ratings ranging from "Good" to "Very Good" and "Excellent (Table 50). The cumulative response indicates a high level of satisfaction; hence, the library website is very effective in providing RSS.
- VII) Analysis of the researchers' responses indicates that the library's research support in their institutions is reasonably effective and meets the researchers' satisfaction, with a cumulative 79.3% of the results rated as "Excellent" or "Above Average (Very Good)" (Table 51).

Objective 3: Find out the competencies of library professionals in providing research support services.

A well-competent professional is always an asset to their organization. Through skills, expertise, and experience, they maintain a high level of professional recognition. In

the context of facilitating research support services, present-day library professionals face several challenges. These challenges range from handling advanced tools, staying aware of research publications and current research trends, maintaining publication relations, and developing organizational and time-management skills, among others. Objective 3 of the present study focuses on the skills and competencies possessed by LIS professionals for the smooth delivery of research support services (RSS). The findings for this objective are presented here, based on the responses received from the LIS professionals of the institutions under study. The findings are as follows:

- I) Technology plays a vital role in present-day research activities. To study the libraries' challenges in extension of research support, it is found that the technical expertise of LIS professionals is a major concern. Hence, though the majority of libraries possess LIS professionals with sound technical expertise, still almost 30% have to focus on the technical knowledge of their staff (Table 70).
- II) Infrastructure provides a better scope and opportunity for effective service dissemination. The study comparing staff competency found that 85.7% of technical institutions' libraries hold designated spaces suitable for staff competency development and research support (Table 71).
- III) According to the analysis, more than 40% of libraries believe that just a small number of their employees have the necessary expertise to handle Research Support Services. This reflects a large competency gap, which may impede the effective delivery of such services to researchers (Table 62).
- IV) Above all, the library staff play a very crucial role in materialising the services effectively introduced for research enhancement. The study found that not all library professionals possess the required level of competency. Almost 45.0% staff (43.0%) consent that their staff need more competency in handling RSS (Table 71).

Objective 4: List out the outreach and promotional endeavours of libraries for research support services.

Along with fulfilling academic needs, responsibility is vested in the library to strengthen research endeavours in the institution and enhance the competencies and skills among the researchers to carry out research seamlessly. With complete and in-depth knowledge or awareness of research requirements and recent trends associated with it, a researcher can undoubtedly achieve their goals. Therefore, it is a significant responsibility of the library to keep researchers informed periodically about advanced research standards. In this context, the measures taken by the library to keep researchers updated and their impact are explained here. After thoroughly examining the responses received from librarians, faculty, and research scholars, the analysis yielded findings that correspond to objective 4, as described below.

- I) The library conducts outreach programmes to keep researchers updated on various research developments. This is evident from the responses presented in Table 25. Sixty-six respondents reported visiting the library to receive research assistance, and ninety respondents participated in various outreach programmes organized by the library (Table 25).
- II) Notably, under the outreach programme, the library has been organizing workshops, training sessions, orientations, seminars, and expert talks, which the respondents have attended. Among these, orientations on RSS are organized by all libraries (100.0%), followed by workshops (71.4%), which were identified as the most effective outreach programmes undertaken by the library (Table 26).
- III) Most respondents (71.2%) attended between one and five outreach programmes, as reflected in Table 27 of the data analysis section. Hence, it is explored that the library outreach programme is in practice.
- V) Although various research support activities are covered through outreach programmes, the workshop on the usage of anti-plagiarism

software was attended by 69.9% of respondents, followed by sessions on strategies to browse online journals (61.1%), understanding research publication and ethics (52%), and retrieving information from open-access online resources (50.5%). These findings suggest that researchers are focusing more on research article publication and intend to stay updated regarding publication practices and trends.

- V) The study reveals, based on the analysis of responses from librarians, research scholars, and faculty, that every library has access to Grammarly software, and six out of seven libraries also have Turnitin anti-plagiarism software. Correspondingly, 62.4% of respondents reported being very familiar with Grammarly, while 41.1% are familiar with Turnitin. Therefore, it can be inferred that the libraries in the selected technical institutions have effectively oriented researchers about these widely used anti-plagiarism software tools (Tables 29 & 60).
- VI) The management of collected resources and data is crucial from the researcher's perspective. This study found that, although several effective reference management tools are available, Mendeley is the most preferred tool among researchers. According to the librarians' responses, six out of seven libraries use Mendeley for reference management. It can be assumed that the libraries recognize Mendeley as an effective tool, which likely explains why most scholars have also chosen Mendeley for managing their references (Table 30).
- VII) There is a chance of acceptance of research publications by publishers, provided proper referencing and other recommended criteria are met. To assess researchers' knowledge and experience with referencing styles, the study examined citation preferences and found that APA style is the most commonly used, with 218 out of 319 respondents adopting it. This is followed by Chicago, Oxford, and MLA styles, with 148, 140, and 138 users, respectively. The findings indicate that APA

is the predominant referencing style among the majority of researchers (Table 31).

VIII) Every study remains focused on its analysis section, where data collection is evaluated using different statistical analysis tools based on the researcher's appropriateness. The analysis may focus on quality, quantity, or both. In this objective, to examine the conduct of outreach programmes by the library, responses from respondents were analysed. It was found that Microsoft Excel is the primary statistical analysis tool preferred by respondents, with 73% reporting high comfort in using it. This indicates that despite the availability of advanced tools such as SPSS, R, Python, and Stata, Microsoft Excel remains the most prominent choice among researchers and librarians for imparting training or organizing workshops on it (Table 32).

IX) Facilities of the library, analysed in Table 33, through which it is assumed that the conduct of the outreach programme is functional. According to the analysis, 80.9% experienced a dedicated section for RSS, 68.3% got assistance from a skilled dedicated staff, and 73% benefited from the library website. So, the finding reveals that the library offers dedicated staff, sections, and updated resource links to materialize RSS (Table 33).

Objective 5: Find out various challenges and problems faced by library professionals for the implementation of research support services.

I. Challenges create obstacles to the efficient implementation of services. The study revealed that there are problems that vary from institution to institution. Some libraries have no concerns or challenges, while others face challenges in some areas related to RSS. Again, the survey discovered that a few institute libraries are experiencing frequent troubles and challenges (Table 69).

- II. The study also highlights that human resource (library staff) issues remain the dominant barrier. In contrast, technical, financial, and collaboration-related challenges affect a more minor but notable proportion of respondents (Table 70).
- III. The cumulative percentage related to designated space for providing RS confirms that over four-fifths of institutions have allocated physical space for RSS activities, reflecting institutional commitment towards structured research support. However, the absence of such space in some institutions may limit the effectiveness and accessibility of these services (Table 72).

Objective 6: Design a model of a quality research support system for research scholars.

The library must always have a blueprint prepared to run the RS services properly and demonstrate their effectiveness. However, the research papers published earlier had focused on the RSS model (Vemuri, 1982; Santharooban, 2022), a standard, structured, or proper plan needs to be developed for smooth and effective implementation of RSS. In this study, by analysing the responses of both parties (research scholars and faculty on one side and the library on the other side), a comprehensive research model is being proposed. As the study is conducted for technical institutions that mostly have university-level status, the model would be a helpful and guiding force for all higher educational institutions and research institutions in terms of providing research support services.

Proposed Model for RSS

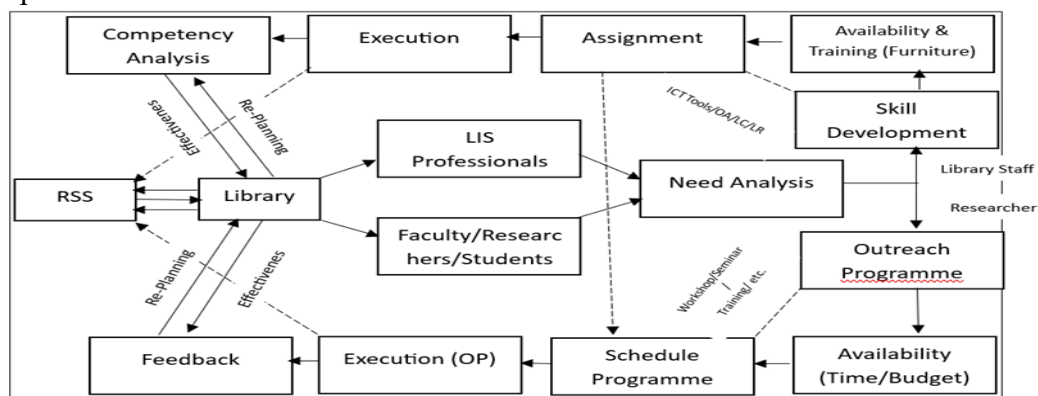


Figure 62: Research Support Services Model

Description of the Research Support Services Model

The model illustrates the systematic process through which libraries provide Research Support Services (RSS) to faculty, researchers, and students.

A. Library as the Central Hub

- The library acts as the connecting point between RSS, LIS professionals, and faculty/researchers/students.
- It initiates the cycle by identifying the needs of researchers and aligning them with institutional resources.

B. Need Analysis

- A core step where both library staff and researchers participate in assessing specific requirements for research support.
- Inputs come from LIS professionals and end-users (faculty/researchers/students).

C. Outreach Programme

- Based on the need analysis, libraries organize workshops, seminars, training, orientations, and expert talks.
- These programmes aim to bridge skill gaps and spread awareness of available services.

D. Skill Development & Availability

- Emphasis is placed on skill development of library staff using ICT tools, OAA (Open Access Archives), and CLR (Current Literature Resources).
- Proper availability of infrastructure (furniture, ICT, time, and budget) is ensured to support RSS delivery.

E. Assignment & Execution

- Roles and responsibilities are assigned to staff, followed by execution of planned services.
- This ensures smooth operation of outreach and support activities.

F. Scheduling of Programmes

- Programmes are scheduled systematically, considering researcher availability and institutional timelines.

G. Feedback & Competency Analysis

- After execution, feedback from researchers is collected and analysed.
- The feedback is linked to competency analysis to evaluate whether staff possess adequate skills.
- Based on findings, re-planning occurs to enhance service quality and address limitations.

H. Effectiveness and Continuous Improvement

- The model emphasizes a feedback loop, where effectiveness is reviewed and services are restructured.
- This ensures continuous improvement of RSS in terms of staff capacity, infrastructure, and researcher satisfaction.

9. TESTING OF HYPOTHESIS

H1- There is no significant difference in extending research support services to the students in public and private technical institutions' libraries.

The chi-square test was applied to examine whether there is a significant difference in extending research support services to students in the libraries of public and private technical institutions. The calculated chi-square value was 1.66 with 6 degrees of freedom. The associated p-value was 0.948, which is far greater than the standard significance level of 0.05. This result indicates that the difference in research support services between public and private technical institutions' libraries is not statistically significant. Hence, the null hypothesis stating

that there is no significant difference in extending research support services is retained, and the alternative hypothesis is not supported. The finding suggests that both types of institutions provide research support services at a comparable level. Hence, null Hypothesis is failed to reject.

H2- There is no significant difference in resource subscription for research support services in public and private engineering institutions.

The chi-square test was conducted to examine the association between the selected variables a. *Types of University* and b. *Kind of Resources Subscribed*. The study shows the various resources subscribed to by selected private and public technical institutions of Odisha to improve access to quality literature for research. The study examined this subscription status and tested the hypothesis using the Chi² statistical approach $\chi^2 = \sum \frac{(O-E)^2}{E}$. The result found Chi² value is 4.742857143, with 12 degrees of freedom (df) and a *p*-value of 0.966020833. Hence, the *p*-value is greater than 0.05, so we find no significant difference exhibited in resource subscription between private and public technical institutions.

So, the null Hypothesis “*There is no significant difference in resource subscription for research support services in public and private engineering institutions*” is failed to reject.

H3-There is no significant difference in research support competencies of LIS professionals in public and private institutions.

A Chi² test was performed between the types of university and whether all the staff of the library possess the requisite competencies to handle all the research tools that are being provided. There was no statistically significant relationship between the types of university and whether all the staff of the library possess the requisite competencies to handle all the research tools provided. $\chi^2(1) = 0.19$, *p* = .659.

The calculated *p*-value of .659 was above the defined significance level of 5%. The Chi² test was therefore not significant, and the null hypothesis “*There is no significant difference in research support competencies of LIS professionals in public and private institutions*” is failed to reject.

10. SUGGESTIONS

In this section, several recommendations for promoting research support services, mainly for technical institutions, are provided to enhance research activities and

improve the overall performance of the researcher and the institution as a whole. The suggestions are made based on responses received, analysed, and findings. Suggestion part covered with two sub-sections, i.e., 1. Suggestions Received from Respondents and 2. Suggestion based on Findings. Hence, the suggestions are listed under their subheading below:

SUGGESTIONS RECEIVED FROM RESPONDENTS

During data collection, respondents have given their suggestions to improve RSS, which are as follows:

- A special scholar room needs to be developed with 24/7 availability. 230
- The library has limited space considering the number of students and faculty. Therefore, the library needs more space and computers to support its digital library.
- Nowadays, the quality of images produced in research matters significantly. Image editing and creation software, such as CorelDRAW, should be beneficial.
- The library needs to maintain a repository for public sharing of theses.
- Need a subscription to more quality journals.
- In the library, all the journal sites should be available for all students or researchers without any external fees. The institutions should provide their email addresses so that researchers can access all those sites easily.
- Give some contingency to research scholars for the enhancement of the research idea.
- The institution will take care of implementing a research helpdesk.

SUGGESTIONS BASED ON ANALYSIS

Here, the suggestions are made on a priority basis as per the data analysis and findings of the study:

➤ Improvement in Library Infrastructure

To strengthen research support services, libraries must address issues related to inadequate infrastructure, dedicated space, and a shortage of staff. This can be

achieved by bringing the issue to the attention of the higher authority, upgrading facilities with modern technologies, ensuring continuous staff training, and recruiting skilled professionals. Such measures will enhance service delivery, improve user satisfaction, and position the library as a vital partner in the research ecosystem.

➤ **CPD Programme to Improve Staff Skills**

To strengthen research support services, LIS professionals must possess the requisite skills and competency to deal with researchers' problems in research activities. To ensure the effectiveness of RSS in the institution, the competency of staff must be developed by organising a continuous development programme (CPD) for library staff.

➤ **Consortium-based Subscription**

Due to the financial constraints, institutions' libraries often fail to facilitate their users' access to online resources and databases. To overcome this, libraries can negotiate consortia-based subscriptions, promote open-access resources, and provide remote access facilities. Such initiatives will ensure wider accessibility, strengthen research support services, and enhance the quality of research output.

➤ **Need-based Outreach Programme**

Awareness of research support services is often more important than their mere availability. It is essential that researchers are well-informed about the library's Research Support Services (RSS). To achieve this, libraries should frequently conduct outreach programs (Orientation, Training, Workshops, Seminars, Expert Talks, etc.) that are designed based on a need-based analysis.

➤ **Facilitating Modern Data Analysis Tools**

While many researchers use MS Excel for data analysis, in the present day, advanced tools like Python, SPSS, Power BI, and R are treated as market-dominating tools for

their greater accuracy, efficiency, and advanced statistical techniques. Procuring such software would enhance library research support services and also empower researchers with modern analytical capabilities.

➤ **Dissemination of Research Grant Information**

Research grants are crucial for supporting high-quality research, enabling scholars to access essential resources, conduct fieldwork, and disseminate their findings. Libraries can enhance research support services by providing information on the scope of funding, assisting with research proposal writing, and offering valuable guidance on research grant application processes. They can also conduct expert orientation sessions, thereby fostering a strong research culture and enhancing institutional research productivity.

SUGGESTIONS FOR FURTHER STUDIES

After going through the present research, it is realised that numerous scopes exist to conduct further research on the topic of Research Support Services. Some of the scopes of the studies are suggested below:

- A Comparative Study between different HEIs of Odisha
- Impact of RSS on the Academic Performance between the states' universities.
- A Comparative Study of RSS on Higher Educational Institutions.
- Impact of RSS on interdisciplinary and collaborative Research.
- Competency Analysis of LIS professionals on Research-intensive Tools

11. CHAPTERISATION

The total project is organized into five chapters to distinguish the phases and optimize the current investigation process. The following are the chapters and their title:

Chapter 1 describes the researcher's research design for the successful completion of the study. It sets out the key components of the research and serves as a scheme for

the whole research process. This chapter succinctly discusses the problem statement, the purposes, and the reasons for the sample choice. It also lays a comprehensive basis for the investigation by discussing the data collection and analysis methods.

Chapter 2 provided the theoretical background to research support services, its components, enabling technologies, the issues and opportunities, and the library's role in the delivery of RSS.

Details of Odisha technical institutions selected for the study are given in Chapter 3. It also focuses on the libraries of the chosen institutions and their materials and services.'

In Chapter 4, the analysis and presentation of research in various dimensions in the direction of research objectives, based on data from the institutions, are depicted.

Chapter 5 emphasizes the researcher's findings and likely recommendations for enhancing RSS, followed by a conclusion.

12. CONCLUSION

The actual application of Research Support Services (RSS), along with the proactive participation of Library and Information Science (LIS) experts, has the potential to improve the research environment in Odisha's technical institutions significantly. Because research activities are such an important factor in determining an institution's rankings and academic reputation, RSS must be strengthened. This study underlines the importance of modern research tools, researchers' capabilities, library facilities, and library staff expertise in determining the quality of research output. A lack of expertise or proficiency with modern tools frequently causes unneeded delays and obstacles in research. Applications such as Mendeley, Zotero, and EndNote for research data management; Grammarly and QuillBot for writing assistance; Drillbit, iThenticate, and Plagscan for plagiarism detection; and SPSS, Python, and R for statistical analysis provide enormous value to researchers at all stages. The efficient use of these resources not only ensures quality proposals but also adds to high-quality publications, seminars, and conference outcomes. Finally, the provision of robust RSS,

along with trained library workers, promotes higher-quality research, increases publication visibility, improves institutional reputation, and helps researchers' career progression through increased recognition and citation. 233 This study, which focuses on the primary Research Support Services (RSS) of technical institutions in Odisha, emphasises the importance of libraries, research tools, and professional abilities in promoting quality research. The study sheds light on how to boost research ecosystems by looking at researchers' knowledge, staff skills, and the availability of current facilities. The findings will assist not only technical institutions in Odisha but also act as a model for other technical institutions throughout India. The findings can benefit higher education institutions (HEIs) in general by increasing research output, institutional rankings, and worldwide awareness. The library plays an important role in improving Research Support Services by serving as a facilitator, enabler, advisor, innovator, and supporter of academic activity. As a facilitator, it provides access to critical resources and tools; as an enabler, it trains and educates researchers; as a guide, it assists them in navigating research complexities; as an innovator, it adopts cutting-edge technologies and practices; and as a supporter, it ensures ongoing assistance. Collectively, these functions establish the library as a critical component in boosting research quality and encouraging academic accomplishment. Research Support Services (RSS) are crucial for fostering academic achievement and worldwide awareness. Higher education institutions (HEIs) must prioritise the development of comprehensive library-based RSS to assist staff, researchers, and students with their intellectual efforts. Faculty and researchers should actively employ modern research tools, plagiarism detection software, and data management systems to boost the quality and credibility of their work. Students should view the library as more than just a resource centre, but as a collaborator in their research. The academic community may use RSS effectively to drive innovation, improve publication quality, and contribute considerably to institutional growth.
