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Evaluating the Awareness of Radio Frequency Identification (RFID) Technology in University Libraries across Pakistan

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Abstract

This study evaluates the awareness of Radio Frequency Identification (RFID) technology among library professionals in university libraries across Pakistan. RFID technology is crucial in modern library management, enhancing inventory control, item tracking, and security measures. The study collects data from 41 university libraries and analyzes it using descriptive and inferential statistics through SPSS. The results show that library professionals in Pakistan generally possess a high level of awareness of RFID, though challenges remain in its widespread adoption. Further analysis revealed no significant difference in awareness based on gender, organization type (public or private), age, experience, or qualifications. Both male and female respondents displayed similar awareness levels, and organizational type did not affect the outcome, indicating equal investment in RFID knowledge across libraries. Additionally, demographic factors such as age, experience, and qualifications did not influence RFID awareness, suggesting that training and professional development is key contributors to awareness. The study shows that RFID awareness among library professionals in Pakistan is high and does not significantly vary based on demographic or professional characteristics. These findings suggest a need for standardized training and development programs to further enhance RFID knowledge across university libraries.

Keywords Radio Frequency Identification (RFID); Library Professionals; University Libraries; Awareness; Pakistan; Technology Integration

Introduction

Radio-Frequency Identification (RFID) plays a significant role in our daily lives, and its impact will continue to be felt in the days ahead. In recent years, there has been significant growth in the industry's adoption of RFID technology RFID technology is utilized in various fields such as supply chain management, attendance tracking, library management, automated toll collection, and more. It involves digital data encoded in an RFID tag, which is then retrieved using a reader (Finkenzeller & Muller, 2010).Radio Frequency Identification in short as RFID. RFID employs electromagnetic waves to recognize and monitor tags affixed to items. According to Zheng & Wen (2017) RFID is being

used in many organizations and primarily use for tracking items checked out/check in. Lyons (2010) described in his doctoral thesis that there are two basic parts of RFID technology, Tag and Reader. In the libraries, RFID tracks the item which is connected by radio waves. In various methods of authentication, the popular example is to save unique number which can identify a person or item. In libraries a barcode/accession number usually used to distinguish the book and the same is to be integrated with RFID tag which provides the full details of particular book.

RFID Technology in Libraries

RFID technology has transformed library operations, offering efficient solutions for tasks such as inventory management, security, and patron services. Libraries utilizing RFID systems getting benefits from streamlined processes, reducing waiting hours and enhancing user experience. Additionally, RFID enables libraries to track and manage collections more effectively, improving inventory control and space utilization. Furthermore, RFID technology enhances security measures, ensuring proper monitoring and protection of library materials. Overall, RFID has become a crucial component of modern library management, empowering libraries to deliver better services to their patrons (Zhang & Wu. 2019). Golding & Tennant (2007) explained that the libraries are supposed to provide an open access services to their users, this may result to some unethical practices like theft, mutilation, etc. and the professionals are unable to notice these issues and looking the technology-based solutions to address these kinds of problems. Many studies have been found to control these issues globally also in South Asia including Pakistan. There are many solutions adopted for security of library materials besides providing the open access and quality services. Various methods have been adopted like installing CCTV security systems, EM technology, Physical monitoring (by placing an extra staff on library exist door), but these were all are the temporary, time consuming and labor involving procedures. They are also of the viewed that there is a need aroused to an electronic/computer based solution should be installed/implemented to safeguard the library material beside providing the efficient services. This may be considered as the evolution of RFID development. An electronic based library management system required which should provide the security, tracking and services to the patrons in less time and labor. Which ultimately fasten the routine library operations like, inventory, circulation, shelving, etc. and also spares the library staff to do another work. The Organizations like universities are intending to use ICT- based solutions in providing the best possible services in quick time. The university libraries are also willing to adopt ICT based solutions to provide the quality services to their patrons. In this digital era, the University libraries are advancing in implementing the innovative technological tools for efficient and quality services. The Use of RFID technology has experienced a remarkable rise in recent years (Pawar et al. 2016).

In university libraries the students, researchers and faculty members have the access of variety of sources. Libraries preserves in a systematic way the thousands of books, journals, magazine, CDROMS, databases. A university library's objective is to fulfill all academic needs of its patrons and its equal access to books, eBooks, databases, IT tools, etc. The manual procedure of serving the patrons is now outdated and libraries are adopting technological tools to automate their services. To operate and manage the Library efficiently the various task and time taking activities has to perform by the professionals working there. Performing these activities manually requires significant resources in terms of personnel, time and budget, which increases the likelihood of human errors occurring. As a result, both efficiency and effectiveness of library operations can be negatively impacted. In this era of Information Technology (IT), libraries are implementing the technological and innovative tools to provide the better services to their patrons. Barcode technology is one of the tools being used by the libraries in order to provide quick services. EM (Electromagnetic Technology) and its strips are used for the security of library materials as the majority of the libraries have the open shelves. RFID replaced both EM strips and barcodes. It does not need a direct line of sight to access the tag and retrieve the data. It simplifies the circulation process of libraries and gets rid of long ques by providing the high-speed automated services. RFID also provides quality anti-theft services through their passive tags. In libraries the kind of passive tags are used as they are more in expensive than the active tags, which electronically stores the information which may be read by RFID reader. (Pawar et al., 2016). The primary goal of this system is to design an efficient library management system and to provide the quick transactions processing, simplifying book borrowing and return processes with minimal manual intervention. RFID provides traceability and security features.

Components of RFID Used in Libraries

RFID for libraries consists on the following components.

- **RFID Tags**

RFID tags are tiny electronic devices that comprising a microchip attached with an antenna. These tags are used for identification and tracking purposes and can be attached to objects, animals, or people. RFID tags use radio waves to communicate with RFID readers or scanners, allowing them to transmit information stored on the microchip. The information within the tag is electronically programmed and varies in size based on the product's antenna dimensions (Patil, 2022). RFID tags are of two types, passive and active. Passive tags do not contain the power and energized themselves with RFID's power, while active yags have the battery as a power source and are strong in functions as they have enough power. RFID tags are extensively utilized in diverse industries for applications such as inventory management, access control, tracking assets, managing supply chains. In libraries, RFID tags are commonly used to track and manage library materials, automate circulation processes, and enhance security.

- **Smart Station/Reader**

A RFID smart station or reader is a device that is used to read and write data on RFID tags. It is a critical component of RFID system and performs an essential role in enabling the efficiency of RFID system. RFID smart stations/readers consist of an antenna, which emits radio waves, and a transceiver (transmitter-receiver), which reads and writes data to RFID tags. The smart station/reader is connected to a computer or a network and is typically used in conjunction with RFID software to manage and process the data collected from RFID tags. According to Khan (2017) these devices come in varieties of formats, different type of readers, each designed for specific application and environment. Handheld readers are portable and can be used to read RFID tags on items that are not easily accessible. Fixed readers are stationary and are often used in automated systems, such as in libraries or warehouses, to track items as they move through a specific location. Mobile readers are designed to be mounted on vehicles or carried by personnel to read RFID tags in a mobile setting. Overall, RFID smart stations/readers are essential components of RFID systems, enabling businesses and organizations to track and manage inventory, assets, and other items efficiently and accurately.

- **Self-Check in /Check out (Kiosk)**

A RFID kiosk is a self-service terminal that uses RFID technology to provide various services to users. These kiosks are equipped with RFID readers that can read. RFID tags on items or RFID cards held by users. RFID kiosks are commonly used in libraries, retail stores, and other public spaces to provide services such as self-checkout, inventory management, access control, and information retrieval. In a library setting, RFID kiosks can be used to issue and return of library material not having the need for guidance from staff. Users simply place their library card (which may have an embedded RFID tag) on the kiosk's RFID reader and follow the on-screen prompts to complete the transaction. RFID kiosks can also be used to renew library materials, pay fines, and search for library items in the catalog. RFID kiosk offers several benefits, including increased efficiency, reduced wait times, and improved user satisfaction. They can help libraries and other organizations to streamline their daily operations and provide better services to their users. (Khan, 2017).

- **Book Drop Machine**

An RFID book drop is a specialized receptacle used in libraries to collect returned library materials, such as books, DVDs, and other items, that have RFID tags attached to them. RFID book drops are equipped with RFID readers that can detect and identify the RFID tags on the items as they are returned. When a patron returns an item, they simply place it in the RFID book drop, and the RFID reader in the drop registers the item's tag, the information is then transmitted to the library's circulation system, where the item is checked in, and the patron's account is updated accordingly. RFID book drop machine offer several advantages over traditional book drops. They can automatically check in returned items, reducing the need for manual processing by library staff. This can help libraries improve efficiency and reduce wait times for patrons. Additionally, RFID book drops can be synthesized with other library systems, i.e security systems and system for managing inventory, to provide a more seamless and integrated library experience. (Gibbs et al. 2011).

- **RFID Digital Library Assistant**

RFID Digital Library Assistant utilizes RFID (Radio-Frequency Identification) technology to enhance library operations. This type of assistant typically involves the use of RFID tags on library

items (such as books) to track and manage them. The assistant can automate tasks like checking in/out books, locating items, and managing inventory. It can also provide real-time information to library staff and patrons, improving efficiency and user experience in the library.

- **Supporting Software**

RFID supporting software in libraries refers to the software applications used to manage and integrate RFID technology into library operations. This software plays a critical role in ensuring the efficient operation of RFID systems in libraries.

Integration with Integrated Library Management System (ILMS)

The RFID tag is integrated with the accession number of the book as the accession number in ILS contains the full information of that particular title. RFID technology improved the library services and user experiences. However, it is important to assess the awareness level of the individuals involved in implementation and providing the services, the significance and potential impact of this technology before implementing on a large scale. This research will evaluate the experiences of library professionals, observe user interactions, and analyze system performance in order to provide valuable insights for decision-makers in the academic sector. RFID technology has transformed library operations, offering efficient solutions for tasks such as inventory management, security, and patron services. Additionally, RFID enables libraries to track and manage collections more effectively, improving inventory control and space utilization. Furthermore, RFID technology enhances security measures, ensuring proper monitoring and protection of library materials. Overall, RFID has become a crucial component of modern library management, empowering libraries to deliver better services to their patrons (Timoshenko, 2017).

Research Objectives

- To assess the level of awareness regarding RFID Technology among library professionals in university libraries across Pakistan

Literature Review

The literature review is based on extensive literature searched in different databases. The search terms include RFID, Radio Frequency Identification, Awareness of RFID, Usage of RFID, Challenges in Implementation in RFID Technology, RFID Technology in University Libraries of Pakistan. The literature review is arranged chronologically covering all the themes of study. Radio Frequency Identification (RFID) Technology in an innovative library system for electronic identification and book tracking. Presently, RFID applications encompass a wide range, including tracking books and managing inventory, as well as detecting theft and automatically sorting books. It has been emphasized that RFID technology in libraries is substantial, with implementation evident in both developed and developing nations, consequently affecting library end users (Mamdapur & Rajgoli, 2011). Ge (2024) elaborated that RFID technology has become so popular and extensively used by every domain. It reduces the workloads of managers, decreases the risk loss and damage, speeds up the inventory management, efficient retrieval and simplifies the library operations. He concluded that the RFID becomes the basic and utmost need of the organization to streamline their today's affairs.

Awareness of RFID Technology

In the context of Pakistan, there is limited research on the awareness of RFID technology among library professionals. However, a study has been conducted to examine the challenges of implementing RFID technology in academic libraries in Pakistan and identified lack of awareness, technical infrastructure and technical expertise among library professionals as major barriers to adoption (Abbas & Mahmood, 2016). Chang and Li (2016) examined that in China the level of awareness and perception of RFID technology among library professionals are high as they have atmosphere equipped with technological innovation, the findings revealed a high level of awareness and the participants were expressing their positive attitudes towards the implementation, operation and are well informed about the potential benefits of RFID in Libraries.

In university libraries of India, the library professionals have a moderate level of awareness with positive attitude towards the implementation, however their study pointed out challenges such as cost, technical issues, and staff training in adoption for providing the quality services to their patrons (Singh & Sharma, 2017). Tiew and Tan (2017) examined the awareness and readiness of library professionals in Singapore about the adaptation of RFID Technology in library services. The findings indicated a moderate level of awareness among professionals, mostly professionals of the view for more trainings and support from authorities in implementing this innovative technology effectively.

Despite this, there was a general optimism about the potential benefits of RFID technology in enhancing library services and operations. Sivaraj and Gopalakrishnan (2018) investigated the awareness and acceptance of RFID technology among library professionals in Malaysia. The results showed a moderate level of awareness, with participants highlighting the need for more training and support to implement RFID systems effectively. A similar kind of studies conducted in Malaysia by Rahman and Yusof (2018) and they determined a high level of awareness among library professionals specially the professionals working in university libraries of Kaula Lumpur, and they found that the professionals possessing a positive mind set and highlighted the importance of training programs in enhancing awareness and acceptance of RFID technology. Chen and Chang (2018) investigated the awareness and perceptions of RFID technology among library professionals in Taiwan. The findings revealed a moderate level of awareness, with participants expressing concerns about the cost and complexity of implementing of RFID systems in their libraries.

Bhattacharjee and Biswas (2019) surveyed the academic libraries of Dacca city in Bangladesh and gathered the information from working librarians in these organization about the awareness and perceptions of RFID technology and concluded that the majority of the professionals were of the view that they have heard and the seen this technology in various library and revealed a moderate level of awareness, with participants expressing interest in learning more about the potential applications of RFID technology. Al-Rababah and Al-Adwan (2019) investigated the awareness of RFID technology among library professionals in Jordan. The results indicated a low level of awareness, with participating library professionals and they explored that the professionals working in the libraries here have concerns about the security and privacy implications of RFID technology. Bhattacharjee and Biswas (2019) examined the awareness and perceptions of RFID technology among library professionals in Bangladesh. The results showed a moderate level of awareness, with participants expressing interest in learning more about the potential use of RFID in libraries. Alemna and Kevor (2019) conducted their studies in Ghana and focused the library professionals working in higher educational institutions on the awareness and attitudes towards the Implementation of RFID Technology in their libraries, the result showed a low level of awareness, with participants expressing their concerns about the compatibility of RFID system with their existing ILS, they are of the view that the may may loss the data during the integration.

Denen, Akor and Udensi (2023) suggested in their studies that a relationship between the level of understanding of professionals regarding RFID technology which is backbone for the implementation and emphasized the need of substantial investment in ICT for university libraries in upgrading the existing systems and a comprehensive training may be provided for optimal benefits of modern technology. Kaur and Kaur (2020) explore the awareness and acceptance of RFID technology among librarians in India. The result showed a high level of awareness with participants highlighting the potential benefits of RFID components in improving the library services and challenges were explored as the cost and positive mind set of administration of the organizations.

Khayyam et al. (2022) explored the awareness and use of RFID in business community of Pakistan in supply chain management industry and found that the lack of awareness of RFID technology is the result of lack of readiness in adopting RFID solutions for their business. The Researchers found that the culture is also the hurdle in implementing RFID technology and concluded to reduce the gap between industry and academic knowledge and suggested the exploration of more barriers and driver for implementation of RFID. Saha and Roknuzzaman (2024) examined the perception of University librarians of Bangladesh about the implementation of smart technologies for library services. According to the finding the librarians have varied degree of understanding and positive attitude toward the implementation of smart technologies including RFID systems. Challenges are being faced by the libraries in Bangladesh are almost same as the other south Asian countries are facing i.e lack of funds, inadequate technological infrastructure, trained staff, positive attitude.

Research Methodology

This study employs a quantitative survey research design within the positivist research paradigm to assess the awareness of Radio Frequency Identification (RFID) technology among library professionals in university libraries across Pakistan. Surveys are a practical and cost-effective method for gathering data from large, geographically dispersed populations, ensuring no key segments are overlooked (Osayande, 2019; Meena, 2024; Ali, Naeem et al., 2024). Previous research has

successfully utilized this approach (Asim et al., 2023; Faizan, 2023; Hussain & Parveen, 2021; Kishan & Chakravarthy, 2021), further validating its use in this study. The survey method, commonly employed in similar research, is particularly effective for collecting contemporary data and analyzing a wide range of cases (Connaway & Powell, 2004). The questionnaire, designed as the primary data collection tool, was based on methodologies used in earlier studies (John et al., 2017; Ahmad & Huvia, 2017). Data were gathered from 41 university libraries across Pakistan, where the head librarians were initially contacted by phone. In some cases, all library professionals involved with RFID technology were included in the study. The list of 41 university libraries was compiled through various sources, such as professional colleagues, vendor confirmations, and institutional websites. After obtaining this information, follow-up calls were made to confirm the current status of RFID implementation at each institution. For determining the sample size, Krejcie & Morgan's table was utilized, providing a 95% confidence level and a 5% margin of error. The sample was then drawn from library professionals across the 41 universities. The questionnaire, designed using Google Forms, was distributed to the library professionals, with follow-up requests sent through email, phone, and WhatsApp, as well as through institutional websites to gather contact details. To ensure a higher response rate, follow-up efforts included phone calls and personal visits to nearby libraries. Ultimately, 41 completed responses were received. The questionnaire went through several revisions after consulting related studies to reduce redundancy and ensure clarity. It consisted of questions that measured the participants' awareness of RFID technology. Responses were analyzed using a Likert scale, where participants rated their level of agreement with various statements on a scale from 1 to 5, with 1 being "Strongly Disagree" and 5 being "Strongly Agree." This scale enabled the assessment of library professionals' perceptions of RFID technology, providing valuable insights into their awareness levels.

Data Analysis & Interpretation

After cleaning the data, it was analyzed using the Statistical Package for the Social Sciences (SPSS27.0). Quantitative data comprises descriptive statistics, such as frequencies, percentages, means, standard deviations, as well as inferential statistics data including Independent Sample t-test, One-Way ANOVA.

Awareness of RFID Technology

Data collected from the researcher's questionnaire through four statements based on a 5-Point Likert Scale. Majority of the Library Professionals (mean=4.41) are agreed that the RFID technology is quite beneficial for libraries. The respondents are agreed that they are familiar with the security features of RFID Technology (mean=4.29). The average of the remaining two statements is close to four which indicates that the Library Professionals are fully aware about the technology and its components.

Table 1

Awareness of RFID Technology (N=41)

Statements	Mean	Std. Deviation
I am familiar with RFID technology	4.1951	.95445
I am aware of the specific Components of RFID technology	4.1707	.66717
I understand the benefits of RFID technology in Libraries	4.4146	.74080
I have the knowledge of security features of RFID technology	4.2927	.81375

Scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree
SD=Standard Deviation

Difference in Awareness Level Based on Gender

To determine the difference of gender on Awareness of RFID technology, the sample t-test has been applied to test the awareness level between male and female respondents to know the difference is significant or not. The table 4.11 shows the slight difference between the groups of male (M=17.03, SD=2.27), and female (M=17.222, SD=3.193). The significant value .840 which is quite higher than 0.05 with t (-.203), hence it is concluded that awareness level between Male and Female respondents is insignificant.

Table 2

Difference in Awareness level based on Age (N=41)

Variable	Gender	N	Mean	SD	t	p
Awareness	Male	32	17.031	1.278	-.203	.840
	Female	09	17.222	1.193		

Difference in Awareness Level Based on Organizations

To determine the difference of nature of organization on Awareness of RFID technology, the sample t-test have been applied to test the awareness level between the respondents working in public and private respondents to know the difference is significant or not. The Table 4.12 shows the difference between the groups working in public (M=17.440, SD=2.200) and private sector organization (M=16.600, SD=2.873). The significant value .340 which is quite higher than the significant value .050 this resulted the insignificant difference in awareness level between the library professionals working in public and private sector organizations.

Table 3

Difference in awareness level based on nature of organization

Variable	Organization	N	Mean	SD	t	p
Awareness	Public Sector	25	17.400	2.200	1.041	.304
	Private Sector	15	16.600	2.873		

Difference in Awareness Level Based on Age

A One Way Annova test has been conducted to determine the difference level of age groups on Awareness level of RFID technology in university librarians of Pakistan. The table 4.13 shows result of the p value .059 is the greater than the significant value i.e .050, hence we concluded that the there is no any impact of age group on the awareness level of library professionals in awareness level.

Table 4

Difference in Awareness level based on Age (N=41)

Variable	Gender	N	Mean	SD	t	p
Awareness	18-25	02	13.500	2.121	2.709	.059
	26-35	19	17.211	2.519		
	36-45	18	17.027	2.164		
	46 & Above	02	16.500	2.121		
			17.277	2.164		
			20.000	0.000		

Difference in Awareness Level Based on Experience

A one way Annova test has been conducted to determine the difference level of experience group on Awareness level of RFID technology in university librarians of Pakistan. The table 4.14 shows result of the p value .159 is the greater than the significant value i.e .050, hence it is clear that there is no any significant difference of years of experience groups on awareness level of library professionals.

Table 5

Difference in Awareness level based on experience of respondents (N=41)

Variable	Years of exp	N	Mean	SD	t	p
Awareness	01-05	10	16.100	2.846	1.845	.159
	06-10	17	17.705	1.961		
	11-15	09	16.222	2.682		
	16 & above	05	18.400	2.190		

Difference in Awareness Level Based on Qualifications

A One Way Annova test has been conducted to determine the difference level of qualifications group on Awareness level of RFID technology in university librarians of Pakistan. The table 4.15 shows result of the p value .137 is the greater than the significant value i.e. .050, hence it is clear that there is no any significant difference of qualification group on awareness level of library professionals.

Table 6

Difference in awareness level based on qualifications (N=41)

Variable	Qualif.	N	Mean	SD	t	p
	BS/MLIS	23	17.130	2.262		
Awareness	M.Phil	15	17.066	2.604	1.956	
	Ph.D	01	12.000	--		37
	Others	02	19.000	1.414		

Results and Discussion

The study focused on to assess the level of awareness among library professionals working in university libraries of Pakistan. The data opposed the theory that the library professionals working in university libraries of Interior Sindh have the low knowledge of ICT including RFID technology (Subhpoto, Subhpoto & Ahmed 2021). The analysis identified that the awareness level among library professionals working in university libraries of Pakistan have the high level (mean=4.41) of awareness, as received the responses of the participants from province of residence the professionals from Sindh has the maximum participation 65.9%. The data indicated that not only the professionals have the knowledge of RFID technology but are well aware about its specific components, features specifically designed for libraries, its various integration with existing technologies. The study supported the idea presented by Rafique, Subhopoto and Idrees (2023) that the professionals working in the Central Libraries of Universities in Interior of Sindh have the moderate level of awareness in comparison with the professionals working in small, departmental or seminar libraries in the universities.

As this study focused on the university libraries, the Central Library of any public/private sector university has been considered as the university library (Akhar, 2007) as it serves the entire university community including students, faculty, researchers and staff. Hence the findings suggested that the in-University Libraries of Pakistan including Interior of Sindh Universities has moderate level (M=4.41) of awareness among their professionals. The current study found that the library professionals are aware about the various features of RFID technology (mean=4.17). Findings suggested that the participants have the knowledge about the potential benefits about the RFID in the libraries, and are capable to understand how RFID technology will affect their daily library operations, how it provides the efficient library services by minimizing the time of users and saved the extra labor of staff. The similar findings have been found in various previous studies (Ameen et al. 2017; Asim & Arif, 2023; Bharti & Verma 2021).

The findings of the study indicated the result of .840 insignificant value of influence of gender group on the awareness level of RFID technology. The findings suggested that regardless of gender, library professionals in the study have a similar level of awareness of RFID technology. The findings indicated that the gender may not play a significant role in influencing the understanding of RFID technology among library professionals. The study opposed the idea that the demographic factors may influence the level of awareness of RFID technology in university libraries (Mensah & Onyancha, 2021). The findings of the current study also showed the similar kind of results in other demographic factors like organization showing the result insignificant value .340, Age .059, experience .159, qualifications .137. The findings revealed that the there is no significant difference in the awareness of RFID technology among university library professional based on demographic factors such as age, gender, educations, organization and experience. This study suggested that regardless of these demographic variables the library professionals in this study have the similar level of awareness regarding the implementation of RFID technology in university libraries.

Conclusion

This study highlights the generally high level of awareness regarding RFID technology among library professionals in university libraries across Pakistan. The findings demonstrate that library professionals, regardless of gender, organizational type, age, experience, or qualifications, possess a solid understanding of RFID technology, its components, and its integration with existing library systems. While demographic factors such as gender, age, experience, and qualifications did not show

significant differences in RFID awareness, the study emphasizes the importance of continued professional development and training to ensure uniformity in knowledge across the library workforce. Despite challenges in widespread adoption, the high level of awareness across diverse library professionals suggests that a more standardized approach to enhancing RFID knowledge and facilitating its implementation is crucial. This research underscores the need for consistent training programs and institutional support to optimize the use of RFID technology in libraries, thereby improving operational efficiency, security, and user experience.

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