

ASSESSMENT OF USE OF RADIO FREQUENCY IDENTIFICATION IN SOME SELECTED UNIVERSITY LIBRARIES IN NIGERIA

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Abstract

This study assessed the Use of Radio Frequency Identification (RFID) in Some Selected University Libraries in Nigeria. It was guided by four objectives and four research questions. Survey research design was used for the with a target population of thirty four respondents. Total population sampling technique was employed for the study and online questionnaire was the main instrument used for data collection. Data collected were analyzed using descriptive statistics of frequency count and percentages. The findings of the study revealed; majority of the respondents strongly agreed that they have good perception on the effectiveness of RFID implementation in the management of library resources, secondly, the study strongly agreed that RFID can be applied or use for the management of library resources as well as provides users with all their seamless services. Furthermore, the study also strongly agreed that FRID implementation has positive influences in the management of library resources. Finally, the study strongly agreed that; RFID cost is higher compared to other methods, RFID tags are vulnerable to compromise and RFID implementation can lead to loss of job as some of the major barriers affecting the use of RFID in the management of library resources. The study concludes that; the use of RFID technology in University libraries under study revealed numerous advantages and is very flexible compared to other methods of library operation most especially in this 21st century. However, the implementation of system in University Libraries requires significant investment in the technology as well as in the training of staff that would handle the system, though the technology is not widely understood and not in use by majority of the universities in Nigeria but gradually RFID is increasing in popularity among University Libraries because of its economic sense, efficiency and easy to use.

Keywords: Assessment, Antenna, Radio Frequency Identification, University Libraries, Microchips,

Introduction

Technological advancement is drastically impacting operations in organisations around the world. One of such advancements is the RFID (Radio Frequency Identification). It's one of the emerging technologies used by organizations worldwide. It is a combination of radio-frequency-based system, microchips and antenna that is being considered as one of the most important applications used in almost every field to automatically and remotely identify, monitor, store and retrieve data in organizations such as libraries, industries and shopping malls to move payments for goods purchased. Libraries around the world use RFID to identify and monitor inventory, control the movement of materials, handle check-out and check-in process of the library materials. According to Sharma and Hashmi (2021) the recent emergence of Radio Frequency Identification (RFID) applications has attracted the attention of all the stakeholders, namely developers, manufacturers, and end-users. In essence, RFID has permeated the broad spectrum of item tracking, identification, and sensing. Alternatively, it is safe to say that RFID has revolutionized library items tracking, sensing, and monitoring mechanisms within the library. The use of RFID technology in the library cannot only solve the contradiction between the librarians and the readers but also can improve the work efficiency of the librarians.

Radio Frequency Identification is a new technology now used in libraries worldwide, the adoption of it has resulted in a positive solution that makes it possible to identify, monitor inventory of hundreds of thousands of library items in their collections in days instead of months and in months instead of years (Danladi, 2019). Librarians especially, in developing countries have started to adapt to the new technology and using it to provide more effective and efficient library services, safety and security of the library collections. Similarly, Vedanth, Rohan, Sai, et'al. (2023) opined that RFID is a cutting-edge automated technology for quickly classifying, arranging, and tracking a wide range of library materials. Today's RFID applications include automatic sorting, theft detection, and inventory tracking among others. In the near future, data gathering, identification, and analysis will be crucial for certain library activities. Radio frequency identification (RFID) technology is the dynamic link between people and things. RFID-enabled automated libraries are transformed into "self-service stations" that require little assistance from library workers. By implementing self-service "check-in" and "check-out," major delivery delays for library resources are eliminated, and operational effectiveness is enhanced. It is mostly utilised in

libraries to automate procedures for managing books, including circulation, inventory control, check-in, shelf management, and anti-theft.

Radio Frequency Identification is a technology that uses radio frequency or waves to transmit data between a reader and electronic tag or transponders which is attached to a material or book in the library. RFID tags or transponders usually contain chip or microchip in them that store data or information usually of about 2,000 bytes or less and often used in libraries for determination of a material location, number of days or weeks on loan or for specific access authentications for check-out, check-in and other uses that demand security clearances in the library. Solanke, (2021) posit that Radio Frequency Identification is the use of wireless non-contact radio system to transfer data from a tag attached to books, for the purpose of automatic identification and tracking. It is one of the technologies being adopted by both the industry and academic world. Modern academic library is a place where millions of books, periodicals, CDs, DVDs and other electronic reading materials are contained. It is a challenge for librarians to manage such type a huge collection. Library staff handle lending, returning, sorting, tagging etc, of books using RFID tags in library system. The tag contains electronically stored information which can be read from up to several meters away. RFID is an accepted technology in libraries.

The RFID device must be scanned to retrieve the identifying information of the library materials being tagged using radio frequency or radio waves transmission such as; 2.45GHz (Microwave frequency), 125kHz (Low Frequency), 13.5 MHz (High Frequency) or 800-900MHz (Ultra High Frequency). It functions and serves almost the same purpose as bar code, ATM cards, access cards, hotel cards and others that have magnetic strips on their back each with a unique identifier number attached to them. Geetanjali, (2020) affirmed that, the use of RFID tags and readers in libraries must be of high quality and standard to be able to produce the maximum performances. RFID tags are capable and much faster than barcodes and with the help of handheld reader; items in the stack can be read at the same time. These RFID technologies can improve customer services, reduce workers injury, reduce labour expenses, reduce time required to perform circulation operation, improve searching books, enhance monitoring and reduces book theft, continuously update records of new library collections and provide better user-services.

Statement of the Problem

Due to the large amount of resources in libraries, their management, safety and securities become issues of concern, but with the help of new technologies like Radio Frequency Identification (RFID), many of these challenges can be easily

solved. The application of these new technologies in libraries has always been a welcome idea to improve the quality and delivery of information services rendered to the library users. The use of RFID in managing library resources is more effective, convenient and cost efficient. It is also quite clear that RFID is a technology that addresses both the security and materials tracking needs of the library. It also speeds up all activities or functions needed to be performed in the library as compared to barcode and other technology. Preliminary investigation by the researchers revealed that few Universities in Nigeria have already started using of RFID in their libraries. The questions however are; what are the perceptions of employees on the effectiveness of RFID, areas of application in libraries, positive impact and barriers affecting the use of RFID. These are what informed the study.

Research Questions

The study was guided by the following research questions:

1. What are the perceptions of employees on the effectiveness of RFID implementation in the management of library resources in some selected University Libraries in Nigeria?
2. What areas is RFID applied in the management of library resources in some selected University Libraries in Nigeria?
3. What are the positive impacts of RFID implementation in the management of library resources in some selected University Libraries in Nigeria?
4. What are the barriers affecting the use of RFID for the management of library resources in some selected University Libraries in Nigeria?

Literature Review

Library management and operations deal with many activities and processes to be adhered to and performed repeatedly. Such activities are; shelving/re-shelving, shelve reading, tagging of new items, issuing of items to users, checking overdue, inventory management and making sure that books and other library materials are kept safe. These activities being manual consume time and require large number of personnel and high budgetary allocation. Accordingly, Thiruvengadam and Gokulakrishnan (2020) the RFID based library management system will serve as a suitable alternative to the existing system of using barcodes for library books. The proposed system ensures proper books inventory management, books safety, records maintenance for issued and in-stock books, easy and self-book issuing, renewal and return of books. This system also ensures that it reduces the time taken in the overall processes like tagging, issuing, etc. for both the students and the librarian.

Radio Frequency Identification technology application has many potential benefits for libraries. These include improved efficiency, accuracy, security and

user satisfaction among others. Sivasankar, Soundararajan and Rajeswari (2020) revealed that, RFID technology is used in libraries to manage smooth circulation processes of library materials as well as ensuring the safety and security of books and other materials in the library. Furthermore, the implementation of RFID in the library can save the time of patrons and library staff and at the same time helps the libraries improve customer satisfaction with self-service experience and increases employee efficiency by multiple value-added services at a time. Similarly, Pranav, Binny, Thomas, Joseph and Namboothiri (2022) in their research titled RFID Implemented Library System highlighted that, RFID is very effective in terms of security, time management, data accuracy and effective library management as compared to the conventional library management system. The RFID technology in the Library system helps in stock management, provide high-speed inventory, speed up the book issue and borrowing process, tracking each book and also checking the availability of a particular book available in the library. Such application will result in future benefits like sustainable management of labours, cost efficiency, improved service to the customer, reducing book theft and provides continuous updates of all books available in the library.

Radio Frequency Identification has been increasingly used in many libraries for various purposes, ranging from circulation processes, inventory management, check-in check-out processes, tracking movement of library materials, processing of overdue payment, providing multi-tasking work, security control and many other services in the library. Solanke, (2021) on a research titled Radio Frequency Identification (RFID) Technology in Libraries maintained that, Librarians are using various new inventory technologies in libraries and they have started using RFID to give more effective and efficient circulation services as well as for security of library collections. It is more effective, convenient and cost efficient technology in library security and this technology has replaced the traditional barcode on library items. Day-by-day the use of RFID system by libraries has grown dramatically and it is one of the fastest growing and most beneficial technology adopted by libraries for increasing efficiency and improving safety, security, productivity, accuracy and conveniences. This technology is also helpful in finding missed items and identifying misfiled items, but the cost factor, non-availability of standards and user privacy is the major barriers in adoption of RFID technology by more libraries. As far as the cost constraints are concerned, once the libraries implement such a technology, its benefits can be realized in terms of "Return on Investments" as it will speed up the circulation process and the staff can perform other user centric services.

RFID technology can enhance the overall patron experience in libraries with faster checkout times and more efficient inventory management, patrons can spend less time waiting in line and more time browsing and checking out materials. This can therefore lead to increased patron satisfaction and patronage. However, Rajasekaran, Mohan, Ganesamoorthy and Selvakamal (2022) expressed that RFID-based library management systems can be used in libraries for book identification, self-checkout, anti-theft control, and informing users about the status of their library. RFID technology effectively provides self-checking for library staff and non-return books. It offers an intelligent library management system that improves service quality while providing immediate and effective benefits to both library management and users. These applications can result in significant labour cost savings, improved customer service, reduce book theft, and a continuous record update of new book collections. To achieve the best results, RFID readers and RFID tags must be of high quality. The main advantage of it is that, all of the activities, including the Book renewal and return are digitised, and all of these actions are automatically recorded in the database. The information that will be written in tag is also important for the efficient use of the technology.

Methodology

Survey research design was adopted for the study because is a quantitative study. The population of the study comprised of thirty four (34) library staff from three (3) selected Universities in Nigeria who are currently using the RFID. American University of Nigeria, Yola, Skyline University Kano and Nile University Abuja. Data was gathered using online self-designed questionnaire. Descriptive statistics of frequency counts and percentages was used in analysing the data. Results were presented in tables and charts where necessary.

Result and Discussion

Out of thirty four (34) respondents for the study, thirty two 32 (94.1%) are males and two (5.9%) are females.

Table 1: Age Distribution of the Respondents

Age of the Respondents	Frequency	Percentage (%)
18-30	-	-
31-40	23	67.6
41-50	11	32.4
51-60	-	-
61-Above	-	-
Total	34	100

Table 1 shows that, the age bracket of 31-40 has 23 (67.6%) respondents, thus 41-50 has library staff within these age brackets 11 (32.4%). 18-30, 51-60

and 61-Above has no respondents. Therefore, the age bracket of 31-40 with 23 (67.6%) has the highest respondents for this study.

Table 2: Highest Qualification of the Respondents

Highest Qualification	Frequency	Percentage (%)
Diploma	-	-
HND	-	-
First Degree	26	76.5
Master Degree	8	23.5
PhD	-	-
Total	34	100

Table 2 shows the respondent's qualification with First Degree having 26 (76.5%), Master Degree 8 (23.5%). Diploma, HND and PhD has no respondents. Basically, respondents with First Degree have the highest number of respondents.

Table 3: Perceptions of Employees on the Effectiveness of RFID Implementation in the Management of Library Resources

S/ N	Perceptions	N	SA	A	SD	D
1.	RFID enhances automation within the library	34	33 (97%)	1 (3%)	0 (0%)	0 (0%)
2.	RFID provide better inventory control		32 (94%)	2 (6%)	0 (0%)	0 (0%)
3.	RFID Implementation and usage are relatively easy		29 (85%)	5 (15%)	0 (0%)	0 (0%)
4.	RFID Increased customer satisfaction		32 (94%)	2 (6%)	0 (0%)	0 (0%)
5.	Managing material on the shelves is more reliable and efficient		33 (97%)	1 (3%)	0 (0%)	0 (0%)
6.	RFID reduces percentage of material loss, misuse and damages		29 (85%)	5 (15%)	0 (0%)	0 (0%)
7.	RFID support multi-tasking services at once		33 (97%)	1 (3%)	0 (0%)	0 (0%)
8.	RFID Improves safety and security of		31	3	0	0

	library materials	(91%)	(9%)	(0%)	(0%)
9.	RFID Fast track library services	33 (97%)	1 (3%)	0 (0%)	0 (0%)
10.	RFID Reduced workload of library staff	32 (94%)	2 (6%)	0 (0%)	0 (0%)
	Total	317	23	0	0
	Average	32 (94%)	2 (6%)	0 (0%)	0 (0%)

Table 3 shows the perceptions of employees on the effectiveness of RFID implementation in the management of library resources as follows: employees strongly agree that RFID enhances automation within the library, Managing material on the shelves is more reliable and efficient, RFID support multi-tasking services at once, RFID Fast track library services (33:97%). Secondly, employees strongly agree that RFID provide better inventory control, RFID Increased customer satisfaction, RFID Reduced workload of library staff (32:94%) followed by RFID Improves safety and security of library materials with (31:91%). Response shows that (29:85%) strongly agree that RFID Implementation and usage are relatively easy and RFID reduces percentage of material loss, misuse and damages. Out of the 34 respondents, majority with 32 (94%) indicated strongly agreed while 2 (6%) indicated agreed on the perception. The findings agreed with the study conducted by Nivedita Malipatil, Roopashree, Sanjana Gowda, Shobha, Sateesh Kumar (2020) on RFID based library management system that the proposed system is perceived by employees to be very effective and efficient technology which is easy to use, consumes less time and reduce the workload of the librarian, provide better inventory control, managing material on the shelves is more reliable and efficient, support multi-tasking services at once and Increased customer satisfaction. RFID in the management of library resources speeds up the process of book borrowing, tracking, books searching and thus frees workers to perform further customer support tasks. Furthermore, the technology simplifies all activities including renewal and returns of books are digitized and all these actions are modified in the database automatically. Such applications will result in substantial labor cost savings, improve customer service, lower book theft and provide a continuous update of new book collections.

Table 4: Areas of RFID Application in the Management of Library Resources

S/N	Areas of RFID Application	N	SA	A	SD	D
1.	Shelf management of resources; Book arrangement, book movement and placing of new book on shelf	34	31 (91%)	3 (9%)	0 (0%)	0 (0%)
2.	Tracking of library resources; book location etc		29 (85%)	5 (15%)	0 (0%)	0 (0%)
3.	Self-service and self-sufficiency in the library		30 (88%)	4 (12%)	0 (0%)	0 (0%)
4.	Book drop-off during non-working hours of the library		30(88%)	4 (12%)	0 (0%)	0 (0%)
5.	RFID provide Security, Control theft.....		32 (94%)	2 (6%)	0 (0%)	0 (0%)
	Total		152	18	0	0
	Average	30 (88%)	4 (12%)	0 (0%)	0 (0%)	

Table 4 shows the areas RFID is applied in the management of library resources. The respondents strongly agreed that RFID provide Security, Control theft 32 (94%). For Shelf management of resources; Book arrangement, book movement and placing of new book on shelf strongly agreed with 31 (91%). For Self-service and self-sufficiency in the library and for Book drop-off during non-working hours of the library 30 (88%) strongly agreed. For Tracking of library resources; book location 29 (85%) strongly agreed. Thus out of the 34 respondents, majority of them with 30 (88%) strongly agree on the areas of application of RFID and 4 (12%) agree. These study correlate with the study conducted by Ahmad (2019) on RFID technology in libraries: a case study of Allama Iqbal Library, University of Kashmir that substantial (86.05%) percentage of students comprising post graduate and graduate, 80% research scholars and 69.23% faculty members do their Self-service and return of books via self-check-out and check-in system, book-drop-off during non-working hours of the library. The collected data further reveals that majority of users with 60.85% students, 61.77% research scholars and 67.5% faculty members rate their satisfaction in the application and implementation of RFID in the management of library resources under satisfied category. However, this may be due to the fact that RFID application and implementation has minimized the laborious exercise at circulation desk, and users have free hand to issue and return the library resources.

Table 5: Positive Influences of RFID Implementation in the Management of Library Resources

S/ N	Positive Influences of RFID Implementation	N	SA	A	SD	D
1.	RFID positively contributes to the library operations	34	33 (97%)	1 (3%)	0 (0%)	0 (0%)
2.	RFID implementation has enhanced effective customer interaction		34 (100%)	0 (0%)	0 (0%)	0 (0%)
3.	RFID technology added great value to our operations		32 (94%)	2 (6%)	0 (0%)	0 (0%)
4.	Work is more easier and better with the implementation of RFID		33 (97%)	1 (3%)	0 (0%)	0 (0%)
5.	RFID benefits exceed its drawbacks		31 (91%)	3 (9%)	0 (0%)	0 (0%)
6.	RFID Solve problems related to customer services		31 (91%)	0 (0%)	0 (0%)	3 (9%)
7.	RFID Save the time and effort of library users and employees		32 (94%)	2 (6%)	0 (0%)	0 (0%)
8.	RFID Improved work efficiency and accuracy		31 (91%)	3 (9%)	0 (0%)	0 (0%)
9.	RFID Improves decision making		32 (94%)	2 (6%)	0 (0%)	0 (0%)
10.	RFID Implementation and usage are relatively easy		26 (76%)	8 (24%)	0 (0%)	0 (0%)
11.	RFID reduces the risk of injuries among staff		34 (100%)	0 (0%)	0 (0%)	0 (0%)
12.	RFID Increased customer satisfaction		31 (91%)	3 (9%)	0 (0%)	0 (0%)
	Total		380	25	0	0

Average	32 (94 %)	2 (6 %)	0 (0 %)	0 (0 %)
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Table 5 shows the positive influences of RFID implementation in the management of library resources. Respondents strongly agree responsively 34 (100%) that RFID implementation has enhanced effective customer interaction and RFID reduces the risk of injuries among staff. Also they indicated 33 (97%) that RFID positively contributes to the library operations and Work is more easier and better with the implementation of RFID. Furthermore, 32 (94%) strongly agree that RFID technology added great value to operations, RFID save the time and effort of library users and employees and RFID improves decision making. Also, 31 (91%) strongly agree that RFID benefits exceed its drawbacks, RFID Solve problems related to customer services, RFID improved work efficiency and accuracy and RFID Increased customer satisfaction. Lastly, RFID implementation and usage are relatively easy as indicated by 26 (76%) of the respondents who strongly agreed. Therefore, out of the 34 respondents, majority of them with 32 (94%) strongly agree and 4 (12%) agree on the positive influences of RFID implementation in the management of library resources. This finding is closely related to the study of Zhou (2019) on the intelligent library system based on RFID technology who discovered that RFID implementation provides automatic and efficient identification system that improves administrators accuracy and efficiency, enhanced effective customer interaction by simplifying the circulation processes, provide strong data statistics, save the time and effort of library users and employees. The study further revealed that RFID provides humanized services for Readers, improves decision making and reduces the risk of injuries among staff, the technology also provide multi-tasking functions and reduces the workload of the librarians.

Table 6: Barriers Affecting the Use of RFID for the Management of Library Resources

S/ N	Barriers	N	SA	A	SD	D
1.	RFID cost is higher compared to other methods		34 (100%)	0 (0%)	0 (0%)	0 (0%)
2.	RFID has Non-availability of standards	3 4	2 (6%)	5 (15%)	27 (79%)	0 (0%)

3.	Vulnerability to compromise RFID tags	29 (85%)	0 (0%)	5 (15%)	0 (0%)
4.	RFID has negative influence on privacy of information	4 (12%)	7 (20%)	23 (68%)	0 (0%)
5.	RFID implementation can lead to loss of job	34 (100%)	0 (0%)	0 (0%)	0 (0%)
6.	RFID technology has bad health influence	1 (3%)	0 (0%)	33 (97%)	0 (0%)
	Total	104	12	88	0
	Average	17 (50%)	2 (6%)	15 (44%)	0 (0%)

Table 6 shows barriers affecting the use of RFID implementation in the management of library resources. Respondents indicated strongly agree (34:100%) that RFID cost is higher compared to other methods and RFID implementation can lead to loss of job. Vulnerability to compromise RFID tags is another barrier with 29 (85%) respondents who strongly agreed. Furthermore, RFID has Non-availability of standards as a response 27 (79%) strongly disagree, likewise RFID has negative influence on privacy of information is another response 23 (68%) respondents who also strongly disagree. Accordingly, Vishakha (2020) conducted a study on RFID Based Library Management System: A Case Study of Arignar Anna Central Library, Bharathiar University, Coimbatore and maintained that some of the major disadvantages affecting the use and implementation of RFID technology in the management of library resources is high cost and its implementation can also lead to loss of job. There is a perception among users that RFID is a threat to patron privacy because of its non-availability of standards which will lead to vulnerability of the RFID tags to be compromise.

Summary of Findings

Based on the data analysis, the findings of the study are presented thus:

1. The perception of employees on the effectiveness of RFID implementation in the management of library resources in some selected University Libraries in Nigeria are that RFID enhances automation within the library, provide better inventory control, implementation and usage are relatively easy, RFID increased customer satisfaction, managing materials on the

shelves more reliable and efficient, reduces percentage of materials loss, misuse and damages, support multi-tasking services at once, improves safety and security of library materials, fast-track library services and RFID reduces workload of library staff.

2. The areas of RFID are applied in the management of library resources in some selected University Libraries in Nigeria are: in shelf management of resources, book arrangement, book movement, placing of new book on the shelf, tracking of library resources, book location, self-service and self-sufficiency in the library, book drop-off during non-working hours of the library, RFID provide security and control theft.
3. The positive impact of RFID on the management of library resources in some selected University Libraries in Nigeria are: RFID positively contributes to the library operations, implementation enhanced effective customer interaction, RFID technology added great value to library operations, work is more easier and better, RFID benefits exceed its drawbacks, solve problems related to customer services, save the time and effort of library users and employees, improved work efficiency and accuracy, improved decision making, RFID implementation and usage are relatively easy, RFID reduces the risk of injuries among staff and increased customer satisfaction.
4. The barriers affecting the use of RFID in the management of library resources in some selected University libraries in Nigeria are: RFID cost is higher compared to other methods, vulnerability to compromise RFID tags and implementation can lead to loss of job

Conclusion

Based on the results of this study, the use of RFID technology in University libraries under study revealed that, the system has numerous advantages and is very flexible compared to other methods of library operation most especially in this 21st century. However, the implementation of RFID in the University Libraries requires significant investment in the technology as well as in the training of staff that would handle the system, though the technology is not widely understood and not in use by majority of the universities in Nigeria but gradually RFID is increasing in popularity among University Libraries because of its economic sense, efficiency and easy to use.

Recommendations

1. In view of the positive influence of Radio Frequency Identification, University Libraries in Nigeria should present proposal to their managements for financial support, adoption and use.

2. Nigerian University Libraries should corporately seek expert guidance on the challenges of vulnerability to compromise RFID tags and the loss of job as a result of RFID implementation.

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