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AND TACKLING THE CHALLENGES FOR
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Use And Effects of Radio Frequency Identification (RFID) Technology on Theft Detection For Library Resources Management In Two Private Universities In Abuja, Nigeria

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Abstract—The study was designed to investigate the use and effect of Radio Frequency Identification (RFID) technology on theft detection for library management in two private universities in Abuja, Nigeria. Three objectives and three research questions guided the study. The study adopted descriptive research design. The population of the study comprises of 234 postgraduate students and 9 librarians in the two private universities in Abuja metropolis. Total enumeration method was employed and a self-designed closed ended questionnaire was used to collect data from respondents. Frequency counts, tables, percentages, mean and standard deviation were used for data analysis. The results indicated that the tags, readers, handheld readers, servers, antennae, RFID label printer, and external book return kiosk were available, installed and in use in the libraries, except for handheld readers that are rarely in use. The study further revealed that despite the positive effect of RFID technology in reducing book theft in the library, much still needed to be done to revamp, upgrade and make functional RFID equipment that are obsolete as well as boost manpower development through training to enhance librarian's productivity and efficiency in using the RFID technology to check library theft. Based on the findings it was recommended that the management of Nile University of Nigeria (NUN) and African University of Science & Technology (AUST) should invest more in other technologies to compliment RFID technology through upgrade and periodic maintenance; it also recommended that training and retraining of librarians should be advanced in the use of rarely used facilities such as handheld readers, in order to boost their morale and productivity toward a more efficient and effective service delivery.

Keywords-RFID technology; library theft; library management; theft detection; Abuja metropolis

I. INTRODUCTION

Library theft has remained topical issues confronting libraries globally. Academic libraries have taken frantic steps to tackle library theft related issues headlong by installing various electronic security gadgets such as installing security surveillance camera, security and anti-theft technologies using electromagnetic anti-theft gates which is widely

accepted by libraries in both developed and developing countries including Nigeria. In libraries that utilises Radio Frequency Identification (RFID) technology; it is common to have a part of the read-write tag secured against rewriting i.e. the identification number of the book. Library theft can be described as a crime of stealing books, Digital Video Displays (DVD) as well as other media from the library. This menace is typically prevented by installing electronic article surveillance alarms systems at the entrance and exits of the library. Library materials are tagged and if the tag is not deactivated it sounds an alarm; in some libraries with older or rare materials, readers are not allowed to take coats or bags into the reading areas except for a few items in a clear plastic bag. Security cameras are not commonly used in libraries for privacy reasons. Consequently, Theft detection using Radio Frequency Identification (RFID) technology in library management connotes the use of Radio Frequency Identification (RFID) Electronic Articles Surveillance (EAS) Gates. However, [1] opined that one study commissioned in the United Kingdom (UK) estimated the average loss rate of libraries to theft at 5.3%. The authors stated further that in the United States of America (USA), State of Pennsylvania, the third conviction for library theft is a felony, regardless of the value of the material. Library thieves, who may be staff or regular visitors of the library, risk being discovered if a book is found in the library catalog but missing from shelves. To curb this menace, some library thieves have been careful to also steal the catalog card describing the book.

The Radio Frequency Identification Technology was first used by the United States of America (USA) Department of Defense (DOD) in identifying, locating, tracking and recovering people and equipment during the World War I & II. This was made possible by tagging arms and ammunitions as well as placing RFID tags under the skin of Army personnel for the purpose of identification and tracking. The utilisation of Radio Frequency Identification (RFID) for library management can be viewed from the perspective that saves library staff's time by computerising their tasks. An institution that uses the Radio Frequency Identification (RFID) library management saves a book reader precious time that he would have spent waiting for his turn in a queue for borrowing or returning a book.

Reference [2] opined in addition to the use of Radio Frequency Identification (RFID) technology as highlighted above, it was also used for inventory as well as supply chain management and real-time monitoring of military equipment. Reference [3] reported that novel technologies have always been of concern to the library professionals both for the prospect of increasing the quality of service and for improving the efficiency of processes. Radio Frequency Identification (RFID) Technology provides a platform for adequately securing library materials through a modified security enabled service delivery mechanism using tags, readers and antennas. Reference [4] stated that the implementation of ICTs in the development of libraries in Nigeria has metamorphosed into the creation of e-libraries as well as retrospective conversion of manually produced catalogues. Reference [5] opined that Radio Frequency Identification (RFID) technology is a technology that uses radio waves, tags, antenna and readers to track and detect object real-time within the geographical location of such item. It enables library personnel to work smarter rather than working hard and achieving less result. The author further stated that Radio Frequency Identification (RFID) system provides a solution to excellently collect, manage and distribute books to library users without delay using RFID charge/discharge kiosk and book return station. Unlike the barcode technology, non-line of sight Automatic Identification and Data Capture (ADIC) technology is used to identify objects, images and videos that are Radio Frequency Identification (RFID) technology enabled.

It is important to note that Radio Frequency Identification (RFID) technology is not only used in libraries but also in other sectors of the economy namely: Healthcare, Agriculture, Maritime, Tourism, Mining and Mineral resources, Education, Aviation and Aerospace, Manufacturing and Supply chain, Transports and Logistics, Oil and Gas, Banking and Finance, Defense and Homeland Security, Construction and Hospitality respectively. Despite the prominence accorded to RFID Technology most libraries in Nigeria are yet to adopt RFID technology for effective service delivery especially with regards to circulation operations. It is in view of the foregoing that the research tends to delve into the use and effect of RFID technology in theft detection for library management in two private universities in Abuja metropolis.

Reference [6] asserted that Abuja is located in north-central Nigeria with Six (6) Area councils namely: Bwari, Kuje, Gwagwalada, Kwali, Abaji and Abuja Municipal Area Council (AMAC). Abuja according to oral tradition Abuja originated from the name of one of the followers and brothers of Muhammed Makau (i.e. Abuja and Kwaka) Abuja succeeded Makau in 1825. Abu Ja meaning Abu, the red. Some sources however revealed "Ja" was abridged from Isaku Jatau-his father's name. King Abubakar discovered the kingdom of Abuja. This statement is evident according to (<http://www.abujagallery.com>)

II. STATEMENT OF THE PROBLEM

The library security with respect to theft of library resources has remained topical issues discussed at various

library and Information Science fora. In an ideal situation, libraries are supposed to adopt an advanced technology to prevent book theft, by fixing security cameras, electromagnetic (EM) technology gates and Radio Frequency Identification (RFID) Technology which are usually on top of the list when putting into consideration which library security technology to adopt. Unfortunately, the actual situation after initial inquiries can be described as worrisome. According to [7], It was discovered that the theft of library materials is a major problem confronted by libraries today; [8] opined that many library employees and patrons discovered that, it is increasingly common to find empty DVD and CD cases littering library shelves due to the fact that the contents have been stolen. Some library patrons sheepishly return DVDs they purchased on the street only to later discover, upon closer inspection, that the DVDs belonged to the local public library. High-profile cases involving employee theft of library materials valuing hundreds of thousands of dollars are numerous. The problem of theft is one that affects libraries and archives of all types.

The book theft exists from pre-historic times, this continues to exist even in contemporary libraries now; more so, that there is population expansion making the old system of management ineffective. Non-Radio Frequency Identification (RFID) libraries spend huge amount of time and money trying to safe-guard books but all to no avail. The study is designed to determine the use and effect of RFID Technology in theft detection for library management in two private universities in Abuja, Nigeria.

III. RESEARCH QUESTIONS

The study was designed to provide answers to the following research questions: -

- What type of RFID facilities are installed and in use in the two private university libraries in Abuja metropolis?
- What are the effects of RFID utilisation in theft detection on library resources in the two private university libraries in Abuja metropolis?
- What is user's perception on competence of librarians on the use of RFID technology in the two private university libraries in Abuja metropolis?

IV. OBJECTIVES

The main objective of the study is to determine the use and effect of RFID technology in theft detection for library management in two private universities in Abuja metropolis.

The specific objectives of the study are to: -

- To find out the type of RFID facilities installed and in use in the two private university libraries in Abuja metropolis.
- To determine the effect of RFID utilisation in theft detection in the two private university libraries in Abuja metropolis.
- To investigate user's perception on competence of Librarians on the use of RFID technology in the two private University libraries in Abuja metropolis.

V. LITERATURE REVIEW

Reference [9] explained that contemporary academic library is a place where millions of innovative books; periodicals, Compact Discs (CDs), Digital Video Displays (DVDs) and other electronic reading materials are confined. It is a humongous task for librarians handling such type of gigantic collection. [10] conducted a study on Radio Frequency Identification (RFID) adaptation in some institutions and its usage in libraries and found out that more than 300 libraries in the United States of America (USA) had deployed Radio-Frequency Identification (RFID) technology since 2003. These authors disclosed further that these libraries had some benefits from Radio-Frequency Identification (RFID) technology. Based on the reports of the implementation, it was realized that Radio Frequency Identification (RFID) technology made the tracking, identifying and controlling system more proficient in libraries where it was used.

Reference [3] opined that frequency allocations are managed through lawmaking and byelaw by individual governments. Internationally, there are also modifications in frequencies allocated for RFID uses, although it goes through standardization process with International Organisation for Standardisation (ISO) and similar organisations which are assisting in compatibility. For example, Europe uses 868 MHz for UHF and the United States of America (USA) uses 915 MHz presently, very few frequencies are consistently available for Radio-Frequency Identification (RFID) uses on a global foundation.

Reference [11] findings discovered that Radio Frequency Identification (RFID) component such as tags, Readers, Work stations and Antenna are the main component of the RFID systems. [12] Opined that RFID technology has been in use in agriculture for Animal identification, Inputs Quality Control and Tracking, Traceability of Food Products through the Supply Chain Asset Tracking. In Aviation, it is used for Aircraft Components Management and Tracking, Automated Baggage Handling and Tracking, Personnel Management and Tracking. In Oil and Gas, it is used for Product Monitoring and Tracking, Equipment Management and Maintenance Tracking, Personnel Safety and Tracking and Logistics and Operations Optimization.

The writers stated further that Radio Frequency Identification (RFID) Technology is used in library systems management to control access, manage extensive collections of books, as well as offering self-check and protecting them against theft. In the Philippines, some schools already use RFID in Identifications for borrowing books and also gates in those particular schools have Radio Frequency Identification Identity (RFID ID) scanners for buying items at a school shop and canteen, library and also to sign in and sign out for students and teacher's attendance. Reference [13] stated that RFID technology is a new technology with tremendous potential for multiple applications in the future. It is a flexible technology that combines security and item identification in a single tag and reduces library losses by providing effective library detection systems. It can also be used to:

- Improves patron service & staff productivity.
- Provide efficiency to collection management.
- Provide wireless inventory management.
- Eliminate many sources of repetitive stress injuries.
- It gives better availability of books as the library database is updated in real time.
- Inventory is 20 times faster than with barcodes.
- Free librarians to focus on doing what they do best-assisting patrons.
- It is designed to work efficiently with a materials sorting system, which will automate the charge and discharge processes.
- Radio-Frequency Identification (RFID) eliminates the applied labour of manual material discharge and return processes.
- The self-check machines are extremely user-friendly. Multiple items can be checked out at the same time by simply passing the materials over the scanner.
- There is no need to align or position materials for checkout and all materials (books and audio-visuals) are checked out at the same way.

RFID technology works through flexible, paper-thin RFID tags, which can be placed inside the cover of each and every document [14]. The author further explained that the tags are available in a variety of shapes and sizes. Also, libraries make use of a bibliographic database to track circulation information about item(s) in the collection. Check-out occurs at either a circulation desk or a special "self-check" machine that allows patrons to check out their own books. In a study carried out by [15] on user's perspective towards the Radio Frequency Identification (RFID) technology System in the Allama Iqbal Library shows that the data of 100 registered users of the Allama Iqbal Library was undertaken. The results revealed that the students were satisfied with the Radio Frequency Identification (RFID) system especially self-service stations and access control system, that is to say that the technology works effectively in the library.

[12] observed that Radio Frequency Identification (RFID) technology must be tailored to go with the needs and structure of the library and its users; for example, the University of Hong Kong's library has installed Easy Check units, Easy Return units and Easy Detect units to better serve library patron. This is to ensure better reworked copy and continuous refining of the process. [10] posited that the lack of any technological experts in the library is a problem when implementing RFID technology

RFID usage competences of librarians in terms of skills and competency development, changing environment in academic libraries, impact of new technologies, integration of RFID technology with existing information technology infrastructure [16]. Other areas of competence as further stated by the author include: personal competencies: corporate mindset, communication skills, logical and analytical skill, presentation skill, negotiation and human resource management. Professional and/or Technical such

as; Computer literacy, Internet literacy, Networking knowledge, Information search and retrieval competency, Developments in ITES and Operational knowledge of equipment and tools in use. [17] is of the view that lack of training and skill affects the use of RFID technology. This situation causes problems on a daily basis. In order to overcome this problem, the provision of training and education to develop library staff's competence in using RFID technology is indispensable.

Reference [18] in their research on adoption and implementation of Radio Frequency Identification (RFID) Technology found out that the major impediments to adoption of RFID include technological limitations, interference concerns, prohibitive costs, lack of global standards and privacy concerns. [19] found out that 9.10% of RFID technology is been applied to Tracking of Digital Video Displays (DVDs) location. On Keeping track of user history, [20], [21] and [22]. On Tracking Video location [10] found out that 4.55% and 6.10% respectively is been applied. Reference [23] and [24] are of the opinion that Self-service and self-sufficiency as well as Borrowing and returning book accounted for 9.10% of RFID Technology is being applied in this area in information science. [25] found out that on self-charge and self-discharge 10.61% of RFID technology is been applied in this area. Reference [26], in the author's research on the application of RFID technology in self-service, the author revealed that 3.03% of RFID has been applied in this area. Reference [27] research on Security and theft detection in libraries, an RFID system provides a security method to prevent theft of library resources. Reference [22], [28] & [14], in their research on Control of Theft using RFID technology found out that 6.10% of RFID technology is been applied in this area. Similarly, implementation of Radio Frequency Identification (RFID) Technology in libraries as a new approach to solve the problem of theft, circulation, stacking, etc. have been taken into consideration by [29] in their study. They further discussed about the technical characteristics, components, technology, its advantages, disadvantages and its standards for library use, etc

The impact of technology on theological libraries has been discussed to find out the progress of automation and RFID technology by [30]. The study covered 55 libraries located in Goa and coastal Karnataka using a structured questionnaire and personal interviews. As the findings show a significant change has taken place in the way how information is generated, accessed, stored and used in the libraries. [6] carried out a research on the application of ICT in library operation and services in three private universities in FCT, Abuja, and using qualitative investigation, the methodology adopted for the study was descriptive survey and qualitative research through in-depth interview and responses from the respondents were recorded on mobile phones and papers. The results showed that out of the three (3) private universities studied by the authors, only two private universities i.e. Nile University and African University of Science and Technology uses Radio Frequency Identification (RFID) Technology to monitor the activities of the users when it comes to library circulation operations. The

Authors further maintained that circulation of books has been made easier since the introduction of RFID technology.

VI. RESEARCH METHODOLOGY

The Descriptive survey design was used and the target population of the study consists of Nine (9) experienced librarians and 234 post-graduate's students in two (2) private universities in Abuja metropolis, namely: -

- African University of Science and Technology, (AUST), Abuja
- Nile University of Nigeria, (NUN) Abuja.

The instrument for data collection is the close ended questionnaire. The questionnaire was administered on the respondents by the researcher and assisted by two research assistants. Reference [31] asserted that questionnaire is the most suitable instrument that should be used for a study of this nature. However, two sets of questionnaire were administered on the respondents, one for the librarians and the other set for the library users.

Data collected were analysed using simple descriptive statistics. Simple descriptive statistics such as frequency counts, percentages, mean and standard deviation were used.

VII. RESULTS AND DISCUSSION

A. Research Question 1: RFID Tools Available, Installed and in Use in The Two Private University Libraries?

TABLE I. AVAILABLE RFID TOOLS IN SELECTED UNIVERSITIES IN ABUJA

RFID Tools	Nile University of Nigeria (NUN)	African University of Science and Technology (AUST)
Tags	✓	✓
Readers	✓	✓
Antenna	✓	✓
Server	✓	✓
RFID Label Printer	✓	✓
Handheld Reader	✓	✓
External Book Return	✓	✓

Source: Author's Field Survey, 2018

The qualitative analysis of the availability and usefulness of the RFID tools in the library was obtained from the interview granted by the library staff and the users. The difference between the two selected universities is shown on the number of this RFID tools available in their respective libraries. The AUST library has more RFID tools than the NUN. The use of RFID in these schools does not need line of sight by the library staff and each library users can borrow as many as 3 different textbooks borrowed a time. The study also revealed that the library staff environment is efficient and improvement on their performance. The RFID tools have also relieved them of stress in their daily routine activities in the library. For instance, the cataloging process that usually takes a longer time has been reduced drastically. The effect of this is reduction in the number of staff in the library; location of relevant materials by the library users accurately and much quicker. It was also observed that the time saved by the library staff had clearly benefited the library.

TABLE II. RFID TECHNOLOGIES AVAILABILITY AND FUNCTIONALITY IN THE SELECTED UNIVERSITIES

RFID Technologies Availability	NUN		AUST	
	Not Available	Not Functional	Not Available	Not Functional
Tags	3	3	5	4
RFID Readers	4	3	6	4
Antenna	1	1	2	1
Server	1	1	2	1
RFID Label Printer	2	1	3	2
Handheld Reader	4	3	6	4
External Book Return	2	1	2	2

Source: Author's Field Survey, 2018

TABLE III. EFFECT OF RFID TECHNOLOGY ON THEFT DETECTION OF LIBRARY MATERIALS

Effect of RFID Technology on Theft Detection	Rating				TDPI	Rank
	4	3	2	1		
1. Using Radio Frequency Identification (RFID) technology in the library checks the theft of library materials	1.6	0.9	0.4	0.1	3.0	7 th
2. Radio Frequency Identification (RFID) ensures accuracy of records	2.0	0.9	0.4	0.0	3.3	5 th
3. It ensures more efficient tracking of library materials	2.0	1.2	0.2	0.0	3.4	2 nd
4. It ensures easy charge and discharge of library materials	2.0	1.5	0.0	0.0	3.5	1 st
5. It provides real time tracking system and surveillance for all tagged library resources	1.6	1.5	0.2	0.0	3.3	5 th
6. It enables librarians to reduce treasured staff time spent scanning barcodes	2.0	1.2	0.2	0.0	3.4	2 nd
7. Radio Frequency Identification (RFID) Technology is fast, easy and innovative to implement and replaces physical and manual security approaches.	2.0	1.2	0.2	0.0	3.4	2 nd
Mean Theft Detection Perception Index					3.33	

Source: Author's Analysis, 2018

TABLE IV. USER'S PERCEPTION ON COMPETENCE OF LIBRARIAN RFID TECHNOLOGY USE IN NUN LIBRARY

Level of Competence	Rating of Competence				CPI	Rank
	HC	AC	LC	NC		
1. Use of Radio Frequency Identification Reader (RFID) is satisfactory	2.47	1.02	0.06	0.01	3.56	3 rd
2. Use of Handheld Readers for Inventory with respect to Shelving is satisfactory	2.61	0.90	0.08	0.01	3.60	2 nd
3. Use of Tags for Authentication of Library resources is satisfactory	2.67	0.85	0.08	0.01	3.61	1 st
4. Use of Electromagnetic security gates for anti-theft detection is satisfactory	2.44	0.92	0.14	0.01	3.51	4 th
5. Use of Radio Frequency Identification (RFID) label for the printing of Tags is satisfactory	1.86	1.31	0.18	0.01	3.36	6 th
6. Tagging of Library materials for processing is satisfactory	2.19	1.19	0.07	0.02	3.47	5 th
Mean Competence Performance Index					3.52	

Source: Author's Analysis, 2018

TABLE V. USER'S PERCEPTION ON COMPETENCE OF LIBRARIAN ON RFID TECHNOLOGY USE IN AUST LIBRARY

Level of Competence	Rating of Competence				CPI	Rank
	HC	AC	LC	NC		
1. Use of Radio Frequency Identification Reader (RFID) is satisfactory	2.27	0.97	0.22	0.00	3.46	5 th
2. Use of Handheld Readers for Inventory with respect to Shelving is satisfactory	2.22	1.00	0.22	0.00	3.45	6 th
3. Use of Tags for Authentication of Library resources is satisfactory	2.58	1.07	0.00	0.00	3.65	1 st
4. Use of Electromagnetic security gates for anti-theft detection is satisfactory	2.31	1.27	0.00	0.00	3.58	2 nd
5. Use of Radio Frequency Identification (RFID) label for the printing of Tags is satisfactory	2.09	1.43	0.00	0.00	3.52	3 rd
6. Tagging of Library materials for processing is satisfactory	1.96	1.50	0.01	0.00	3.47	4 th
Mean Satisfactory Performance Index					3.52	

Source: Author's Analysis, 2018

TABLE VI. USERS PERCEPTION ON LIBRARIANS' COMPETENCE ON USE OF RFID IN SELECTED UNIVERSITIES

Level of Competence	Rating of Competence				CPI	Rank
	HC	AC	LC	NC		
1. Use of Radio Frequency Identification Reader (RFID) is satisfactory	2.38	1.00	0.13	0.01	3.52	3 rd
2. Use of Handheld Readers for Inventory with respect to Shelving is satisfactory	2.36	1.00	0.14	0.00	3.50	4 th
3. Use of Tags for Authentication of Library resources is satisfactory	2.63	0.94	0.05	0.00	3.62	1 st
4. Use of Electromagnetic security gates for anti-theft detection is satisfactory	2.39	1.05	0.09	0.01	3.54	2 nd
5. Use of Radio Frequency Identification (RFID) label for the printing of Tags is satisfactory	1.95	1.36	0.00	0.00	3.31	6 th
6. Tagging of Library materials for processing is satisfactory	2.10	1.31	0.05	0.01	3.47	5 th
Mean Competence Performance Index					3.49	

Source: Author's Analysis, 2018

The analysis of the availability of the RFID Technology tools available in the selected schools indicated that they are not working optimally as some of the equipment are obsolete and out of service. The Librarian in the NUN opined that "the use of the RFID Technology has really helped us in discharging of our duties, but the problem is the number of the items available as many users of library has to wait for others or revert to manual system to borrow books and other materials".

The implication of this is that the technology is over utilized because of number of users compared with the number available to the library. Therefore, there is overstretched of the facility in the library. This will lead to breakdown of the technology and will not serve the purpose. The analysis also proved that both RFID Technology and traditional method are employed for the management of the selected libraries in Abuja.

B. Research Question 2: Effects of RFID Utilisation in Theft Detection On Library Resources in The Two Private University Libraries?

A total of 10 librarians were interviewed (5 each from the two Universities) to determine the perception of the librarians on the issues of usage of RFID Technology in detecting theft in the library. Their perceptions were rated on 4 level Linkert's Scale. The result is presented in Table 3:

The analysis indicated that the librarians in the selected Universities have a mean Theft Detection Perception Index of 3.33 (undesirable condition). This implies that the deployment of the RFID Technology has not really helped in curbing the theft of library materials as many of the library users circumvent the process; especially in the borrowing of books and return of such. The perception ranges from 3.50 (moderately satisfactory) condition to 3.30 (undesirable satisfactory condition).

This implies that the deployment of the RFID Technologies in the selected libraries has not help in the smooth management of the library. The system has to be revamped and proper monitoring employed to stem or reduce the cases of theft of library materials by the users.

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C. Research Question 3: User's Perception On Competence of Librarians on the Use of RFID Technology in The Two Private University Libraries?

Analysis of the satisfaction of users of library on the use of RFID Technology was considered based on six different items and scaled on 4 level Linkert's Scale. The result of the analysis is presented on individual university bases and then the composite of the responses of the respondents in both selected universities.

D. Level of Competence of librarian on the use of RFID Technology in NUN Library.

The analysis of the level of user's satisfaction in the Nile University of Technology, Abuja indicated that the Mean Satisfactory Performance Index (SPI) in Nile University of Nigeria was 3.52 which is moderately satisfactory (it ranges between 3.36 undesirable condition and 3.61 moderately desirable condition). The implication of this is that the extent of usage of the RFID Technology in the NUN Library is moderately satisfactory (moderately desirable) to the user of such tools in the library. Table 4 presented the mean level of satisfaction of the library users to the deployment of RFID Technology in the Management of Nile University of Nigeria.

The result indicated that the use of Tag Authentication is the most favoured RFID tool in NUN library. This enabled the users of the library materials to place the Tag on each of the library materials in order to identify the books and other materials in the library on time. The use of the Tag replaces the OPAC (Online Public Access Catalog) in the library. The level of competence is 3.60 (moderately desirable). This is followed by the use of handheld reader to determine the materials in the library at CPI of 3.60 (desirable condition). The least RFID tool used in the library according to satisfactory usage is the use of RFID for printing Tag on the library materials.

The implication of this is that the library users in the Nile University are satisfied with the employment of RFID Technology in Library management but are of opinion that more has to be done to achieve excellent utilisation of RFID

Technology in the library management. Therefore, the management of the library and the University need to invest additional technology for smooth running of the library automated.

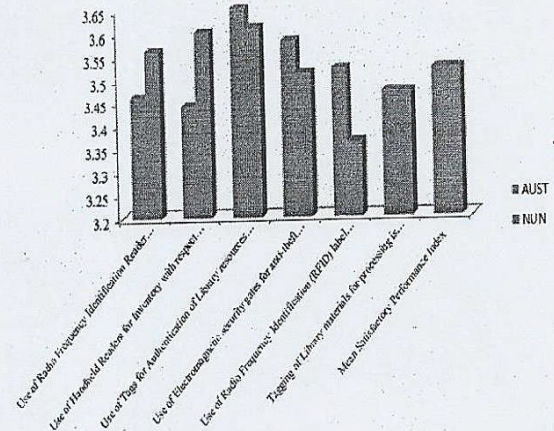
On the other hand, the employment of RFID Technology in African University of Technology, Abuja presented a similar Mean Competence Performance Index (CPI) of 3.52. This implies that the level of Competence is moderately desirable. The index ranges between 3.44 (undesirable condition and 3.65 moderately desirable conditions). This also implies that the usage of RFID Technology in African University of Science and Technology is desirable by the library users. The employment of the technology has helped the library users to have high level of self-service check-in and self-service check-out of the library material. What is next is for the library and the University authority to improve on the employment of such technology to enhance optimum satisfaction by the library users. Table 8 presented the level of satisfaction by the library users in the African University of Science and Technology, Abuja.

The analysis indicated that use of Tag is also the best satisfactory technology in the library (3.65 moderately desirable) followed by the use of electromagnetic security gate for anti-theft detection (3.58 moderately satisfactory). The least satisfactory technology employed by the University is the use of handheld reader for inventory of the library materials. This implies that there are three (3) RFID Technology that provided moderate satisfaction to library users while the other three does provided unsatisfactory conditions to the users. The implication of this is that the library users in African University of Science and Technology are moderately satisfied with the use of the RFID Technology in the school library. Therefore, the library and the university management has to do more to provide more technology to improve the library services and create high sense of satisfaction among the users of the library.

The comparative analysis of the level of satisfaction among the users of the two selected library in Abuja present similar level of satisfaction but variation in items considered. Figure 1 shows the different level of satisfactions among the library users in the two selected private universities in Abuja.

As shown in the figure 1, the level of competence differs across all the RFID Technology employed, but the mean CPI is the same. The composite analysis of the perception of the library users in both Universities about the level of satisfaction on the deployment of RFID Technology for library management in Abuja indicated that the mean CPI is 3.49. Table 6. shows the composite analysis of the Competence Perception Index of the Library users.

The analysis indicated that the Mean Competence Index ranges between 3.62 Moderately Competent and 3.31 Undesirable Competent level. It shows that four (4) variables (RFID Technology) usage contributed positively to the level of satisfaction by the library users while two (2) variables do not contribute to the mean level of satisfaction (undesirable satisfactory condition). Therefore, the usage of these RFID Technologies is met with different level of satisfaction by the library users.



Source: Author's Analysis, 2018

Figure 1. Level of competence for RFID in selected library in Abuja

VIII. DISCUSSION OF RESULTS

RFID Technology has proved to be one of the fast improving and largely beneficial technologies emerging for every facet of human endeavours at the moment, and the advantages it brought about to the management of human and material resources in the library are apparent. The adoption of RFID Technology in all size and shape of libraries, either self-service or staff serviced has brought about efficiency and high level of improvement. This can be seen in the saving of staff work time being effectively reduced, it has also reduced interaction among the staff and library users, and reduction in the number of staff needed or required to man libraries among others.

The installed RFID Technology system in the selected library include: Tags; Readers (both hand held and RFID); Antenna; Server; RFID Label Printer and External Book Return. Though available at different numbers, they are not working optimally as some of the equipment are obsolete and out of service. There is high pressure on the available tools thereby causing delay in the service to the library users. The use of RFID Technology in these schools does not need line of sight by the library staff and each library users can borrow as many as 3 different textbooks borrowed at a time. The study also revealed that the library staff environment is efficient and therefore has impacted positively on the improvement on their performance. The findings of [29] discovered that Radio Frequency Identification (RFID) software such as tags, Readers, Work stations and Antenna are the main component of the RFID systems.

The usage of self-check-in and self-check-out system is better than the use of staff check-in and staff check-out system in both Universities. The self-service has improved the use of library in the following areas: the automatic lending machine; effective and efficient use of library materials; faster and speedy responses to library users need

that allow up to maximum of 3 books to be borrowed at a time and RFID technology has anti-theft function that streamline the borrowing procedures. These findings corroborate the findings of [7] and [1] who maintained that Self-service and self-sufficiency as well as Borrowing and returning book accounted for 9.10% of RFID Technology is being applied in this area in information science. Also, [25] found out that on self-charge and self-discharge that 10.61% of RFID technology is been applied in this area of library and information science and have improved library services optimally.

The extent of usage of RFID tools to promote theft detection and management in the selected libraries shows that almost all the RFID Technology deployed in the Universities are most frequently uses except for hand held reader that is rarely used. The perception of the librarians in the selected University on its deployment for determining its effectiveness in detecting theft shows variations and the mean perception index was estimated at 3.33 (undesirable satisfaction condition) when placed on Linkert's Scale of preferences. This implies that the deployment of the RFID Technology has not really help in curbing the theft of library materials as many of the library users circumvent the process. Again, these findings differ from the findings of the following authors such as [22], [27], [14] and [26] who observed that the control of theft using RFID technology has been greatly utilised and that RFID technology provides a security method of preventing theft of library resources.

The result of the level of satisfaction in the use of the RFID Technology by the library users in the selected private Universities in Abuja indicated that the Mean Satisfactory Performance Index (SPI) was 3.52 that is moderately satisfactory. The result shows that the use of Tag Authentication is the most favoured of the entire RFID tool employed in the libraries. The implication of this is that the library users are satisfied with the employment of RFID Technology in library resources management but are of opinion that more has to be done to achieve excellent utilisation of RFID Technology in the library management. Therefore, the management of the library and the University need to invest additional technology for smooth running of the library automated.

The use of the RFID Technology has reduced staff employed in the selected libraries in the following ways: librarians are relieved on daily routines, self-service has reduced the circulation tasks of librarians, job responsibilities has also reduced, it has also reduced their man hour to a great extent because sorting of the returned materials has reduced drastically, cataloging has become more efficient and finally, tracking the misplaced books has also reduced. The level of satisfaction pertaining to user's perception substantiate the findings of [15] who opined that the students (i.e. the user's) are satisfied with RFID Technology systems especially self-service stations as well as access control systems. One can conclude based on this that RFID technology works more effectively and efficiently in the libraries.

IX. CONCLUSION

The study concluded that Radio Frequency Identification (RFID) technology proffers substantial advantages and solution in theft detection in the two university libraries in Abuja, Nigeria when weighed against the traditional method of library theft detection management in terms of circulation operations which mainly has to do with charge and discharge of library materials. Similarly, RFID facilities namely; Tags, readers, Antennas, servers, RFID label Printers and external book return are available, in use and installed, except for handheld readers that are rarely in used in both libraries. The study further confirmed that library users are satisfied with the use of RFID technology in the libraries which has culminated in relieving librarians of daily routines, self-service by users have reduced the circulation task by the librarians, job responsibilities have also reduced as well as reduction in man hours especially with respect to sorting of the returned books. Despite the fact that RFID technology is new to the Nigerian library system, it requires improvement in all ramifications. The swift growth and rising usage will no doubt show the way to a clearer utilization and implementation of RFID technology. The technology will definitely perform a significant role in theft management in libraries at the present and in the future.

X. RECOMMENDATIONS

The following recommendations is made based on the findings as thus:

- It is also recommended that the management of the Nile University of Nigeria (NUN) and African University of Science & Technology (AUST) close rank in providing more training and retraining for librarians on the use of handheld readers which are rarely used in the libraries, this will promote a culture of fast and smart inventory system within the shortest possible time.
- It is recommended that librarians should equip themselves more in the use of theft detection facilities to prevent theft related issues in the library. This will bring about positive effect on the use of RFID technology in the libraries and reduce tendencies of some criminally minded users in circumventing the process.
- It is also recommended that considering the fact that the users are of the opinion that they are satisfied with Librarians competence on the use of RFID technology in the management of the library, NUN and AUST libraries should upgrade and maintain RFID facilities in their libraries in order to achieve excellent utilisation of the technology in the libraries.
- Non-Radio Frequency Identification (RFID) compliant libraries who will see the benefit of RFID technology should also follow suit to learn, collaborate and implement RFID technology in their libraries for effective and efficient service delivery across networks of libraries in Nigeria.

REFERENCES

- [1] R. Griffiths, & A. Krol, "Insider theft: Reviews and recommendations from the archive and library professional literature." *Library & Archival Security*, 22 (1), 2009, 5-18.
- [2] K. Kapoor, Y. K. Dwivedi, N. Piercy, & B. Lal, "RFID integrated systems in libraries: Extending TAM model for empirically examining the use." *Journal of Enterprise Information Management*, 27(6), 2014, 1-23. Retrieved from <http://doi.org/10.1108/JEIM-10-2013-0079>
- [3] C. M. Roberts, "Radio Frequency Identification (RFID)" in *Computers & Security*, vol. 25, 2016, pp.18-26.
- [4] R. P. Bajpai, K. S. Hada, & G. S. Jodan, "Implementing Radio Frequency Identification" in *Libraries: A new approach*, K. Sanjay, P. A. K. John & R. Shri (Eds.), *Emerging Technologies and Changing Dimensions of Libraries and Information Services*, 2010, pp. 346-350.
- [5] D. Omofoman, "ICT and Security." in *Radio Frequency Identification (RFID) Proceedings of 6th Forum of Laureates of the Nigerian National Order of Merit*, December, 2013.
- [6] K. A. Saka, & A. Aliyu, "Application of ICT in library operations and services in three private universities in FCT Abuja." in proceedings of the 5th International Conference of School of Science and Technology Education, Federal University of Technology Minna, Niger State, October 2017, pp.367-373.
- [7] Mendeley, "Mendeley Desktop." 2010, Retrieved from <http://doi.org/10.1378/chest.122.6.2183>
- [8] S. Littera, "Antiquarian, Used and Rare Books on the Internet: A reader guide." 2010, Retrieved March, 02, 2016. From www.litterascripta.com
- [9] I. Lee, B. C. Lee, "An Investment Evaluation of Supply Chain RFID Technologies: A Normative Modeling Approach" in *International Journal of Production Economics*, 2010.
- [10] P. E. Kourouthanassis, M. George, "Embedding Technology In The Retail Arena" in *Consumer Driven Electronic Transformation: Applying New Technologies to Enthuse Consumers and Transform the Supply Chain*, G. J. Doukidis, A. P. Vrehopoulos, (Eds.), Berlin, Springer, 2015, pp. 227-240.
- [11] S. C. Yu, "RFID Implementation and Benefits in Libraries" in the *Electronic Library*, 25(1) 2007, 120-131.
- [12] K. Suda, & N. Rani, "Radio frequency identification for efficient library management." in *Ijbsnet.Com*, 4(15), 2013, pp.125-131. Retrieved from http://ijbsnet.com/journals/Vol_4_No_15_Special_Issue_November_2013/18.pdf
- [13] S. Vasishtha, "Roadmap for RFID Implementation in Central Library", in *Infrastructure and Policy Issues*, 302 2009.
- [14] N. K. Singh, & P. Mahajan, "Application of RFID Technology in Libraries." in *International Journal of Library and Information Studies*, 4 (2), 2014, pp.1-9.
- [15] S. Vimalraj, S. Sameera, S. Saranya, "RFID Based Library Management System", in *International Journal of Innovative Research in Advanced Engineering (IJRAE)*, Issue 1, Volume 2, January 2015.
- [16] C. Greene, M. Roser, and E. Ruane, "The anywhere library: Primer for the mobile web." ACRL, Chicago, 2010.
- [17] M. S. Cunningham, "A case study into the implementation of RFID" Pilkington Library Loughborough University. Loughborough University Institutional Repository, 2010.
- [18] K. M. Yusof & S. Y. Saman, "The Adoption and Implementation of RFID: A survey Literature." in *WKW School of Communication & Information & NTU Libraries*, Nanyang Technological University, 26(1), 2016, pp. 31-52.
- [19] I. Markakis, T. Samaras, A. C. Polycarpou, & J. N. Sahalos, "An RFID-enabled library management system using low-SAR smart bookshelves." in *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, 2013, pp. 227-230. Retrieved from <http://doi.org/10.1109/ICEAA.2013.6632228>
- [20] D. Zhang, & X. Shi, "Self-service management platform design for library based on RFID." in *2nd International Conference on Artificial Intelligence, Management Science and Electronic Commerce*, AIMSEC, 2011, pp. 7237-7240. Retrieved from <http://doi.org/10.1109/AIMSEC.2011.6010604>
- [21] A. Repanovici, & L. Cristea, "RFID technology used in small library—case study at Transilvania University." in *Romanian Review Precision Mechanics, Optics & Mechatronics*, vol.39, 2011, 109-112.
- [22] A. A. K. Jain, & T. R. Krishna, "Dynamic book search using RFID technology." *International Journal of Engineering Research and General Science*, 2(6), 2014, 138-142.
- [23] C. Evans & A. Moore, "Using RFID technology at University of Sussex." *SCONUL Focus*, vol 59, 2013, pp. 13-15. http://www.sconul.ac.uk/sites/default/files/documents/5_12.pdf
- [24] M. S. Abdou, "RFID in the Egyptian libraries: Case study," *Wildauer Bibliotheks-Symposium: RFID and Beyond*, September 2012. Wildauer, Germany: Technical University of Applied Sciences. Retrieved from https://www.thwildau.de/fileadmin/dokumente/bibliothek/dokumente/Rfid_2012_Vortraege/RFIDingypt.pdf. 20/05/2017.
- [25] L. Wan, & K. O. L, "Adoption of RFID technologies in UK logistics: Moderating roles of size, barcode experience and government support." in *Expert Systems With Applications*, 41(1), 2014, pp.230-236. Retrieved from <http://doi.org/10.1016/j.eswa.2013.07.024>
- [26] M. Madhusudhan, "RFID technology implementation in two libraries in New Delhi." in *Electronic Library and Information Systems*, 44(2), 2010, pp.149-157. Retrieved from <http://doi.org/10.1108/00330331011039508>.
- [27] S. Cadoo, "RFID use within libraries: an Australian perspective, 2014." Retrieved from <https://www.yumpu.com/pt/document/view/17437706/rfid-use-within-libraries-anaustralian-perspective-alia-conferences>.
- [28] B. D. Blansit, "RFID terminology and technology: Preparing to evaluate RFID for your library." *Journal of Electronic Resources in Medical Libraries*, vol 7(4), 2010, pp. 344-354. <http://doi.org/10.1080/15424065.2010.527255>.
- [29] E. O. Makori, "Adoption of radio frequency identification technology in university libraries: A Kenyan perspective." in *The Electronic Library*, 31(2), 2013, pp.208-216. Retrieved from <http://doi.org/10.1108/02640471311312384> on 7th March, 2017.
- [30] K. Aydın, E. Ustaahmetoğlu, and S. Yıldırım, "The Theoretical Framework for Usage of RFID Technology in Retail Sector," *ITAM 8 Conference*, June 2012, Yıldız Technical University, Istanbul, Turkey.
- [31] U. Ibrahim, "Techniques for writing and presentation of thesis/dissertation: A Companion Guide for Postgraduate Students in Nigerian University System." Zaria. Ahmadu Bello University Press Limited, 2013.