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1 Review of the Strategic Importance of RFID data Concept for 2 Examination Management Process

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6

7 **Abstract**

8 The main goal of the researcher in this study is to re-examine the RFID data concept from a
9 new point of view. The preponderance studies on RFID data concept have focused on
10 substantial adoption in different sector. In this study, the investigator has tried to shift the
11 focus to not only adoption but to the relevance of adoption in the management of examination
12 and this has led to the understanding and conversation on the topic of an Automatic and
13 Data Capture Technology (AIDCT) like RFID data.

14

15 **Index terms**— strategic importance, examination, management, RFID data concept, process improvement,
16 conceptual review.

17 **1 Introduction**

18 dvocate of process improvement approach are of the view that process improvement tools and techniques can be
19 used to increase effectiveness, efficiency, agility and sustainability of a particular process under a condition of
20 scarce resources (Khosravi, 2016; Zemguliene & Valukonis, 2018; Shafique, Khurshid, Rahman, Khanna & Gupta
21 2019). One possible reason for this submission is that, organizations that implement an end-to-end processes
22 improvement can improve the quality of their products and services thereby achieving a significant cost reduction
23 and make their business process more reliable and efficient (Khosravi, 2016). Hence, the age of information
24 technology such as the use internet, mobile devices and other computing platforms have made it possible for
25 organisations to collect data, store and share this information within and outside the organisations boundary for
26 effective decision making (Wang, Gunasekaran, Ngai & Papadopoulos, 2016).

27 One popular tool or technique of doing such process improvement is the Radio Frequency Identification (RFID).
28 Identification technology such as RFID data enables every item to possess a special symbol that identifies a body
29 of data which can be read far-off place, enabling automatic, "real time identification and tracking of individuals
30 objects" (Mirza & Brohi, 2016). It also has the capacity to provide mechanical devices with the means to
31 recognize items, understand condition, exchange information and where required, get into action, construct "real
32 time awareness" (Akpinar & Kaptain, 2010). RFID data enables the use of radio signals rather than wires in the
33 act of storing data as well as automatic recovery of data (Pala & Inanc, 2009). The most important or essential
34 of RFID data system are grouped into three major parts: 1) device for sending and receiving radio waves known
35 as antenna, 2) RFID reading device that is, RFID reader and, 3) a small piece of cloth, paper, plastic, or other
36 material attached to object as a label or means of identification which is regarded as RFID tag (Akpinar &
37 Kaptain, 2010; Abugabaha, Nizamuddina & Abuqabbeh, 2020).

38 Although, the RFID technology experienced a significant acceptance in the retail outlets (Reyes et al., 2016),
39 transportation (Fu et al., 2015), in footwear and apparel industry to improve the visibility of the several of
40 products (Mohammed & Wang, 2017; Majeed & Rupasinghe, 2017), as well as within the charitable organisations
41 for humanitarian food supply chain and networks (Biswal et al. 2018). But little attention has been given to
42 education industry particularly the examination management process which has been a lingering issue in the
43 developing countries due to low infrastructure, corruptions and mismanagement of the entire process (Ogunji,
44 2011; Kawugana, & Woyopwa, 2017). This predicament resulted in the reduction of quality of education and

45 students' outputs (Kawugana et al., 2017) and integrity of the entire process. Some of the causes of re-occurring
46 cases of examination malpractices in those institutions include things such as lack of proper monitoring of the
47 entire process, student teacher alliance (Dusu et al., 2016), lack of sound moral values and attitude toward
48 education excellence (Kpangban et al. 2008). Thus the question is can RFID data concept be used to address
49 some of the problems?

50 There is general assumption that the implementation of RFID data technology in the student's check-
51 in process can led to enhanced and significant process transformation thereby eliminating problems such as
52 student's impersonation and other malpractices thereby improving the credibility and integration of entire process.
53 However, when technology is first been adopted to deal with a very sensitive issue such as student verification,
54 there are several other vital factors that need to be taken into account that include the cost of acquiring and
55 management of such technology, its operational reliability, ethical and other legal considerations (Raj et al., 2018).
56 Because, the privacy and confidentiality of the candidate are equally important, this study was set to investigate
57 and conceptually establish the relevance of adopting RFID data concept in examination process improvement
58 and suggest some possible limitations of RFID in the higher education sector.

59 2 II.

60 The Concept of RFID Data Technology RFID data technologies are now considered as one of the recent
61 technologies that have been labeled as a major enabling technology for automating and making a process to
62 be contactless and data driven collection. But little is known about it perceived strategic importance of RFID
63 data among stakeholders. The system has three basic components that include a reader, a tag, and back office
64 data-processing capability. In most applications, chips are used to store information about objects, products,
65 or transportation that the company needs to follow. The reader tracks the physical movement of the tag,
66 thereby tracking the physical movement of the object followed. (Zhu et al. 2012). However, recently cloud base
67 technology has been incorporated in the RFID data concept in order to ensure the reliability and analytical
68 capability of object identification and categorization of an object. According to Moselhi and Montaser (2012),
69 "RFID is wireless communication of data through radio waves." Compared with manual recording and routine
70 tracking of items on construction sites, RFID can bring more improvements in terms of Lower costs and enhanced
71 features that meet the needs of the construction industry. These authors, proposes the utilization of RFID data
72 technology that involves RFID fixed reader, RFID encapsulated and labels tag printer in near real time as an
73 automatic technique for tracking earthmoving operations to capture data during construction.

74 Robert (2006) gives an explanation of the concept of Radio frequency identification (RFID) data technology.
75 This study believes that the concept of RFID data technology is similar to the concept of bar code, and bar
76 code technology is considered to be a means to enhance data processing capabilities and is a supplement to
77 existing technology. The study describes RFID as a data transaction system through the RFID tags on top of
78 objects or useful things along with readers to gather the tag information. The study explains tag data as read
79 only memory (ROM), write once or read many memory (WORM), and random access memory (RAM). ROM
80 is used to store security data, the data is a unique device identifier, operating system instructions, data storage
81 (volatile or non-volatile) and electronic product code (EPC), while RAM is used for storing data at some stage
82 in transponder examination and response. The study concluded with the consideration of privacy and security
83 concern of RFID as regards to the increasing use of the technology. This is in line with other scholars' submission
84 ??Shafique, et al. 2018). RFID technology is similar to barcodes because they both use tags and scanners to
85 read tags, and use background software to store data for retrieval and subsequent use.

86 3 III.

87 4 Review of Empirical Studies on RFID Data Concept

88 The effectiveness of an RFID data application in dealing with the most wanted process is reliant on quite a lot
89 of significant factors that incorporate the issue of sourcing power -that is, whether the RFID tag source it power
90 "passively" via an RFID reader or from an inbuilt power source. Even though, due to the cost considerations,
91 nearly all application is passive system in nature. The next factor considers the read range, because most
92 RFIDs are passive in nature. As a result, "restrict the utility of the application to the application where assets,
93 commodities, people or animals must be in close proximity to the reader". The last factor is the storage capacity
94 in such that, the limited amount of storage capacity (read only) normally associated with the lowest cost of tags
95 (Hunt, Puglia & Puglia, 2007).

96 There is substantial evidence in both conceptual, empirical and simulation analysis (Chanchaichujit, et al.
97 2020;Lee, Cheng & Leung, 2004; ??emguliene & Valukonis, 2018) suggesting that RFID data has the potential to
98 automate, enrich and accelerate, automate a particular process. Brock, Allen, and Schuster (2007) conducted a
99 study on the Global RFID: the value of the electronic product code (EPC) global network for supply chain
100 management. The study believes that the most important concept of RFID data involves attaching radio
101 frequency identification tags (RFID tags) to physical objects, allowing information to be exchanged between the
102 object and the reader. The study further found that RFID tags provide the potential for seamless, continuous
103 two-way communication for items to pass through the supply chain-this means that when a tagged object passes
104 through the reader field, two-way communication starts to be used for objects and reading Exchange information

105 between devices. The study concluded that object bearing an RFID tag can be converted into a network with
106 no human involvement or manipulation by computerized device as in case with other identification technologies
107 like barcodes. This has been supported in various studies ??Shafique et Lopes (2010) carried out a study on
108 RFID and the internet of things in freight and handling operations. The study described RFID data as an
109 automatic identification technique, relying on holding data and remotely restoring it by means of devices called
110 RFID tags or transponders which allow the remote identification of items, whereas the Internet of Things are
111 "things with identities and virtual characters that operate in a smart space through smart interfaces to connect
112 and communicate with society, the environment, and the user environment." The study believed that RFID tags
113 can be fixed into a product, animal or person allowing for identifying and tracking them through radio waves,
114 and the reader can read from several meters away without line of sight. The study goes on to identified two parts
115 of RFID tags: the first part involves an incorporated path for holding and processing information, modulating
116 and demodulating radio frequency signal as well as other operations, while the second part contains an antenna
117 for receiving and broadcasting the signal. The study concluded that this technology will have an essential role
118 in the very near future of freight and handling operation through the efficiency improvement of the involved
119 stakeholders during the deterrence of ground handling operation errors tightening to the control of the process
120 (Abugabah et al. 2020). ??odes and Mccarlane (2004) found that RFID data technology relies on radio frequency
121 communication, so that the reader releases energy in the form of radio waves of a specific frequency, and uses this
122 to power the tag and communicate with it. The process described in the study does not require a direct line of
123 sight like bar code technology, because the communication system is supported by radio wave transmission -this
124 means that even if the level of attachment or even the entire item is missing, it is possible to identify the tagged
125 object in the reader's directly in sight. For example, they can be located behind other objects in a covered area
126 or out of sight. The research further demonstrated and clarified that the ability of an RFID system to operate
127 without a line of sight can make "eavesdroppers" very simple and undetected, but the indicator that originate
128 from the tag are extremely not strong, and therefore, an "eavesdropper" would require to be somewhat lock in.
129 Even though, this can be secure through the design of an RFID system, where information that communicated is
130 converted into a code (key), but this will impact the cost of the tags and the performance of the system as well
131 as the range and communication speed. Despite these, the study believed that once the tag gets nearer into the
132 closeness with the RFID reader; the reader will discover the tag's presence and can read its data and can also
133 hold its data, but with little amount of memory capacity. The study concluded that there is a certain distance
134 between the RFID reader and the tag to be able to pick up enough signals to operate reliably. This depends
135 on many factors, including the radio frequency used for communication, the power released by the reader, radio
136 intrusion sources and items in the environment that absorb radio waves.

137 Hakala (2014); Tsao, et al. (2017); Werthmann, et al. (2017) studied the feasibility of RFID technology in the
138 supply chain of ABB's medium-voltage products, and realized that RFID data technology can capture data and
139 then integrate it into a required database (e.g. ABB medium voltage products). The study conceived RFID as
140 a means of communication device that can read while object is moving. And this to the study does not need a
141 direct line of view since the identification is based on radio waves, and is also feasible to read numerous labeled
142 objects simultaneously. The most important idea behind RFID data here as determined by the study is its ability
143 to read and write information in the RFID tag via a radio transmission, and the indicator is released by means
144 of the reader and data exchange occurs as soon as the tag is close enough to the reader. The study went further
145 to discovered a link between RFID tag and antenna as an important area that can effects on reading range
146 and durability especially on ultra-high frequency (UHF) antennas due to their shorter wavelength. The study
147 concluded that the RFID-based identification system makes it possible to achieve moderate inventory, faster and
148 more accurate tracking of goods, reduce operating costs, more effective warehouse management, and improve the
149 traceability of work-in-process (product and inventory) and more understanding of supply chain activities.

150 Aggarwal and Han (2013) are engaged in the investigation of RFID data processing. This research inspired
151 the definition of RFID technology, in which they described a technology that enables sensors (readers) to be read
152 remotely without line of sight, while at the same time associating a unique product identification code (EPC)
153 with the tag. Research has found that this tag can be used to track the movement and location of a large number
154 of items in a low-cost manner, which is useful in inventory and logistics management. The research further
155 identified two types of data contained in RFID data processing: 1) static data and 2) dynamic data. They treat
156 static data as data related to profitable objects, such as location information, product level information, and
157 sequence information. The dynamic data is divided into two types: the first type communicates with occurrence
158 data, such as serial numbers and production dates, and the second type communicates with time data, such as
159 location observations and time changes in object accommodation. Similarly, the second type of temporal data
160 is recorded through EPC tag readings and is related to the movement of the product. These processes together
161 influence RFID technology to identify objects.

162 Guinard et al. (??011) conducted a study on cloud computing, representational state transfer (REST) and
163 Mashups to simplify RFID application development and deployment. This article first observes the application
164 of the Electronic Product Code (EPC) network, which is the RFID standard framework, which aims to enable
165 "interoperability" and application development, as well as the process of communication between tags and readers,
166 reader configuration, monitoring, translation of tag identifiers, filtering and aggregation of RFID data, and
167 continuous storage of application events. The paper also pointed out how the successful use of blueprints on

4 REVIEW OF EMPIRICAL STUDIES ON RFID DATA CONCEPT

168 the web can help make the adoption of EPC less difficult. ??inally show that the implementation of RFID can
169 bring huge benefits and impetus to customers and enterprises. The "2 C" classification of profit-driven factors is
170 novel and should provide practitioners with more motivation to utilize RFID. In addition, the link between the
171 benefits of RFID-driving force and competitive advantage is also conceptually established. Finally, it focuses on
172 some future research approaches, so it can be used as a starting point for current and other academic research.

173 In the same vein, Derakshan et al. (??007) did an examination on RFID data management: challenges and
174 opportunities. The authors begins with the concise synopsis of RFID technology where they found numerous
175 techniques of identification, but for the most part is to store a serial number that identifies a person or item,
176 and possibly other information on a microchip that is affixed to an antenna, and the antenna allows the chip to
177 broadcast the detection information to the reader, and the reader translates the broadcasting signals reproduced
178 back from the RFID tag into digital information so as to be able to transfer on to computers with the aim
179 of making use of it. The authors started with a concise introduction of RFID technology. They found many
180 identification technologies, but in most cases it is to store a serial number that identifies a person or object
181 and possibly other information on a microchip attached to the antenna. The antenna allows the chip to detect
182 information to the reader, and the reader converts the broadcast signal reproduced from the RFID tag into
183 digital information so that it can be transmitted to the computer. The authors believed that the chip and
184 antenna together are called RFID tag or transponder. The author continues to summarize some of the challenges
185 related to the various layers of the RFID data management recommendation system architecture, and proposes
186 to overcome these problems. These layers include: capture layer, process layer and enterprise applications.

187 Although some studies believe that in the early stages of the entire system, they often travel in large numbers
188 in groups ??Gonzalez et al. 2009), but they also believe that these observations will bring to the traditional
189 relational and data warehouse technology. This method may include restoring and reasoning a large number of
190 "interrelated tuples" through various levels of item movement. The study concluded that techniques should be
191 develop for reviewing and cataloging data as well as methods for processing a range of queries ??Gonzalez, et
192 al., 2009).

193 In the field of education, Shahid (2005) conducted a study to explore the use of RFID technology in libraries:
194 a new method for library material circulation, tracking, inventory and security. The research first regards RFID
195 data technology as a combination of radio frequency technology and microchip technology. The study went on
196 to consider RFID tag, reader or sensor, antenna and a computer system as the components of RFID system.
197 According to the study, tag is the heart of RFID system which is an automatically programmed with unique
198 information and can be attached to an objects in library like books, or compact discs (CDs) plates or videos
199 allowing for identification of the objects. While the reader or sensor is used to query the tag passing the reader
200 field or area, the information stored in the tag will be read by the reader and sent to the computer system, and the
201 computer system will then communicate with the integrated library system and the antenna is the communication
202 method between the tag and the reader.

203 Even so, the research observes the readers in the RFID library in the following ways: 1) Switching stations,
204 writing library data into tags. 2) Recycled employee workstations are used for loading and unloading library
205 materials. 3) There is a self-service sign-in desk, and library materials can be checked out without human
206 intervention. 4) There is a self-service check-in desk, which allows you to check in library materials without
207 personnel support. 5) The exit sensor is used to confirm that all materials leaving the warehouse have been
208 checked out. 6) Book reader, used to automatically release library materials and reactivate security. 7) Sorters
209 and conveyors are suitable for automated systems that return materials to appropriate areas of the library. 8)
210 The handheld reader can be used to take inventory and verify whether it has Volume XXII Issue VI Version
211 I 54 () been properly shelved. The study concluded that the use of RFID in the library can tackle both the
212 security and materials tracking needs of the library as well as to speeds up borrowing and inventories in addition
213 to requiring no staff to perform more user-service jobs. Similarly, Mishra and Mishra (2010), concluded that
214 application of RFID in baggage handling will ensure effective management of baggage tracking or delivery and
215 providing the airport or airline security and premium customer services (Li et al. 2017).

216 Similarly, Yu and Wang (2011) studied product quality inspection that combines structured lighting systems,
217 data mining and RFID technology. The research uses RFID data and quality inspection systems for production
218 tracking and tracing. The research believes that RFID data is a technology that uses a radio signal system to
219 identify objects and transmit data from tags attached to movable objects to readers. This technology is fast,
220 reliable, and does not need a line of sight or contact between reader or scanner and the tagged objects. The
221 research continues to believe that transmitting RFID tags to each inspected component can identify the product
222 type and write the quality inspection results determined by the data mining classifier for real-time quality query.
223 Research has concluded that these processes can improve the traceability of product quality.

224 As can be seen, RFID data has observed substantial adoption in the different sectors (Mohammed & Wang,
225 2017; Mejjaouli & Babiceanu, 2018). For instance, RFID enables end to end supply chain management through
226 traceability of particular items sourced from different destination ??Tsao et al., 2017). Other scholars are of
227 the view that, without RFID technology tracking a particular object; it becomes difficult to swiftly locate the
228 source of particular items for information for accurate decision making (Chanchaichujit, et al. 2020). Apart
229 from medicine and foods processing sector, RFID also witnessed a rising acceptance in industries/sectors such as
230 footwear and apparel (Majeed & Rupasinghe, 2017)

231 5 IV. Theoretical Relevance of RFID Data Concept

232 The theoretical foundations of the current study is based on Resource-based View (RBV) Theory of the firm
233 competitiveness which suggested that organisations that possess resources and capabilities that are valuable rare,
234 imitable and no substitutable can be used to enhance performance (Barney, 1991).

235 6 H

236 Therefore, Since RFID data technology represents the resources and capabilities of an organization that are meant
237 for process improvement (Shafique, at al. 2019). Hence, RBV theory is suitable for the conceptual assessment
238 of the relevance of RFID data technology on examination management process. That is, RBV theory higher
239 education institutions in Nigeria can used RFID data technology to improve the efficiency of student's check
240 in during examination processes. This is in turn, address the issues of impersonation and other examination
241 malpractices.

242 If tertiary institutions desire to transformation some of the examination process such as student's check in
243 process, diffusion of innovations theory (DIT) can be used to complement the assumptions of RBV theory. DIT
244 is based on five identified attributes of innovations that are said to influencing their adoption and utilization
245 of a particular technological solution to address business problem ??Roggers, 1995). These features include
246 compatibility, relative advantage, complexity, observability and trialability of IT solution ??Roggers, 1995). So
247 the strategic importance of RFID data in management some part of examination process is explains by these
248 theories.

249 V.

250 7 Discussions of Findings

251 Analysis from the literature review shows that RFID data is an effective technology that can be used to identify
252 objects and allow information to be exchanged between the identified objects and the reader that reads the
253 objects. The effectiveness and usefulness of RFID data was shown in some literature from which significant
254 thought emerged. In a review by (Lopes, 2010), two areas of RFID tag have been identified that appraised RFID
255 data, the first area involves an integrated path for holding and processing data, modulating and demodulating
256 radio frequency signal as well as other operations. The second area contains an antenna for receiving and
257 broadcasting the signal. This implies that the effectiveness of RFID data depends on RFID tag and reader since
258 the tag result is very appropriate if connected with the reader in identifying object.

259 In addition, even if there is a certain distance between the RFID reader and the tag, it can allow adequate and
260 reliable signal distribution. This depends on many factors, including the radio frequency used for communication,
261 the power released by the reader, the source of radio intrusion, and items in the environment that may reflect or
262 absorb radio waves. Nevertheless, the most important idea behind the appraisal of RFID data concept as noted
263 in the research work of (Hakala, 2014) is its ability to read and write information in the RFID tag via radio
264 transmission, and the indicator is released by means of the reader and data exchange which occurs as soon as the
265 tag is closer to the reader. This is therefore important in designing, implementing and evaluating examination
266 processes. In addition to these challenges, there were also discoveries on the challenges of analyzing massive RFID
267 data sets. Gonzalez et al. (??009) identified these challenges based on two observations: The first observation
268 is that objects often move collectively in large collections in the early stages of the system (for example, in the
269 distribution center), and only in later stages (for example, stores), they move in smaller groups. The second
270 observation is that, though RFID data is recorded at the initial stage where data analysis typically takes place
271 at a higher generalization point. However, the research work of (Bai et al., 2006) recommended further research
272 to develop various effective techniques for filtering RFID data as well as noise removal and duplicate elimination
273 in order to achieve the goal of RFID data appraisal in identifying, locating, tracking and monitoring physical
274 objects with no line of sight.

275 8 VI.

276 9 Conclusion

277 The study has provided a background for understanding and appraising RFID data concept from a strategic point
278 of views. The analysis has considered the different thoughts of authors that appraised RFID data concept within
279 the context of substantial adoption in different sector. Findings of the analysis revealed a better understanding
280 and conversation on the topic of an Automatic Identification and Data Capture Technology (AIDCT) like RFID
281 data is an effective and useful technology in identifying objects. Even though, some of the findings were concerned
282 with the challenges of RFID data in the areas that include for example, privacy and security concern as regards
283 to the increasing use of the technology. It also involves filtering RFID data and eliminating noise and repetitive
284 elimination to achieve the goal of the technology's effectiveness and practicality in identifying, locating, tracking,
285 and monitoring physical objects without line of sight. This paper believes to have extends knowledge and ideas
286 on the effectiveness and usefulness of RFID data which can lead to process accuracy and integrity of the adopting
287 organisation.

9 CONCLUSION

288 In the future, the researcher will look at how other AIDCTs like biometric, cloud base and analytical computing
289 can be used to address these issues and to examine the relevance for adoption in the management of higher
290 education examination. This can thus be useful to organizations in making an appropriate decision on whether
291 to utilize or apply to a particular situation. For instance, the object driven elements of RFID concept focused on
292 the ways on which traceability of an objects through RFID technology adhere to meeting process requirement,
293 while the strategic driven adoption of RFID data concept focused on how object identification and traceability
can lead to process accuracy and integrity of the adopting organisation.^{1 2 3}

294 Figure 1:

¹⁽⁾

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³Review of the Strategic Importance of RFID Data Concept for Examination Management Process

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9 CONCLUSION

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