Barriers to Rfid Adoption in Material Management Of Construction Industry: The Perception of Project Manager

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Abstract

Technology has become more sophisticated to deliver comfort in daily life. A merging with enormous and gigantic building projects could create a greater output. In this paper, the Radio Frequency Identification (RFID) implementation will show in a few aspects improvisation for materials management in a construction project. However, in Malaysia construction industry, the implementation of RFID is seen as shallow and stagnant. The benefits of implementing RFID technology in material management have been discussed since the construction players in Malaysia are still mostly unaware of its potential. As a project manager in construction projects, it is vital to evaluate their understanding, as they are the top-level management on the construction project. A holistic questionnaire were used as the tool for gathering the interpretation from construction industry project managers. The findings show that for the construction project, most project managers are aware of the RFID technology but have very less understanding of assimilation into material management. It also revealed that most construction companies were hesitant to use this technology because of high costs and fewer experts to manage the technology.

Keywords

Radio Frequency Identification (RFID), materials management, current progress, future demand, Malaysia

Introduction

Radio Frequency Identification (RFID) is a wireless communication technology that enables the device to gather information from the tags remotely without any labour-intensive support (Jia, Feng, Fan, & Lei, 2012). It has grown in various sectors from the obscurity to the mainstream. In Malaysia, the term RFID associated with toll collection is always heard. According to Ishtiaq, Sajid, & Wagan, (2019), RFID implementation is expected to smooth the traffic flow as drivers do not need to queue up in a long line to tap on the 'touch n go' reader. In short, RFID has brought the user multiple benefits.

Figure 1 shows how RFID uses of various radio wave frequencies to identify objects. A typical RFID system consists of two main components that are the transponder and a reader or interrogator (Hawrylak, Mickle, & Cain, 2019). A tag will either be attached to the object being tracked, or an object carrying information. A reader emits an electromagnetic signal to receive information from the tagged objects by processing radio communication through the antenna. The medium for the contact between tag and reader is an antenna.
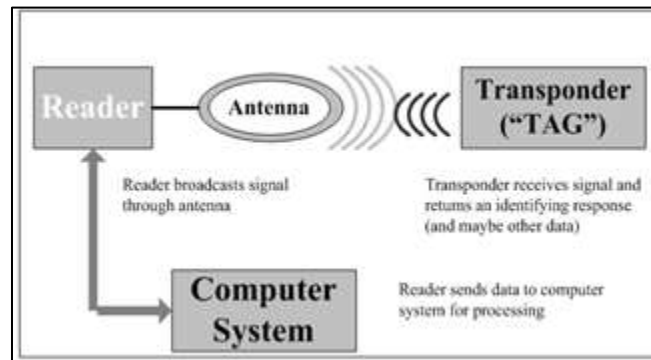

Figure 1. The simple mechanism of RFID Technology

RFID start by the invention from Sir Harry Stockman in 1940s where later been used in World War II (WWII) to distinguish friendly and foe aircraft. In the 1950s, D.B. Harris patents the RFID in radio transmission with a modularly passive responder. RFID Technology started its journey into commercialization area when first implant-able RFID tags used in dairy cows in Europe during the 1970s. Since early 2000, RFID had been widely used in supply chain management associated with food stores and supply (Hawrylak et al., 2019; Roberti, 2005).

In the construction industry, RFID is typically used to meet the growing demands for speed and efficiency in material management, as construction projects are now becoming more complex and unique, requiring more detailed administration. There are some more innovations of the implemented applications, such as 3D location of buried objects, automatic monitoring of pipe spools and other valued items, as well as the on-site inspection support system. The RFID technology may also boost the efficiency and management of the construction (Hinkka & Tätilä 2013; Lu, Huang, & Li, 2011; Wang, 2008)

According to CIDB Malaysia, a research conducted in 2012 concluded that construction materials accounted for about 74% on average of the overall construction value or cost of construction works only with a 15% overhead assumption and profit from the cost of the goods sold and labours (Lu et al., 2011). Material management is crucial as a result, as materials contribute to the main building expenses. Material management is a program implemented to ensure that the appropriate quality and quantity of materials are identified correctly on time and obtained at a reasonable cost, and are most importantly accessible at the point of use when necessary by materials planning and control. If the materials could not be delivered in the right quality, the right quantity and the right time, productivity could be reduced, as well as additional expenses could be incurred due to the materials unavailable at that time (Gulghane, & Khandve 2015; Iqbal et al., 2015)

Studies conducted saying project profitability would be affected because of the improper handling of materials on the building site (Gulghane, & Khandve 2015; Le, 2020). Researchers are thus exploring the use of RFID in materials management to overcome the issue of materials handling inefficiencies (Lee et al. 2013; Majrouhi Sardroud, 2012; Wang, 2008). The implementation of RFID into materials management is imminent to ensure the materials are well-controlled and organized, delivered in the right quality, the right quantity on time. How does technology benefit materials management in the construction industry in Malaysia, to be at the bottom of something?

This research study aim at analyzing the current state of RFID implementation in material management. The research objectives are to identify the benefits of RFID for better building materials management and investigate the demand for RFID technology among construction players.

Methodology

The data collection construct measures are based on the existing literature and are revised to fit the context of the RFID. A questionnaire survey used to gather data from CIDB Malaysia list of registered project managers. A total of 180 questionnaires have been distributed, and 82 valid answers have been received, reaching a response rate of 45%. Demographic characteristics of the respondents are set out in Table 1. We conducted three pilot interview studies before the survey to check if our questionnaires present any content validity problems. The data was collected through online surveys as well as offline paper surveys to access the traditional method bias.

Table 1. Demographic characteristic of respondents

Respondent Characteristic	N	%
Gender	64	78
Male	18	22
Female		
Years of experience		
< 5 years	49	59.7
5 years - 10 years	26	31.7
10 years - 15 years	4	4.8
> 15 years	4	4.8
Type of project		
Residential Project	22	26.7
Mixed Commercial Project	38	46.7
Infrastructure Project	22	26.7

Measurement items were developed based on a comprehensive review of the literature and expert opinions and revised according to the RFID context. Seven-point Likert-like scales ranging from (1) "strongly disagree" to (7) ''strongly agree'' are used for all items.

There are two types of statistics which are descriptive statistics and inferential statistics which would be obtained through a survey questionnaire. Descriptive statistics are used to promote the visualization of the respondent's raw data obtained. For a better understanding, a more straightforward interpretation of the data may be presented to the reader. Mean, median, mode, per cent, frequency and range, for example. Conversely, inferential statistics are used to generalize the collected sample size representing the population. To generalize the findings and make predictions it analyzes the relationship between multiple variables. For example, the correlation, the regression and the variance analysis.
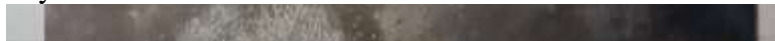
Results and Discussion

Majority of project managers (85.7%) knows about the RFID technology; however, very less of them (33.3%) aware of the accessibility of RFID in construction material management. Comparatively, most of the project managers (61.1%) always thought of RFID technology as tolls management. It is due to the commercialization of RFID usage as one of the tool in tolls management in Malaysia.
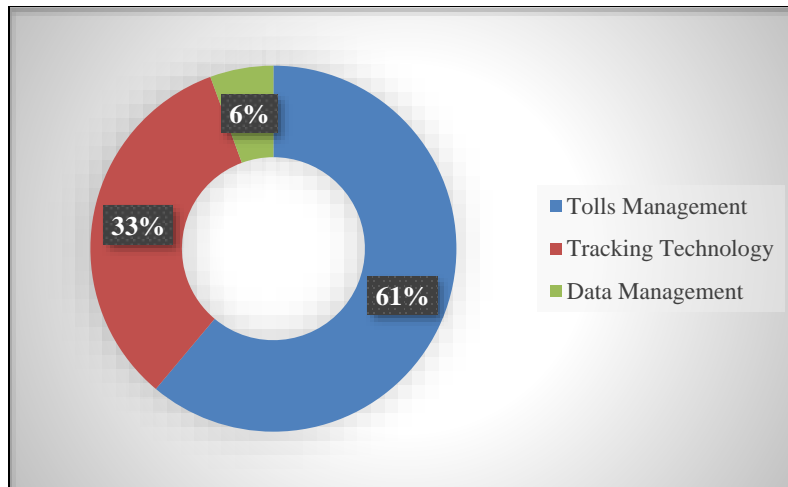

Figure 2. Knowledge of Project Managers on RFID implementation

The advantages recognized by the project managers are shown in Figure 3. It shows that RFID capable of eliminating delays and error as the first advantage with 28.7%, followed by increase productivity with 20.5%, provide automation with 16.7%, real-time tracking with 16%, increase security with 13.6% and last one data collection with 4.5%

The top barriers against RFID assimilation in construction material management recognized by the project managers as it involves a higher cost into application and implementation with 27% and very less expertise into managing and maintenance with 25.6%. Figure 4 identified the balance of the barriers from the views of project managers which are compatibility issues of a system with 18.2%, lack of common industry standard with 15.8% and lack of awareness with 13.4%.
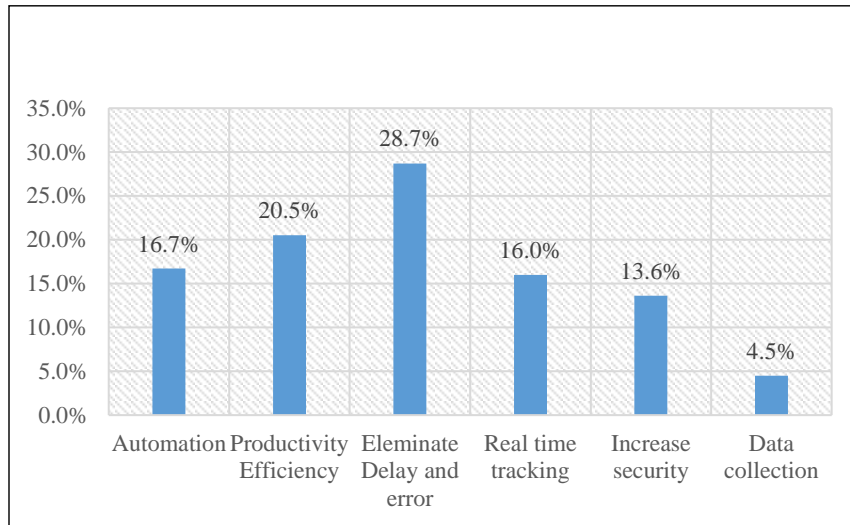
Figure 3. Identified benefits of RFID implementation in construction material management
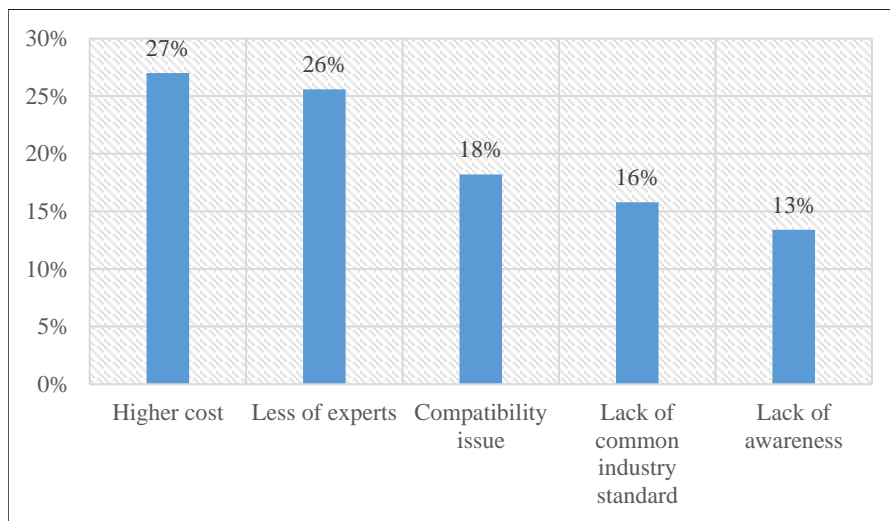

Figure 4. Identified barriers against RFID assimilation into construction material management

The RFID system was found to have many benefits to the material management in the construction industry that are using it, and also potential benefits to companies that are planning to use it in future. The result shows that the majority of project managers aware of existence RFID technology, however very less know the RFID benefits into construction material management. Finally, the study concludes that RFID application in construction material management has so many benefits but having a cost and experts as a barrier makes the assimilation of RFID technology in construction material management as stagnant and not widely accepted.

Conclusion

This paper discussed the current issues surrounding RFID as an emerging technology for material management in the construction industry. Primary themes discussed included the benefits and the barriers to RFID adoption, lack of awareness and RFID as an immature technology with very less expert to handle. As each barrier and knowledge were examined through the perception of project managers, it turns out that most of the project manager did not seem aware of having the proper knowledge to handle the RFID as material management in the construction project. The investment needed by the construction company, also seen as one of the most significant barriers to the implementation of RFID. It is advisable that maybe the agency bodies such as CIDB can get a hand into this matter by providing a workshop to the project managers to use this RFIS technology. It is also suggested that the Government probably can provide a grant to increase the implementation of RFID in material management in the construction industry.

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