

THE EFFECTING FACTORS OF RADIO FREQUENCY IDENTIFICATION DEVICE  
(RFID) ADOPTION IN SUPPLY CHAIN MANAGEMENT

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MAY 2019

## DECLARATION

I/We hereby declared that I/We had read through this thesis and in my/our opinion that this thesis is adequate in terms of scope and quality which fulfill the requirements for the award of Bachelor Degree in Technology Management (Technology Innovation).

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## DEDICATION

Thank you wholeheartedly to:

My irreplaceable parents,

Lovely siblings,

Fellow friends,

And my supervisor; Dr Nusaibah binti Mansor

For all moral, spiritual support and knowledge sharing that has been given to me all these times.

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## ABSTRACT

The effecting factors is most important thing when an organization would like to adopt an innovation. RFID technology is a wiser method of monitoring shipments, deliveries of time and inventories, making processes quicker, more productive and with less inaccuracy. It goes far beyond those systems, as it covers more data than previous technologies. Technology delivers companies with techniques in becoming faster and more systematic from the industrial partner to the end consumer in all zone of the supply chain. The purposed of this research is to identify the effecting factors of Radio Frequency Identification Device (RFID) adoption in Supply Chain Management (SCM). This researched was including; review of the literature on RFID and supply chain technology, meaning of SCM and radio frequency technology plus chronicle, and methodology in obtained the information. Researcher believed that this empirical study would benefit to the industry practitioner and academic researchers to be served as future reference. This research was complete by using quantitative method and analyzed data by using SPSS version 23. To measure the relationship between independent variable (Ubiquity, Job Relevance, Performing Gaps, Benefit, Cost Saving, Financial Resource, Technology Knowledge, and Technology Improvement Concern) and dependent variable (RFID Adoption). In this study, researcher recommend adding Compatibility variable for further research to be analyze more detail in future. Thus, researcher found that cost and lack of standards is the challenges of RFID adoption. Next, by using Pearson Correlation Analysis researcher have achieved the objective to find out the relationship of independent variable and dependent variable which is all the variables have relationship with RFID adoption. Lastly, the most driven factor the adoption of RFID is Technology Knowledge variable.

***Keywords:*** Adoption, RFID, Supply Chain, Effecting Factor, Industry

## ABSTRAK

*Faktor-faktor yang mempengaruhi adalah perkara yang paling penting apabila organisasi ingin mengadopsi teknologi. Teknologi RFID adalah cara yang lebih berteknologi untuk memantau penghantaran, penghantaran masa dan inventori, membuat proses lebih cepat, lebih cekap dan kurang ketidaktepatan. Ia jauh melebihi sistem tersebut, kerana ia meliputi lebih banyak data daripada teknologi sebelumnya. Teknologi ini memberikan syarikat-syarikat dengan cara-cara untuk menjadi lebih cepat dan lebih cekap daripada rakan industri hingga pengguna akhir dalam semua bidang rantaian bekalan. Tujuan penyelidikan ini adalah untuk mengenal pasti faktor-faktor yang mempengaruhi penggunaan Rangkaian Pengenalan Frekuensi Radio (RFID) dalam Pengurusan Rantaian Bekalan (SCM). Penyelidikan ini termasuk; kajian literatur mengenai RFID dan teknologi rantaian bekalan, definisi pengurusan rantaian bekalan dan teknologi frekuensi radio serta sejarah, dan metodologi dalam mendapatkan maklumat. Penyelidik percaya kertas penyelidikan ini memberi manfaat kepada pengamal industri dan ahli akademik untuk dijadikan rujukan masa depan. Kajian ini diselesaikan dengan menggunakan kaedah kuantitatif dan menganalisis data menggunakan SPSS versi 23. Untuk mengukur hubungan antara pembolehubah bebas (Ubiquity, Relevan Pekerjaan, Jurang Menjalankan, Manfaat, Penjimatan Kos, Sumber Kewangan, Pengetahuan Teknologi, dan Peningkatan Teknologi) dan pemboleh ubah bergantung (Penggunaan RFID). Dalam kajian ini, penyelidik mengesyorkan untuk menambahkan pembolehubah Kesesuaian untuk penyelidikan selanjutnya untuk menganalisis lebih terperinci pada masa akan datang. Oleh itu, penyelidik mendapati bahawa kos dan kekurangan piawai adalah cabaran penggunaan RFID. Seterusnya, dengan menggunakan penyelidik Analisis Korelasi Pearson telah mencapai matlamat untuk mengetahui hubungan pembolehubah bebas dan pembolehubah bergantung yang semua pembolehubah mempunyai hubungan dengan penggunaan RFID. Akhir sekali, faktor yang paling didorong penggunaan RFID adalah Pembolehubah Pengetahuan Teknologi.*

**Kata Kunci:** *Adopsi, RFID, Rantaian Bekalan, Faktor Penyebab, Industri*

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## LIST OF ABBREVIATION

|             |   |   |
|-------------|---|---|
| <b>RFID</b> | = | <b>Radio Frequency Identification</b>             |
| <b>SCM</b>  | = | <b>Supply Chain Management</b>                    |
| <b>SPSS</b> | = | <b>Statistical Package for Social Science</b>     |
| <b>SCT</b>  | = | <b>Supply Chain Technology</b>                    |
| <b>CAD</b>  | = | <b>Computer Aided Drafting</b>                    |
| <b>DFM</b>  | = | <b>Demand Forecasting Management</b>              |
| <b>%</b>    | = | <b>Percentage</b>                                 |
| <b>UPC</b>  | = | <b>Universal Product Code</b>                     |
| <b>PET</b>  | = | <b>Passive Electronic Support Measure Tracker</b> |
| <b>IT</b>   | = | <b>Information Technology</b>                     |
| <b>ISO</b>  | = | <b>International Standard Organization</b>        |
| <b>EPC</b>  | = | <b>Electronic Product Code</b>                    |
| <b>EAN</b>  | = | <b>European Article Number</b>                    |
| <b>EFA</b>  | = | <b>Exploratory Factor Analysis</b>                |
| <b>UB</b>   | = | <b>Ubiquity</b>                                   |
| <b>JR</b>   | = | <b>Job Relevance</b>                              |
| <b>PG</b>   | = | <b>Performance Gap</b>                            |
| <b>B</b>    | = | <b>Benefit</b>                                    |
| <b>CS</b>   | = | <b>Cost Saving</b>                                |
| <b>FR</b>   | = | <b>Financial Resource</b>                         |
| <b>TK</b>   | = | <b>Technology Knowledge</b>                       |
| <b>TIC</b>  | = | <b>Technology Improvement Concern</b>             |
| <b>A</b>    | = | <b>RFID Adoption</b>                              |

## CHAPTER 1

### INTRODUCTION

#### 1.0 Background of Study

Radio Frequency Identification Device or known as RFID is an automated information encoded in RFID labels or key names is recorded by a reader using radio waves. Historically, RFID has had a slow-moving development than anticipated, however the esteem added advantage are starting to vanquish the difficulties. In the 1980s, RFID practices were launched and used in many contexts, including animal tracking, modern use, installment on toll roads, stock tracking, identification acknowledgement, national/state ID cards, support following, etcetera (Nash, 2010). The innovation is support organizations to diminish squander, robbery, stock expenses, and giving a more precise stock check. RFID were implemented worldwide across different industries such as; resource the board, report following, process robotization, item verification, constant area following, stock administration, burglary avoidance, holder the executives, plant the board, information insurance, process and stock control, distribution center administration, patients and guests following, and supply chain management.

In Malaysia context, currently RFID projects were implemented in Malaysian supply chain sector, toll payment system, especially retail chains, are generally little are still in a

pilot testing stage, particularly when contrasted with created nations (Paydar & Endut, 2013). Study done by Mah, (2008), project called Malaysia Microchip were selected has chosen smallest RFID in the world which is sized 0.7 mm X 0.7 mm. The incentive is given by government to encourage more company to adopt RFID technology for manufacturing company. The incentive given to allure qualified organizations to undertake coordinate coordination benefits, that cover the whole inventory network, which incorporates the acquirement of programming and equipment; warehousing; dispersion (transportation and cargo administrations); bundling exercises and Customs leeway.

Supply chain technology (SCT) can improve and enhance business forms processes of an organization. According to Kamaruddin & Udin, (2009) out of 15 supply chain technology (SCT) listed, computer aided drafting (CAD) is the most common SCT embraced by over 100% of the organizations in Malaysia. This is trailed by bar-coding innovation received by 94.5% of the associations. 90.4% of respondents reported adoption of demand forecasting management (DFM) in their operations (Kamaruddin & Udin, 2009). From the outcomes acquired, CAD innovation is most much of the time received by the respondents and is the main innovation in the total informational collection with 100 percent reactions by associations answered to have embraced it. According to (Kamaruddin & Udin, 2009) From the outcomes acquired, CAD innovation is most much of the time received by the respondents and is the main innovation in the total informational collection with 100% reactions by associations answered to have embraced it.

In this manner, CAD frameworks would be more relevant to suppliers as they manufacture automotive equipment or machines for automotive manufacturers. Furthermore, CAD is one of the developed advances and it is less expensive than different advances (Patterson, et al., 2003). CAD is intangible technology or called software of using computers for the creation or modification of design while RFID is tangible innovation in which objects can be recognized using a RFID tag which transmit radio frequency between beneficiary and transmitter helping in data exchange. Even though CAD is the most adopted technology is supply chain Malaysia, RFID shown more

attractive to researcher to study because this technology is fully automated and does not need human intervention.

### **1.1 Problem Statement**

The supply chain management should be concern with handling, storage, transportation, assemblage, maintenance and mailing or delivery to the end user. Despite the potential development of assembling industry, Malaysian business players have identified various problems that occurs as a result of the split improvement of inventory network practice. The issues, among others such as inefficient manual integrated system is the most common errors found when using manual integrated system that will lead to inefficient is inaccurate data, model error, and error in use of functions. Most relevant is the cooperation and communication between supply chain members which contributes to a rather proactive approach. Due to no single established sources of supply chain data and information will affect long holding up time or conveyance time of extra parts bringing about genuine deferral of the hardware fix. Besides, lack of skilled and trained manpower will lead to inefficiency. The industry cannot evolve without an abundant pool of trained workers, and it can be not upgrade. The low level of workers' education is directly related with the low level of productivity.

The most interesting advantage was the improvement of efficiency towards the company, including such decreased inventories and lower production costs. RFID makes for more accurate and efficient stock taking and improved availability of product as leading to IR 4.0 Industry. Adoption of RFID with many intermediary steps, supply chain components, intelligent and efficient movement across all these different steps in a holistic way, adding the autonomy aspect. The main role of RFID technology in the supply chain is to automatically scan. RFID in supply chain will improve in increasing the speed and accuracy of product flow from point of manufacture to in-store stock replenishment by giving some benefits. Those advantage that will be receive such as improved product availability by faster responses to inventory problems, faster stock delivery and less out-of-stock instances, increased customer satisfaction by optimal stock delivery at the stores,



reduced costs and time barriers, enhanced operational efficiency and quicker management of the supplier, and better customer/supplier relations.

Thus, the purpose of this research is to recognize some of the driving factors behind RFID adoption among manufacturer in North Malaysia. Based on the problem statement that have stated above, the importance of this research is to create realization of importance in adopting RFID to the organization. Previous research has been done in other sector, while this research was focused on adoption of RFID in supply chain management in manufacturing sector. Because of the ever-changing dynamics of today's global market, it is essential to analyze future trends that may influence business. Supply chain are an important component of all business planning and must therefore be constantly supervised. Yee's paper addressed the issues of changes in customer desires requiring product customization, how sharing of information under such circumstances can help improve supply chain performance.

### **1.2 Research Question**

- What are the challenges of RFID adoption in supply chain?
- What are the factors that lead to the adoption of RFID in supply chain?
- Which is the most factor driven the adoption of RFID in supply chain sector?

### **1.3 Research Objective**

- To identify the challenges of RFID adoption in supply chain.
- To analyze the factor affecting the adoption of RFID in supply chain.
- To investigate the most influencing factors affecting the adoption of RFID in supply chain.

## 1.4 Scope of Study

The Effecting Factors of Radio Frequency Identification (RFID) Adoption research was mainly designed for supply chain management for manufacturing industries around industrial area in Kulim Hi-Tech Park, Kedah and Prai Industrial Estate, Pulau Pinang. In this study, researcher focused on supervisor, executive, assistant manager or manager involved in supply chain management in carried out the email questionnaires survey or online questionnaires in order to issue a broader scope for this research.

## 1.5 Limitations

During doing this research, there have some limitations that been had by the researcher such as constraint of geography, time and honesty of respondent. This research was conducted in Kulim Hi-Tech Park, Kedah and Prai Industrial Estate, Pulau Pinang. The time limitation is one of the factors that the researcher faces. In completing this research, the researcher has six months (24 weeks). Therefore, the duration of this research was inadequate in provided the researcher with more appropriate information and reach a wider variety of respondents. Due to given insufficient time to complete data collection, researcher was only focused to do data collection in focused area that represent manufacturing industries in Malaysia.

Next, answer of questionnaire may be influence by honesty of respondent. Owing to social desirability, respondent may lie. Most people want to portray themselves with a positive image, so that could lie or bend the reality to look better, .e.g. students would overestimate the length of the revision (McLeod, 2014 ). Court & Abbas, (2015) stated that it would involve cultural reflexivity interviewees reflecting on the nature of the interviewer-to-intended participant relationship and how different and similar customs of culture can affect interviewer interactions.

## **1.6 Summary**

This chapter briefly explains about the contextual of study, it points out research questions and goals. In addition, this chapter also explains the scope of the study and the researcher's constraint in conducting the research. The following chapter describes the market orientation literature review in detail. Conceptual framework will also be proposed in second chapter.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction of Literature Review**

This chapter will come up with a review of previous research connected to this study. Previous research on the adoption of RFID in the healthcare industries, warehousing, aviation, and manufacturing industries has been covered to facilitate and fasten every process. Literature review played a vital role as the early phase in the development of this research. It comprises a basic examination and mix of data from different sources, as well as a thought of any holes in writing and conceivable results for future research.

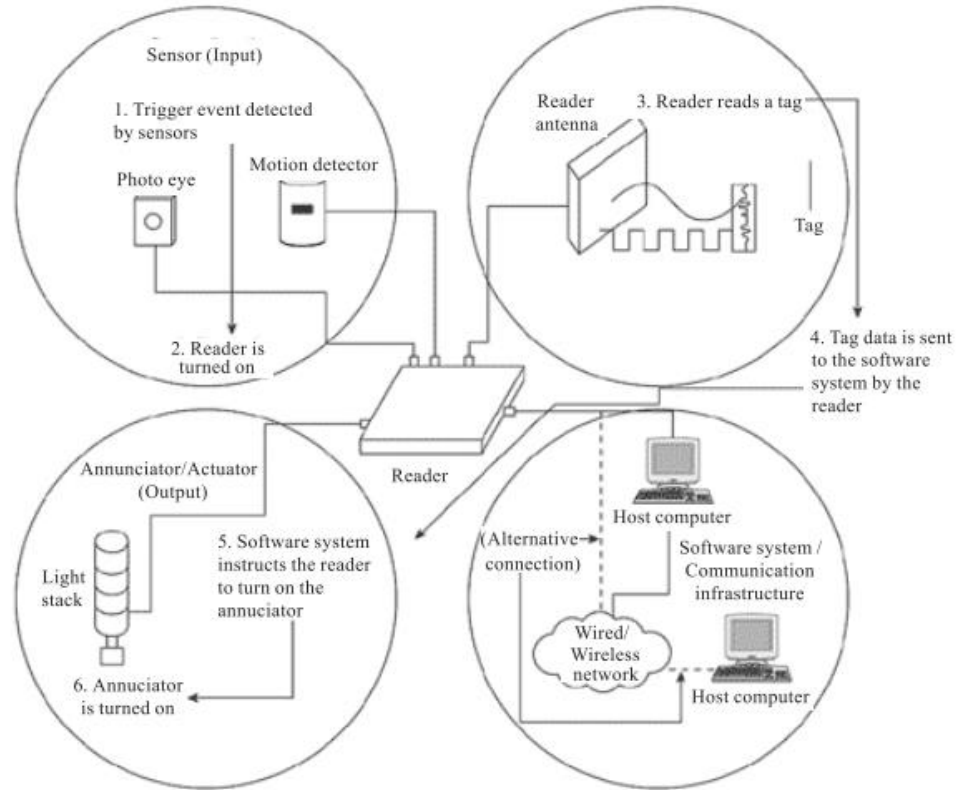
#### **2.1 Radio Frequency Identification Devices (RFID)**

Radio Frequency Identification Devices (RFID) are equipment that identify waves and small device tags that contain an antenna and a small chip. It allows a sensor to read and capture many items at once with a unique tag attached to a product without a line of sight (Anon., 2018). Radio Frequency Identification Devices is innovation that can be functional to supply chain management as a means of improving operating efficiency and

competitive advantage over their rivals. According to Meghdadi & Azar, (2016) is an automatic object identification technology, the tags are attached to an electronic device or a single product, its provide item data at the same time as the transfer request, for example, highlights of items et cetera. RFID labels are connected to provisions and items; checking gadgets, or per users, are then used to recognize data, including the substance, area, date fabricated, arrange number, handful number, dosage and shipping information using an integrated system. The data obtained with the scanning device is transferred to a computer o central workstation via an interface for examination (Coustasse *et al.*, 2015)

RFID has capabilities such as user-friendliness, data accessibility, real-time database facility, assets management, manufacturing schedule, warehouse management, inventory and manufacturing control, enhanced client order delivery and minimized lead time (So, 2010). Scientists and scholar pondered the possibilities of using this technology for decades after this invention. The ability to explicitly distinguish questions remotely could prove useful in numerous fields. In 1983, Charles Walton was credited with the invention for an object using RFID technology.

This process-automation capability provides numerous advantages in the administration of retail outlets and coordination by reducing materials that take care of time and human errors in activities such as getting, checking stocks, passing of information, put-away, routing for cross-docking and cross-border shipping custom clearance. To take a detailed look at a major longitudinal process, it was created to provide a new way to observe and analyze organizations that avoid conventional functional components. The figure 2.0 shows an RFID overall view of system with example components while the following table summarize history timeline of RFID technology.



**Figure 2.0: An RFID system with example components**

| Years | Event  |
|-------|--|
| 1940  | For the first time, radar technology was used to identify enemy and friendly aircraft. Technically, this was the first RFID to be used   |
| 1973  | The first Radio Frequency Identification Transponder system is developed   |
| 1979  | It creates the first radio frequency identification chips that can be implanted into other things.   |
| 1984  | RFID allows the detection and identification of radar reflective objects to be identified by RFID detection devices . This equivalent year, versatile gadgets are presented that do not require batteries. |
| 1987  | The first RFID toll road payment system is introduced in Europe. This is a similar innovation that we often see throughout our nation today  |
| 1991  | RFID's first large-scale marketing campaign begins   |
| 1992  | Tollway collection systems are implemented in developing countries   |
| 1994  | Railway cars implement RFID detection system   |
| 2003  | Walmart is the first retail store in the world adopted RFID Technology.  |

**Figure 2.1: The Timeline of RFID Technology**

## 2.2 Supply Chain Management

Supply chain management is a network of distributors, warehouses, factories, retail outlets and dealers through which raw materials are purchased, processed and delivered to customer customers (Krishnakumar and Kuriakose, 2014). According Datta, (2016) RFID provides an alternative to the barcode tracking system and is quickly adopted and deployed in a variety of applications, including supply chain management, and has superior barcode and assurances many supply chain benefits, such as reduced shrinkage, efficient material handling and increased product availability.

It was created to provide a new method of investigating and analyzing organizations that prevent conventional functional elements to take a comprehensive look at a major or longitudinal process. (Kim and Garrison, 2010). The inventory network consists of the connections between a company and its suppliers, through its transport association and its consumers. According to Nash, (2010) supply chain management focuses on the client and ensures that they are completely satisfied with any products or services provided, while building a relationship of trust that can benefit both partners now and in the future. A large part of this today is technology; this has major impact on the supply chain, which is why it is important to discuss its role as a supply chain enabler (Kim and Garrison, 2010). The Institute for Supply Management and The Supply-Chain Council define supply chain as follows;

*“Design and manage seamless, value-added processes across structural borders to satisfy the true requirements of the end customers.”*

- The Institute for Supply Management

*“Managing market forces, sourcing raw materials and components, manufacturing and installation, storage and inventory scanning, order entry and order management, distribution across all channels and deliver to the clients”*

-The Supply-Chain Council