
**Faculty of Technology Management & Technopreneurship**

# FACTORS THAT CONTRIBUTE TO THE FAILURE OF RFID USAGE IN SUPPLY CHAIN

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# FACTORS THAT CONTRIBUTE TO THE FAILURE OF RFID USAGE IN SUPPLY CHAIN

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## ABSTRACT

Radio frequency identification (RFID) is a technology with a great potential in many industries and a wide spectrum of possible uses. One of the first places where it is being used and where it promises excellent results is supply chain. Unfortunately RFID also brings with it some of its faults which can result in security threats. This paper is a result of a research conducted on the factors that contribute to the failure of RFID usage in supply chain. It firstly explains in detail the paths and methods this research used and elaborates more in depth about the research problem during which the research question and its scope are defined. Threaten attributes is discussed in security problems of RFID in their supply chains. Following parts give introduction to the technology, its application and other issues addressed in the research to ensure better understanding of the subject. Current research and available literature are used do define problems with security in RFID supply chains which is then joined with some practical experiences and experts opinions to create final findings, conclusions and recommendation. The scope of study for this project paper will focus on companies which implemented RFID in Malaysia by different industry sectors where the survey's questionnaire will be distributed to them. The total number of respondents involved in this survey will be 50 respondents. The data analysis was discussed includes of central tendency of mean, mode, and median, and measures of dispersion in terms of range and standard deviation, descriptive analysis and crosstabulation. Furthermore, it also uses analysis of correlation of t-test, ANOVA and Factorial ANOVA to check the relationship between the demographic profile and independent variable. Findings show that, three factors contribute to the failure of RFID usage in supply chain. Those three factors are unauthorized reading tag, change the data on the tag, physical damage and denial-of-service attacks. Recommendations such as minimize tag time exposure, regularly check tags, use tag blocker, and authorization process.

Abstrak projek disajikan kepada Senat Universiti Teknikal Malaysia Melaka sebagai sebahagian dari persyaratan untuk Sarjana dalam bidang Pentadbiran Perniagaan

**FAKTOR-FAKTOR YANG MEMPENGARUHI KEPADA KESALAHAN DARI PENGGUNAAN IDENTIFIKASI RADIO FREKUENSI DALAM RANTAI BEKALAN**

**Oleh:**

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## ABSTRAK

Identifikasi frekuensi radio (RFID) adalah teknologi dengan potensi besar di banyak industri dan spektrum yang luas mungkin digunakan. Salah satu tempat pertama di mana ia ramai digunakan dan memberikan keputusan yang sangat baik adalah rantai bekalan/stok.Akan tetapi, RFID juga membawa sebahagian kesalahan yang boleh mengakibatkan ancaman pada keselamatan. Projek ini merupakan hasil dari sebuah kajian yang dilakukan tentang faktor-faktor yang menyumbang terhadap kegagalan penggunaan RFID dalam rantai bekalan. Hal pertama menjelaskan secara terperinci pusat dan kaedah penyelidikan ini digunakan dan menghuraikan lebih mendalam tentang masalah kajian selama soalan kajian dan ruang lingkup yang ditakrifkan. Selanjutnya, mengancam atribut dibahas dalam masalah keselamatan RFID dalam rantai bekalan mereka. Bahagian seterusnya memberikan pengenalan kepada teknologi, penerapannya dan masalah lain yang dibahas dalam kajian untuk memastikan lebih memahami subjek. Ruang lingkup kajian untuk kertas projek ini akan menumpukan pada syarikat yang dilaksanakan RFID di Malaysia oleh sektor industri yang berbeza di mana survei soal selidik diagihkan kepada mereka. Bilangan responden yang terlibat dalam survei ini adalah 50 responden. Kesimpulan dan cadangan yang dibuat dalam cara yang berguna untuk memberikan gambaran yang jelas dan kepada daripada potensi masalah yang rantai bekalan RFID pembekal mungkin akan dihadapi dan juga memberikan beberapa ide (tidak semua penyelesaian yang mungkin dibahas) tentang bagaimana untuk mengelak atau mengatasi masalah ini kerana dapat dilihat dalam kajian ini.

# APPROVAL

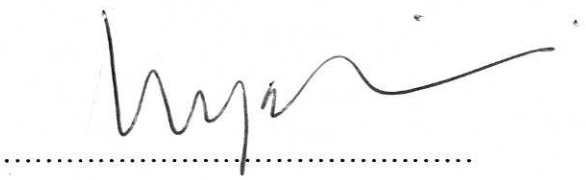
I hereby confirm that I have examined this project paper entitled:-

**"FACTORS THAT CONTRIBUTE TO THE FAILURE OF RFID USAGE IN SUPPLY CHAIN"**

By

**GAN ENG HONG**

I hereby acknowledge that this project paper has been accepted as part fulfillment for the degree of Master of Business Administration



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**Date: 5th March 2010**

# DECLARATION

I declare that this thesis entitled "Factors that contribute to the failure of RFID usage in supply chain" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

**Signature** : 

**Name** : **Gan Eng Hong**

**Date** : **5th March 2010**

# DEDICATION

I would like to dedicate this research paper to my beloved twin uncles and my siblings. Their unconditioned love and encouragement have allowed me to strive and push myself beyond limits that I never thought would be possible. With their support, I was able to complete this research paper smoothly.

# ACKNOWLEDGEMENT

I would like to take this opportunity to express my utmost gratitude and endless appreciation to my supervisor, Dr. Md. Nor Hayati Bin Tahir, for his continuous assistance and guidance. His wonderful communication skills with students made this research with him a very pleasant process. With his excellent supervision, I was able to complete this research paper successfully.

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My special thanks to my thoughtful friends with whom I advise and exchanged views on this research project. All of them are a great source of inspiration for this research paper.

Last but not least, this thesis would not be successfully completed if not for the countless support and encouragement from my family. They had given me a tremendous amount of love, and support towards my well-being along the period when this research is being done.

## TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# Chapter 1: Introduction

## 1.1 Background of Study

Radio Frequency IDentificaton (RFID) is a technology which allows contactless access to data on a transponder (also called tag or chip). Already in the late forties of the last century RFID was used to identify friendly aircraft. In 1948, Stockman described the base of RFID in his seminal article "Communication by Means of Reflected Power" (Stockman, H., 1948). Ongoing miniaturization and advancements in technology have lead to smaller and cheaper tags, which have made widespread use of RFID possible in supply chains.

The benefits of RFID in supply chains are well documented. Large retailers, e.g. Wal-Mart, Tesco, IKEA, and the Metro Group as well as large consumer goods producers like Procter & Gamble and Unilever, are amongst the early adaptors of the technology. Better stock keeping, reduced shrinkage, improved tracking, better information flows along the supply chain and a higher service level are some of the benefits attributed to the introduction and application of RFID.

RFID is sometimes presented as a more sophisticated barcode or simply as the natural evolution from a paper-based to an electronic auto-ID technology. This analogy is dangerous, as it could result in inadequate risk management of RFID projects and systems. If not addressed, the specific nature of RFID, namely the wireless interface and the small computational footprint, might lead to security problems. The risks of RFID implementations are often solely seen as a consumer privacy problem, which can be dealt with at the point of sale by deactivating the tags.

However, RFID specific security risks such as information leakage and data inconsistency arise along the entire supply chain. Ignoring the RFID specific risks in a supply chain environment can become quite costly. A preliminary consideration of the security risks is a prerequisite to achieve a successful RFID implementation. Rather surprisingly, the security implications of RFID projects for the supply chain are rarely addressed in a structured manner, but, if at all, on an ad hoc basis.

## 1.2 Background and history of RFID Technology

It's generally said that the roots of RFID can be traced back to World War II. The Germans, Japanese, Americans and British were all using radar, which had been discovered in 1935 by Scottish physicist Sir Robert Alexander Watson-Watt, warns of approaching planes while they were still miles away. The problem was there was arises when was no solution to identify which planes belonged to the enemy and which were a country's own pilots returning from a mission (RFID Journal, 2009).

The Germans discovered that if pilots rolled their planes as they returned to base, it would change the radio signal reflected back. This crude method alerted the radar crew on the ground that these were German planes and not allied aircraft (this is, essentially, the first passive RFID system).

Under Watson-Watt, who headed a secret project, the British developed the first active identify friend or foe (IFF) system. They put a transmitter on each British plane. When it received signals from radar stations on the ground, it began broadcasting a signal back that identified the aircraft as friendly. RFID works on this

same basic concept. A signal is sent to a transponder, which wakes up and either reflects back a signal (passive system) or broadcasts a signal (active system).

Advances in radar and radio frequency (RF) communications systems continued through the 1950s and 1960s. Scientists and academics in the United States, Europe and Japan did research and presented papers explaining how RF energy could be used to identify objects remotely. Companies began commercializing anti-theft systems that used radio waves to determine whether an item had been paid for or not. Electronic article surveillance tags, which are still used in packaging today, have a 1-bit tag. The bit is either on or off. If someone pays for the item, the bit is turned off, and a person can leave the store. But if the person doesn't pay and tries to walk out of the store, readers at the door detect the tag and sound an alarm.

### 1.2.1 The First RFID Patents

Mario W. Cardullo claims to have received the first U.S. patent for an active RFID tag with rewritable memory on January 23, 1973. That same year, Charles Walton, a California entrepreneur, received a patent for a passive transponder used to unlock a door without a key. A card with an embedded transponder communicated a signal to a reader near the door. When the reader detected a valid identity number stored within the RFID tag, the reader unlocked the door. Walton licensed the technology to Schlage, a lock maker, and other companies (RFID Journal, 2009).

The U.S. government was also working on RFID systems. In the 1970s, Los Alamos National Laboratory was asked by the Energy Department to develop a

system for tracking nuclear materials. A group of scientists came up with the concept of putting a transponder in a truck and readers at the gates of secure facilities. The gate antenna would wake up the transponder in the truck, which would respond with an ID and potentially other data, such as the driver's ID. This system was commercialized in the mid-1980s when the Los Alamos scientists who worked on the project left to form a company to develop automated toll payment systems. These systems have become widely used on roads, bridges and tunnels around the world.

At the request of the Agricultural Department, Los Alamos also developed a passive RFID tag to track cows. The problem was that cows were being given hormones and medicines when they were ill. But it was hard to make sure each cow got the right dosage and wasn't given two doses accidentally. Los Alamos came up with a passive RFID system that used 125 kHz radio waves. A transponder encapsulated in glass injected under the cows skin. It drew energy from the reader and simply reflected back a modulated signal to the reader using a technique known as backscatter. This system is still used in cows around the world today. Low-frequency transponders were also put in cards and used to control the access to buildings.

Over time, companies commercialized 125 kHz systems and then moved up the radio spectrum to high frequency (13.56 MHz), which was unregulated and unused in most parts of the world. High frequency offered greater range and faster data transfer rates. Companies, particularly those in Europe, began using it to track reusable containers and other assets. Today, 13.56 MHz RFID systems are used for access control, payment systems (Mobile Speedpass) and contactless smart cards.

They're also used as an anti-theft device in cars. A reader in the steering column reads the passive RFID tag in the plastic housing around the key. If it doesn't get the ID number it is programmed to look for, the car won't start.

In the early 1990s, IBM engineers developed and patented an ultra-high frequency (UHF) RFID system. UHF offered longer read range (up to 20 feet under good conditions) and faster data transfer. IBM did some early pilots with Wal-Mart, but never commercialized this technology. When it ran into financial trouble in the mid-1990s, IBM sold its patents to Intermec, a bar code systems provider. Intermec RFID systems have been installed in numerous different applications, from warehouse tracking to farming. But the technology was expensive at the time due to the low volume of sales and the lack of open, international standards (RFID Journal, 2009).

UHF RFID got a boost in 1999, when the Uniform Code Council, EAN International, Procter & Gamble and Gillette put up funding to establish the Auto-ID Center at the Massachusetts Institute of Technology. Two professors, namely David Brock and Sanjay Sarma (1999), had been doing some research into the possibility of putting low-cost RFID tags on all products made to track them through the supply chain. Their idea was to put only a serial number on the tag to keep the price down (a simple microchip that stored very little information would be less expensive to produce than a more complex chip with more memory). Data associated with the serial number on the tag would be stored in a database that would be accessible over the Internet. David Brock and Sanjay Sarma (1999), essentially changed the way people thought about RFID in the supply chain. Previously, tags used a mobile

database that carried information regarding the product or container. David Brock and Sanjay Sarma (1999), turned RFID into a networking technology by linking objects to the Internet through the tag. For businesses, this was an important change, because now a manufacturer could automatically let a business partner know when a shipment was leaving the dock at a manufacturing facility or warehouse, and a retailer could automatically let the manufacturer know when the goods arrived.

Between 1999 and 2003, the Auto-ID Center gained the support of more than 100 large end-user companies, plus the U.S. Department of Defense and many key RFID vendors. It opened research labs in Australia, the United Kingdom, Switzerland, Japan and China. It developed two air interface protocols (Class 1 and Class 0), the Electronic Product Code (EPC) numbering scheme, and a network architecture for looking up data associated on an RFID tag on the Internet. The technology was licensed to the Uniform Code Council in 2003, and the Uniform Code Council created EPCglobal, as a joint venture with European Access Network (EAN) International, to commercialize EPC technology. The Auto-ID Center closed its doors in October 2003, and its research responsibilities were passed on to Auto-ID Labs (RFID Journal, 2009).

Researchers found that some of the biggest retailers in the worlds such as Albertsons, Metro, Target, Tesco, Wal-Mart, and the U.S. Department of Defense have said they plan to use EPC technology to track goods in their supply chain. The pharmaceutical, tire, defense and other industries are also moving to adopt the technology. Furthemore, EPCglobal ratified a second-generation standard in December 2004, paving the way for broad adoption.

## 1.3 Statement of Problem

The application of RFID Technology advantageous to supply chain but the usage is uncommon in Malaysia. Therefore this research studies some of the issues in RFID usage in supply chain.

## 1.4 Research Question

The research questions of this study are:

- What are the factors contribute to the failure of RFID in supply chains?
- How to overcome the failures of RFID in supply chains?

## 1.5 Objective of Research

The purpose of the research is to explore factors that affect the failures of RFID in supply chain and solutions to overcome the failure in supply chain. The goal is to assists the business users in overcoming the issues. RFID with its numerous potential applications and accompanying technologies represents more than an incremental step towards improvement for great number of companies and businesses However, the conclusions may not be a popular recommendation or politically correct, yet they constitute a careful analysis of current information.

## 1.6 Hypothesis of Study:

The hypotheses of the research are as follow:

H1: The relationship between Unauthorized reading the tag or skimming and RFID technology in its present form has security related shortcomings or failure.

H0: There is no significant relationship between unauthorized reading the tag or skimming and RFID technology in its present form has security related shortcomings or failure.

HA: There is significant relationship between unauthorized reading the tag or skimming and RFID technology in its present form has security related shortcomings or failure.

H2: The relationship between changing the data on the tag or cloning and RFID technology in its present form has security related shortcomings or failure.

H0: There is no significant relationship between changing the data on the tag or cloning and RFID technology in its present form has security related shortcomings or failure.

HA: There is significant relationship between changing the data on the tag or cloning and RFID technology in its present form has security related shortcomings or failure.

H3: The relationship between Unauthorized on the communication between tags and readers and RFID technology in its present form has security related shortcomings or failure.

H0: There is no significant relationship between eavesdropping on the communication between tags and readers and RFID technology in its present form has security related shortcomings or failure.

HA: There is significant relationship between eavesdropping on the communication between tags and readers and RFID technology in its present form has security related shortcomings or failure.

H4: The relationship between physical damage or remove of the tag and RFID technology in its present form has security related shortcomings or failure.

H0: There is no significant relationship between physical damage or remove of the tag and RFID technology in its present form has security related shortcomings or failure.

HA: There is significant relationship between physical damage or remove of the tag and RFID technology in its present form has security related shortcomings or failure.

H5: The relationship between killing of the tag or data tampering and RFID technology in its present form has security related shortcomings or failure.