

## **CHAPTER 4**

### **RESEARCH FINDINGS AND RESULTS**

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#### **4.1 Chapter Overview**

Previous chapter discussed on the methodology that has been applied in this study which lead to the research findings. This chapter starts with the pre-adoption of RFID (attractors/repellents); follows by during adoption stage (appropriation / disappropriation criteria) and end by the post-adoption stage (reinforcers). It is then follow by the discussion on the newly generated framework of this study - Technology Appropriation Model for RFID adoption in logistic industry. A summary of the study will be discussed at the end of this chapter.

#### **4.2 Attractors and repellents**

The emergence of RFID technology has trigger logistics service providers (LSPs) to evaluate the suitability of the technology in the logistic industry. The initial exposures of the technology acquainted by the LSP are via presentation by the technology providers, readings of technology magazine, adopting of the RFID technology by rivals or encouragement from the government to further explore in this technology. The primary perception the LSPs had on the technology are the supply chain visibility (SCV), overall cost deteriorating in near future, improve customer service and globalisation trend. These determinants influence the

logistician decision to further proceed in appropriating the RFID technology in the logistic industry.

Adopting a new technology is not an easy task as many factors are taken into consideration by the decision makers. For instance, the overall implementation cost, firm readiness, efforts and time spent on the projects and the benefits of doubt of the project. The primary influencer for the adopter would be the cost incurred to initiate the project or evaluation pilot test on the technology. Government's encouragement such as providing incentive to the LSP who pursue the technology would ensure wider adoption of RFID technology. According to Luo et al. (2007), in order for the government to expand the RFID adoption in China, the Chinese government provides funding support for universities or organisations on the diffusion of the RFID technology. The research officer noted: *"The project begins when the research head office (RHO) obtained grant from the government to fund this project"*.

Affordability of the technology is the most crucial factor that determines whether the logistic firm has the capability of purchasing the technology. If this cannot be achieved, the decision to place in the RFID technology within the firm would be rejected immediately. As for now, the government has put in much initiative in promoting the new technology by providing project grants and subsidises to the adopters in expediting the RFID adoption in the country.

LSPs believe that adopting RFID technology would assist them to achieve competitive advantage. According to Wong and Karia (2009), they found that adopting RFID technology which assists the collaboration among supply chain members would result in sustainable competitive advantage. As many global LSPs have adopted the RFID technology, it became a trend which is one of the attractor in this study. An empirical study shows that globalisation trend is one of the most valued factors after RFID adoption cost (Cheng et al., 2007). The LSP IT director recalled: *“Recalling back to the year whereby RFID topic was very hot and everyone is talking about it. As logistic service provider, we need to jump up the wagon to identify whether this piece of technology make sense for us to adopt or not”*.

Supply chain visibility is one the most common attractor that majority of the LSPs are looking for. The flexibility that RFID technology offers to them is the ability to trace and track the movements of goods in real time. This enable better coordination and collaboration among the supply chain partners as information is just within their grab. For instance, warehouse workers able to identify the location of pallets in just a split of second and the best route to retrieve the goods via RFID system as previously collision occurred within the warehouse during pallets retrieval. An operator described the convenience of the RFID system in warehouse as *“it makes my work much easier and a more safety environment to work in.”*

Being in the servicing industry, ensuring customer satisfaction would be the primary objective to achieve. The main concerns that the customers have on LSPs would be the safety of the goods and whether the goods can be delivered on time to the recipient. Hence, adopting RFID technology would improve the overall efficiency of the entire supply chain and increase customer satisfaction at the same time. According to Kim and Sohn (2009), RFID system allow faster logistic processing which not only increase the sales but also increase the repurchase rate as customer satisfaction is achieved.

The study found the overall cost of RFID implementation (e.g. tags, RFID's equipments, software and infrastructure costs) would be the prime repellent. But this does not impede the RFID technology from entering the process of appropriation stage as the LSPs satisfy with the attractors and wish to proceed to further assess and evaluate the suitability of the new technology in the logistic industry. If dissatisfaction occurs, the technology will be directed to the exit or known as non-appropriation. At this initial stage, the repellents seem to be weaker than the attractors. Therefore, the study proceeds to the second stage of the MTA to justify appropriateness of RFID technology in logistic context.

### 4.3 Appropriation criteria

In the process of appropriation stage, a more comprehensive assessments and evaluations on the technology was conducted by the LSPs to justify whether this piece of technology address the needs of the organisation and fits the industry. The technology is appropriated if it meets the needs of the LSPs. To prevent any interruption during the adoption, an independent pilot test on the technology was conducted. Hence, the appropriation criteria that determine whether the RFID technology will be appropriated are discussed in the following.

LSPs who are attracted to RFID technology mainly due to the automated features that this piece of technology had have the capability of expediting the supply chain processes. Process automation eliminates human interaction not only enable faster logistic processes but also reduce error rates as human prompt to higher error rate compared to machine. For instance, prior the introduction of RFID technology, workers have to scan the goods several times during the movements from the receiving station to the rack for storage as well as from rack to out-going station. The workers at the processing station have to count the number of cases on every pallet counter check with the control document to ensure validity of the delivery. Therefore, RFID eliminates this hassle and increases the operating efficiency. One of the warehouse workers stated that: *“With the new system, we save lots of our time and you will be surprised that the error rate reduces almost to zero.”*

Another feature that attracts the LSPs would be cost saving in term of labour. Prior the implementation of RFID, the LSPs operate huge number of manual processes which dampen the entire operation activities such as manual scanning of barcode on each case within a pallet. The pilot test results that the operation efficiency via RFID system has increased 300% compared to the barcode system. The operator claimed: *"In those days, we spend few hours to scan but now it takes only few minutes."* Therefore, optimisation of available resources is achieved by allocating partial of the processing station's workers to other department.

The conspicuous technological advantage that RFID had over the legacy barcode system would be the capability of scanning several to hundreds tags simultaneously without requiring a direct line of sight. This allows speedier processing of activities carried out in the warehouse. Therefore, workers do not require adjusting or making a slight move on the stagnant products upon information retrieval via RFID reader. The warehouse supervisor claimed that: *"In warehouse, we try to minimise the movement of goods as there is a possibility of damaging the goods."*

Having RFID technology in a warehouse is important as safety and security measures on goods are taken. RFID system has the capability of tracking and tracing goods within the warehouse which prevents the movements of goods

deviated from the intended destination. For instance, the installation of RFID readers at all the entrance of the warehouse makes the security tighter which results shrinking reduction. One of the operators says that: *“If anything goes missing, we are the one to be blamed. But since this technology in placed, we feel relief on duty.”*

The availability of real-time data when the goods are travelling along the supply chain is important to LSPs. This piece of information is then being analysed into useful information and assist the management in decision making. For instance, identify the bottleneck in the supply chain and corrective action can be taken immediately.

#### **4.4 Disappropriation criteria**

There have been a number of negative perceptions on the RFID technology results from the pilot test conducted by the LSP. In this study, we justify that the technology will be disappropriated if too few or none of the appropriation criteria are met. There are several reasons that cause the technology to be discarded and will be discussed in the following.

As in any technology adoption, the most common reason that hinders the adoption process would be the cost associated with the technology. The overall

cost of implementation includes the RFID equipments (e.g. RFID's tags, readers, antennas and software), customisation and infrastructure. Many LSPs emphasise on the cost of owning the technology is beyond their affordability and they do not foresee any return on investment (ROI) in the near future. According to Li et al. (2006), a survey being conducted on 50 companies found that ROI uncertainties would be the most common impediment towards the adoption of this technology. The IT director claimed that: *"Barcode cost us less than a cent for a label but a RFID tag would cost about a ringgit or more; saving every penny would be our primary objective to provide the cheapest in the interest of the customer."*

The RFID standards have been an issue since the introduction of the technology in the logistic industry. According to Ward et al. (2006), there are several standards bodies involved in developing and defining RFID technology, they are the International Standards Organisation (ISO), EPCglobal Inc, European Telecommunications Standards Institute (ETSI) and the Federal Communication Commission (FCC). Hence, every institute or organisation has its own set of standards. When there is no uniformity of the standards, many LSPs are hesitate to adopt RFID technology as they do not willing to invest in uncertainties. Another issues highlighted by Wu et al. (2006), most of the frequency spectrum available in a country are sold to the telecommunication service providers and if the RFID frequency fall into these category, it is not possible to repurchase the spectrum for RFID usage. As the IT director of the LSP explained: *"Different region of the world has its own permitted radio frequency range and it is not feasible for preset*



*readers to read several frequencies as we operate internationally. This will kill you already.”*

There are several technical glitches encountered by the IT personnel during the pilot test on the RFID technology. For instance, the reading accuracy is deteriorating if the products contain metal or liquid materials. The test found that metal will reflect the radio wave and liquid will absorb the radio wave at ultra-high frequencies. Additionally, some of the RFID tags were damaged during the movement of goods preventing the reader from accessing the tags. LSPs are concern about the durability of the tags as movement of goods would be common activities in logistic industry. In another occasion, the IT personnel notice the RFID reader was unable to read the tags if two or more products are place in a close proximity. The IT director highlighted that:

*“Assuming you are pulling things from the shelves and you have around an hour to deliver a thousand boxes to your customer. Do you instruct your man to align it in a certain manner during the pickup in order for readers to read? Therefore, because of the non-practicality, it became a problem.”*

Systems integration establishes communication among several independent systems to speak in the same language. Having the right RFID integrator is not easy as these people require extensive technical specialties that will put all these

slices into a whole piece. The challenges arise during the integration process which causes the data redundancy generated by other systems or functional databases. Besides that, the IT personnel found out many “dirty data” were generated due to causes such as reading collision when multiple tags in close proximity, damage tags sending false reads and reading inaccuracy results. One of the IT personnel performs data analysis on the records in the found that: *“There are millions of records generated in a week of testing and only quarter of it would be the actual one. There are lots of works need to be done to filter these data for accuracy purpose.”*

After evaluating all the positive and negative perceptions that the logistician had towards the adoption of RFID technology in the logistic industry, the referred LSP had discontinued the pilot test as the results obtained after the test were insufficient to overcome all the issues mentioned in the disappropriation section of this study. Being in the middle of evaluating the benefits and challenges faced by the technology, the local LPSs are more concern on issues that the technology had in this current stage:

*“I would say cost, inconsistency in standards even in frequency and the limitations of the technology are the impediment of the RFID technology although this technology is deemed to be exciting but the perceived impacts it not substantial.”*

## 4.6 Appropriation of RFID Adoption Model

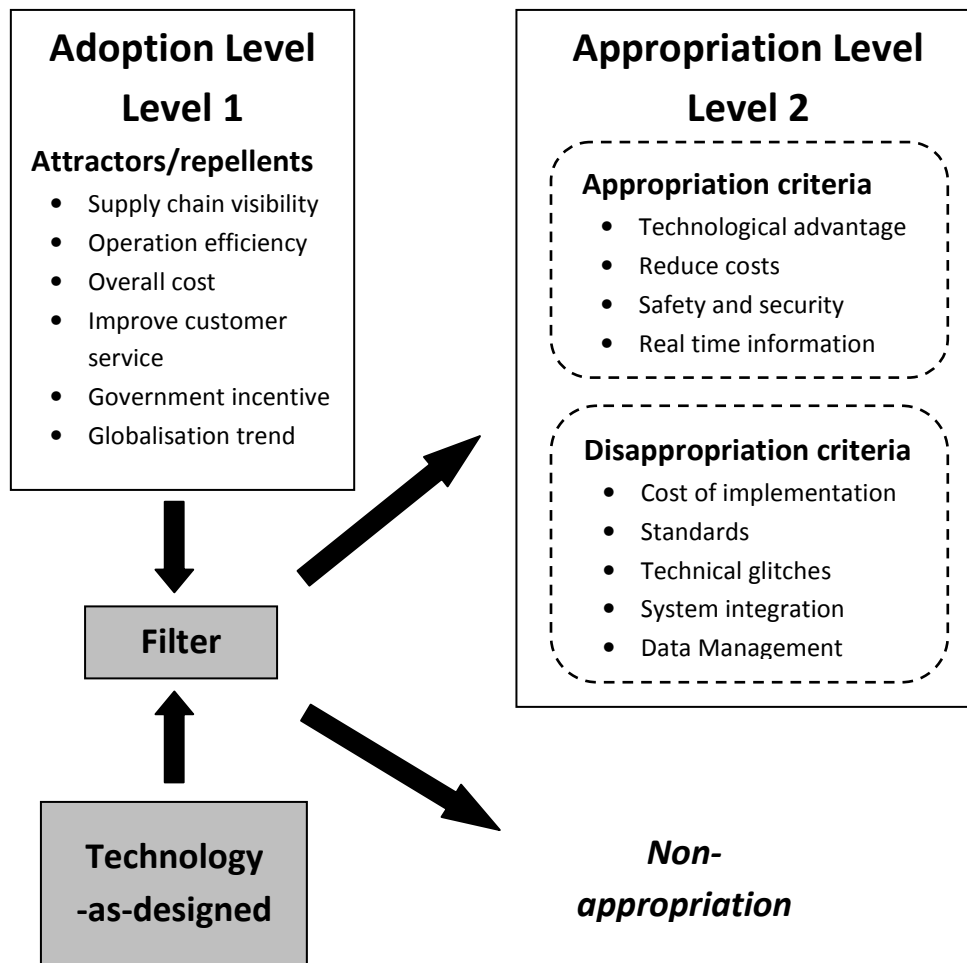


Figure 4.1: Appropriation of RFID Adoption Model

## 4.6 Summary

The RFID adoption process has shown different factors influencing the LSP's decision maker in the process of adopting the technology. There are three stages in the technology appropriation model; the pre-adoption stage, during adoption stage, and post-adoption stage.

The pre-adoption stage is the preliminary exposure for the LSP to get to know the technology and the incentive available for to them pursue it. RFID has been well known for its capabilities in the supply chain industry which attracts many LSPs interest to consider adopting the technology.

When the technology is appeal to them, in-depth evaluation on the technology will be performed in the second stage (during adoption). With the incentive such as project grant provided by the government, the LSP perform a pilot test on the technology to evaluate the technology suitability in the logistic industry. If the technology addresses the LSP's needs, it will be appropriated. If not, the technology will be disappropriated which means the project will be dropped.

The study does not proceed to level 3 of MTA as too many technical glitches occurred during the pilot test and the RFID current issues such as inconsistency in standards and patterns have halt the project from continuing to the next stage.

Figure 4.1 depicts the newly generated model best explain the RFID technology adoption in logistic industry Malaysia. The recommendations and conclusion of the study will be discussed in the next chapter of this study.