

**How will RFID Influence the Retail Environment  
in New Zealand?  
An Investigation of the Views of the Retail Sector**

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## **Attestation of Authorship**

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgement is made”.

**Xiangnan Feng (Simon)**

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## **List of Abbreviations**

- 1. RFID:** Radio Frequency Identification
- 2. SMEs:** Small to Medium Enterprises
- 3. TAM:** technology acceptance model
- 4. NPV:** Net Present Value
- 5. ROI:** Return on Investment
- 6. SKU:** Stock Keeping Units
- 7. EFTPOS:** Electronic Funds Transfer at Point of Sale
- 8. NZDF:** New Zealand Defence Forces

## **Abstract**

RFID technology has been successfully deployed to a wide range of fields over the last decade. Previous studies have examined some factors that influenced the use of RFID technology in the field however there is less empirical evidence found to identify factors that influenced RFID deployment in the retail sector. This research study is a pilot investigation of the impact of RFID technology in the retail sector of New Zealand. The researcher conducted interviews with six participants who had knowledge of the retail area in Auckland. The researcher identified and discussed twelve research themes in this dissertation that have either positively or negatively affected RFID deployment in New Zealand shops. By conducting both qualitative analysis and a review of the literature, the researcher also constructed a matrix for RFID deployment and identified the most significant motivators and barriers to adopting RFID in New Zealand retail; moreover, the retail owners' expectations of RFID were investigated and discussed.

# **1. Introduction to Radio Frequency Identification (RFID)**

## **1.1 Definitions of RFID**

Radio Frequency Identification (RFID) is a technology that was first explored in the 19<sup>th</sup> century but has only in the last decade gained traction in its application for commerce and beyond (Ferret, 2009; Floerkemeier & Sarma, 2008 ; Istart, 2009a, 2009b; Scoop, 2009). To put simply, the technology comprises an integrated circuit incorporating an antenna to transmit and receive signal via a designated radio frequency (Yue, Wu, & Bai, 2008 ). There are two types of RFID, referred to as an active or passive RFID. The former contains a battery that continuously transmits data while the latter does not contain a battery but rather only transmits when it receives a signal from an external source. RFID comes in various sizes and currently has applications ranging from retail to libraries and even government departments e.g. electronic passports (Wamba, Lefebvre, & Lefebvre, 2006).

## **1.2 Issues and Background of RFID**

RFID technology has been around for a few decades since Mario Cardullo put a patent on the technology as early as 1973 in the United States (Cheung, Choy, Lau, & Leung, 2008 ). However, the original design comprised a passive and semi-passive RFID containing only 12 bits memory and only covered applications in transportation, banking, security and medical fields.

Given that the technology is dependent on technological advancements in other fields such as nano-technology, the rate of adoption has seen it lagging behind that of its competitor, the barcode (Potdar, Hayati, & Chang, 2007 ). There have also been discussions in many countries that RFID will eventually replace the barcode to become the common platform for product identification (Pala & Inanc, 2007 ).

However, given the favorable view of businesses and governments on the adoption of the technology, several issues need to be resolved before the technology can become mainstream (Weinstein, 2005 ). According to this source, some potential problems with RFID technology can be outlined as follows:

- The first aspect is that of privacy. RFID technology has the potential to receive and transmit information without the user being aware that this is taking place. Hence, there are advocacy groups who reject this technology, stating that it has the potential to breach consumer privacy.
- The second aspect is the cost of production. Although at present the cost of production is relatively low, it is still not viable for many businesses to adopt the technology unless they have the ability to purchase in bulk to reduce the cost per unit. In addition, there are associated costs such as RFID readers, cost for tagging individual items, cost of hardware and software and so forth.

- The third aspect is the security of data and the possibility that it may be stolen. For example, how easy would it be for unscrupulous individuals to steal passport or banking information that use RFID technology? Of all the issues, information privacy is deemed by many to be the most important.
- Finally, there is a lack of agreed standards to the RFID technologies. Thus there are some tasks that need to be performed in order to resolve the problems. For instance, the criteria to measure the performance of different RFID chips need to be identified. It is valuable to compare different RFID services / hardware in the marketplace or from different service providers and to evaluate their strengths and weaknesses if possible.

### 1.3 Research Objectives for the Entire Study

This study is focused on the New Zealand retail sector, but with some examples taken from elsewhere.

**The first research question is** *“What are the main motivators and barriers for the deployment and adoption of RFID in the New Zealand retail sector and which factors will compel a retail operator to implement RFID technology?”*

**The second research question is** *“What are the retailers’ expectations from the implementation of RFID technology?”*

*There are a number of sub-tasks which need to be undertaken in order to answer these*

*questions, and this research attempts to:*

- I. To identify the stakeholders for RFID market;
- II. To investigate the supply and demand for RFID technology;
- III. To investigate the context and cases of using RFID in the retail sector;
- IV. To examine the deployment and adoption model for RFID technology;
- V. To identify the motivations and barriers for using RFID technology;
- VI. To assess the cases of using RFID technology in retail or other relevant sectors;
- VII. To review the user behavior when using RFID technology;
- VIII. To find out the users' expectations to the use of RFID Technologies.

Tasks I to V are related to literature review, and tasks VI to VIII are the tasks for the research study (qualitative research study using interviews as primary data collection technique).

#### **1.4 Research Motivation: Why RFID use in the retail sector is interesting**

There have been various companies announcing plans to adopt RFID technology in the not too distant future or have already done so, for example Motorola (Seo, Oum, & Park, 2006). It is interesting to see that retail business have taken an interest in RFID because most retailers at present use the barcode technology and have done so since it became mainstream decades ago (Huang & Tang, 2008 ).

The interest in RFID by retailers can be viewed from a cost-effectiveness perspective; imagine the stocktaking nightmare that large retailers currently have in accounting for

inventory while RFID could reduce the time and cost to a minimum (Zhao & Gan, 2006). In addition, retrieving product specific information would be easy e.g. supplier details, batch number, date of manufacture etc. This all adds up to a cost effective way to do business and is of no surprise that retailers are becoming increasingly interested in the technology.

Other perspectives for retail RFID adoption may be the possible increase in sales by using data collected about customer shopping habits for marketing purposes, or to improve customer shopping experience through offering better quality of service. In addition, security and visibility of stock can be improved by using RFID technologies. These are all motivating factors for retailers to adopt RFID.

### **1.5 Who is interested in RFID use in the retail sector in New Zealand?**

There are numerous interested parties (stakeholders) who would be interested in the findings of such a study. According to (Oh, Kim, Kim, & Rhew, 2006 ) these are: First, *RFID users (retailers)* have the interest because they would like to know more about the cost and benefits of the technology, the issues and consumer sentiment surrounding its adoption and application. Secondly, *RFID developers / manufacturers* are another stakeholder group that is interested in the current market demand for the technology and the future development of the technology in terms of the need for new features and functions etc. Furthermore, *advocacy groups* may find the findings of such study to be informative in terms of the efforts made by developers and users to protect consumer privacy by providing a sense of assurance in that they are aware of the

issues and are making an effort to prevent the misuse of such information. Finally, for the *consumers group*, who are the end of the value chain, it is important that they are aware that such technology exists and would be able to make the most informed decision as to whether they purchase products that contain RFID technology.

In essence, this report is relevant to virtually everyone, since everyone is a consumer of products that may potentially contain RFID technology. In this particular dissertation study, the users are the retail companies mainly and the consumers and manufacturers have not been including in this study except where the retailers have speculated about their views.

### **1.6 Structure of the report**

- *Introduction* (Chapter 1) – describes the research background, objectives, motivations, purposes and contribution of the research study;
- *Literature review* (Chapter 2) – reviews relevant academic literature, to build up fundamental knowledge in the field of RFID and the use of the technology in retail sector; possible research framework and research questions will be proposed based on the outcome of the review;
- *Research Approach and Methodologies* (Chapter 3) – describes and explains the research approach, data collection and analysis techniques, research design. It also analyses and evaluates the research framework and the research questions and discusses the risk factors;

- *Research data* (Section 4.1) – presents the raw data gathered from the interviews and conduct a simple data analysis on each interview data set;
- *Research Findings* and analysis (Section 4.2) – Covers the research themes and findings from the raw data presented in the previous section;
- *Discussion* (Chapter 5) – answers the research questions, using the analysed data and research findings, with reference to relevant literature sources to support the arguments; also discusses and summarises the research outcomes;
- *Implications and Limitations* (Chapter 6) – addresses the implications and limitations of this research study, and proposes possible further research;
- *Conclusion* (Chapter 7) – summarises the research study.

### **1.7 Purpose and Contributions of this report**

The main purpose of the dissertation is to develop an understanding of the RFID industry and the applications that it has in commerce and particular, in the retail sector. This will be done by combining and analysing data collected from various relevant stakeholders to determine the current market demand and requirements.

The dissertation contributes to the RFID study in the sense that it has provided up to date research on the view of the market towards the technology being used in retail. The report also attempts to identify research gaps requiring further study and exploration in order to develop a more comprehensive analysis of the technology and its applications in retail.

## **2. Literature Review / Research Background**

The dissertation focuses on reviewing the current state of RFID adoption, as well as identifying and analyzing future prospects of technology in New Zealand's retail sector for improved business efficiency and cost savings. In order to find out about the adoption process for RFID technologies in New Zealand retail sector, this review section follows TAM (technology acceptance model) theory and examines user's acceptance and expectations of the use of technology (RFID) (Mehrtensb, Cragg, & Millsa, 2001). In addition, New Zealand retail businesses are mostly small businesses. Studies that investigate adoption of information technologies for small businesses are considered more valuable (Harrison, Mykytyn, Jr, & Riemenschneider, 1997), since Small to Medium Enterprises (SMEs) have particular business operational and behavioral issues while adopting innovative technology such as RFID (Julien, 1994).

As pointed out in Chapter 1, RFID technology was patented in 1973 in the United States by Mario Cardullo (Cheung et al., 2008 ). Since then, the technology has been rapidly adopted in many countries such as Japan, France, Poland, Norway, China and many more (Curtin, Kauffman, & Riggins, 2006).

Even more interesting is how much the application of RFID has evolved from the proposed applications as set out in 1973 including transportation, banking, security and medical (Zeng, Liu, Liu, & Li, 2008 ). Now, the technology has branched into fields such as sports (used in timing of athletes for improved accuracy compared to

conventional methods), product identification, passports, libraries and much more (Hossain & Prybutok, 2008 ). Furthermore, RFID sales are expected to more than double around the world in the next 5 – 7 years as more and more businesses realize the benefits of RFID (Madison, 2008). However, as with all benefits, there is an associated cost and this is a factor that needs to be explored to ensure adoption of RFID in New Zealand retail is viable.

To date, most if not all of New Zealand's retail sector are using a rival technology to RFID known as the barcode (Karlsson & Symonds, 2006). However, the barcode technology is limited in the sense that it may not provide the functionalities and information capabilities that businesses require (Bendavid, Wamba, & Lefebvre, 2006 ). As a result, RFID is seen to be the preferred technology solution to operational limitations and security problems created by the barcode for companies like Wal-Mart, Motorola and Boeing.

In addition, adopting RFID requires some fundamental restructuring of IT systems both in the back office and at store level. This can become quite an expensive exercise for most businesses and hence is limited to medium to large businesses that are more financially capable of implementing such a solution (Huber & Michael, 2007 ). However, this research study aims to find out what impact the RFID technology would have to small businesses, such as retail business in New Zealand; furthermore, it is valuable to investigate whether RFID can influence retails' business operations,

and also to obtain retailers' expectations of using the RFID technology.

## **2.1 Market Analysis – Demand for RFID**

Literature has shown that commercial use of RFID has been growing rapidly during the last decade in overseas markets (in particular Asia and the United States), with an estimated market growth of 48% (Asia) and 34% (United States) (Grasso, 2006). Furthermore, it is expected that the RFID market will grow to an estimated \$7.26 billion in 2008 (this number is yet to be confirmed) and is projected to reach an estimated US\$24.5b by 2015 (Konomi & Roussos, 2007 ).

It has been suggested that this growth will be around 20% year on year, with the main growth coming from already established solutions such as security access with access cards, tolls and transportation, passports, product tracking and so on (Technol & Dev. Agency, 2007 ). Although established solutions will see an increased growth in their respective market segments (Chaves, Buchmann, & Böhm, 2008 ), it is the emerging segments that will drive the RFID growth. The emerging segments where RFID applications will play a major role are contactless payments and supply chain management with the latter being more crucial due to the drive for efficiency in today's market and is particularly so in retail which is the focus of this study. The expected 20% level of growth moves that there is a large market demand for the technology. Although the present economic climate will have an impact on the expected growth numbers, the end result may still be impressive as most industries

will struggle to attain 20% growth in the current economic climate (Peng, Ji, Luo, Wong, & Tang, 2008 ).

Having said that, it still remains to be seen that the projected level of growth is sustainable and further research is required to more accurately assess this level of growth projection. Applying the above findings to the report, the circumstances around RFID in New Zealand are different to studies done in more developed markets where RFID is already in use across various applications and industries (Cheung et al., 2008 ). In reference to the retail industry, the current demand for RFID in New Zealand is considered to be low due to the high cost of implementation and the fact that the current barcode technology is sufficient for most businesses and therefore they do not feel compelled to look for an alternative (Huang & Tang, 2008 ).

According to (Floerkemeier & Sarma, 2008 ; Huang & Tang, 2008 ; Jo, Youn, Cha, & Choo, 2009 ; Zeng et al., 2008 ), RFID is not regarded as a viable solution in New Zealand at present due to factors such as:

- Cost – it is expected that in order for the solution to appeal to a wider market, the cost of the tag should be below the current 5c/unit in US currency. In addition, the cost of the associated hardware and software systems may be more than most businesses are capable of spending.
- Benefits – many businesses do not envisage RFID providing the gains in efficiency as suggested. This is because in order to realise these benefits,

companies utilizing the technology are required to restructure their operations in order to reap the rewards

- Competing technology – barcode is the dominant technology in New Zealand and has been for some time. It will be hard to compel business to switch technologies.
- Size of the market – unlike overseas markets such as Asia and the United States, the New Zealand market is small and the requirement for advanced technologies is limited to large businesses and enterprises. Even then, these large business would not necessary adopt RFID due to the fact that the perceived costs outweigh the benefits.

However, given time, New Zealand's retail business will come to realise the benefits of RFID. This is derived from overseas retail markets that have already implemented this technology, and given the right factors such as population, cost and so forth, New Zealand will follow suit (Zhang & Symonds, 2008). This is particularly so for businesses that have an integrated supply chain, such as supermarkets and large retail outlets, where RFID can play an integral part in gaining operational efficiency.

## **2.2 Technology Review, Motivation and Barriers**

This study aims to find out the impacts of using RFID technologies in the New Zealand retail sector. Therefore, it is interesting to investigate motivations that push retailers to use RFID in their businesses, and also to examine the difficulties for deploying RFID service to the business environment.

### *2.2.1 Motivations*

#### **Cost benefits**

One rationale for businesses to implement RFID is to reduce operational costs and improve efficiency and even service quality by streamlining processes that take advantage of benefits inherent in RFID (Konomi & Roussos, 2007 ). This is evident with applications in supply chain for retail operators such as Wal-Mart where products are tagged at a unit level and are traceable throughout the whole supply chain from purchase to delivery to the retail floor. It has also enabled them to reduce the inventory requirements and hence reduce warehousing costs, and also improves the accuracy in inventory tracking and reduced labour costs (Ketprom, Mitrpant, & Lowjun, 2007 ).

Hospitals in Asia have also implemented the RFID technology with some making marked gains in efficiency and cost as well as increasing information accuracy in the treatment of patients (Mun, Kantrowitz, Carmel, Mason, & Engels, 2007). It reduced the data entry requirements as well as the time for retrieving information retrieval such as patient diagnoses and medical history. This has resulted not only in cost savings but also improved the service level provided. This demonstrates that with a carefully designed implementation strategy, companies can take advantage of the considerable benefits that RFID can offer.

#### **Improve safety and security**

Applications of RFID have far exceeded initial expectations, with some manufacturers making safety devices containing RFID units (Li & Ding, 2007 ). Such

applications have been applied in hospitals in the treatment of patients, or RFID tags have been used in mining where tags are used to keep track of the location of the miners (Gao et al., 2004 ). Some vehicles nowadays contain RFID technology to prevent them from being stolen by immobilizing the vehicle when an incorrect RFID key is used (Roz & Fuentes, 2007).

### **Drive productivity**

Companies such as Boeing have implemented RFID technology in tracking parts used in the manufacturing of planes. This reduces the instances of the wrong parts being supplied in the assembly process, and also enables better control of parts inventory when it reduces or runs out of stocks (Gao et al., 2004 ). In retail this can be applied to stocktaking of inventory where accurate stock on hand is available at any time and also done with minimum staff involvement and is a key productivity in retail applications (Angeles, 2008)

Other suggestions are that the technology can be applied to vehicles where all parts are tagged with RFID chips so that dealers as well as law enforcement personnel are able to recognize whether a particular vehicle was stolen. Toll roads using RFID is an example whereby a toll station will recognise your account when your RFID card is scanned at the booth, without requiring a physical person there to collect the money. This will save time as well as money (Technol & Dev. Agency, 2007 )

### **Reduce theft**

As mentioned in section 2.2.1, RFID can prevent theft. This can be on the retail floor

where any RFID products that leave the premises without being disabled at the checkout will sound an alarm, alerting the store owners (Song & Mitchell, 2008 ). Other applications are in vehicles where the vehicle will disable the ignition if an incorrect RFID key is used to start the car (Waterhouse & Novak, 2006). Furthermore, the government of Malaysia has implemented an e-Plate strategy where license plates are RFID tagged to enable a vehicle to be identified by police when scanned and provide details such as vehicle make, model, owner and so forth. Although this will not reduce theft, it is certainly a deterrent with successes in countries like Japan and the UK.

This demonstrates the applications that RFID has in reducing theft and shrinkage in retail floors (or even warehouses), and although it will not completely eliminate theft, it has the desired effect in reducing such incidences. According to (Guthrie, 2003) the cost of retail crime in New Zealand was \$NZ564 million, whilst total shrinkage was \$NZ705 million. Retailers believe the majority of the retail crime is carried out by customers (65%), as oppose to employee theft (12%), supplier (vender) theft (3%) or administration error (20%). With the high percentage (80%) of retail theft, the RFID technology is beneficial for the business owners to prevent company losses, as a way of reducing operational cost.

### *2.2.2 Barriers*

#### **Information Security**

The most critical aspect in the resistance to adoption of RFID by companies as well as by individuals is the security of information held within the tags themselves (Harrison et al., 1997). Just imagine the e-Passport that retains all your personal information such as age, nationality, etc, which could be at risk of being “skimmed” by hackers who really want access to such information.

Companies themselves are aware of such flaws and would want to protect sensitive information about their company that hackers may be able to exploit given the correct equipment (Molnar, Soppera, & Wagner, 2005 ). Therefore, in order for RFID to be accepted, there needs to be a focus around the protection of private and sensitive information.

### **Consumer misconception**

Consumers are generally skeptical of “new” technology where private information about them is stored or where it involves their personal finances. As such, this barrier is related to the security barriers that most people have towards technologies such as RFID (Ravindranath, Padmanabhan, & Agrawal, 2008 ).

Imagine where countries move on to implementing RFID for everything, e.g. e-driver licenses, e-passports, e-bankcards and contactless cards. This would certainly attract criticism from consumers that deems the technology to be flawed in security and that their private information may be at risk (Paise & Vaudenay, 2008 ).

This risk is generally a misconception as usually, there are security measures to prevent “hackers” to access your private information. Such measures include using a unique key embedded into the RFID tag which acts as a trigger, (rather than actual private information being stored within the tag itself) to retrieve personal information stored on the organizations servers.

Consumers want privacy, so imagine a retailer that gathers information about your shopping habits and tailors individual promotions to entice you to shop with them (Lee & Kim, 2006 ). Even though this type of analysis exists with loyalty card schemes, it is envisaged that RFID will provide data for more complex and detailed analysis of such habits (Cha, Huang, & Chang, 2008 ).

### **Privacy**

The privacy barrier is closely related to security and consumer misconceptions, in the sense that they would like their personal information or even shopping patterns to be kept private (Molnar et al., 2005 ). This perceived privacy threat is a big barrier to the acceptance of RFID technology. This barrier is existent in all the RFID markets and is probably the hardest to overcome (Hossain & Prybutok, 2008 ; Pagey, 2008 ).

### **Implementation Costs**

Companies and governments wanting to implement RFID should be aware of the costs involved in setting up an RFID system (Dong, Yao, & Riggins, 2007; Sarma, 2004 ). Such costs are:

- the purchasing of the tags (depending on the type of tag and bulk purchasing, this could range from 5c to \$10 or more in US currency);
- purchase of tag readers;
- servers or databases to store information and operate the system;
- maintenance licenses, consultant and implementation costs;
- training and restructuring of processes to fully utilise the technology.

### **No perceived efficiency gains**

Most companies do not perceive large efficiency gains to offset the cost of implementing the system (Oh et al., 2006). This is due to the fact that most businesses that are able to afford such systems have a diverse operations base, so in order to make full use of the technology they need to restructure the operation and supply chain processes. This will usually cause disruptions to a business with little benefit of efficiency gains, and can even incur lost sales if a product is not delivered on time due to process failures (Vaidya & Das, 2008). Therefore, most companies do not see much benefit in implementing RFID for efficiency gains.

### **Competing technologies**

There are competing technologies out in the market place that compete directly with RFID, such as Barcode. Even though these competing technologies have different technical functions, they have the potential to prevent companies from embracing RFID (Want, 2004 ). Overall, there are numerous motivators and barriers when it comes to applying RFID in the real world. This research will attempt to assess them when analysing the viability of RFID application to the retail industry of New

Zealand.

### **2.3 Evaluation of existing model for RFID implementation**

RFID is a technology that has been deployed and in active use across many countries. However, for successful deployment, companies or organisations must identify the motivators for deploying the technology e.g. efficiency and cost savings or safety motives, because each motivator will inherently drive different deployment methodologies, e.g. financial return vs. customer satisfaction or improved operational safety.

Although there are no set guidelines for the deployment of RFID applications, there are similarities between companies who have deployed the technology even though they operate in different industries. Below is a typical deployment model observed in companies such as Wal-Mart and Boeing whose motivator is to generate financial returns. The following deployment framework for using RFID technology in business in built based on the summary of Barriers and Critical Success Factors towards RFID Technology (Vanany, 2008):

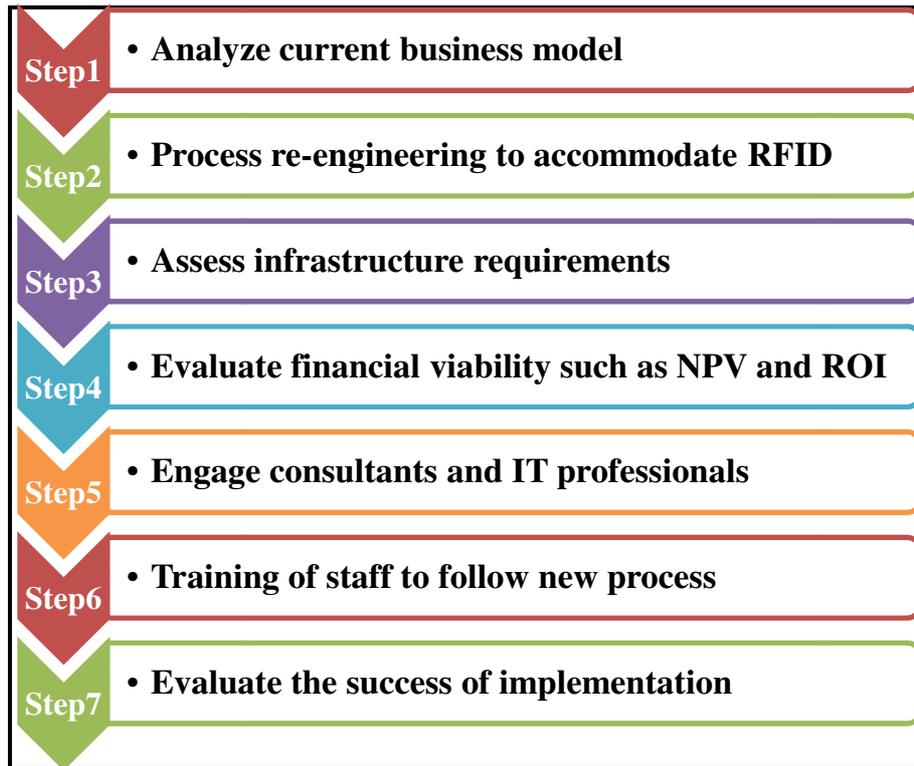


Figure 1 – Seven step Model for RFID Implementation

(Adapted from Vanany, 2008)

1. **Analyze current business model** – detailed analysis of the current business processes e.g. supply chain analysis, retail operations etc.
  
2. **Process re-engineering to accommodate RFID** – once step one is complete, areas should be identified where RFID will provide the most impact in achieving the project goals, e.g. stock take, loss prevention, customer analysis, throughput / productivity and so forth.
  
3. **Assess infrastructure requirements (IT and building/warehousing)** – the next step is usually identifying the infrastructure requirements such as IT systems and middleware, scanners, servers, redesigning the retail or

warehousing floor plans etc.

4. **Evaluate financial viability such as** Net Present Value (NPV) and Return on Investment (ROI) – after careful assessment of the infrastructure costs, labour costs and lost sales due to disruptions versus the anticipated benefits, an assessment should be made as to whether the project will provide a positive return for the business.
5. **Engage consultants and IT professionals** – in the event that it is financially viable, then consultants and experts should be engaged to commence a detailed deployment design of the system. It is important to get this right the first time, as otherwise, reworks can be very costly.
6. **Training of staff to follow new process** – once the systems are ready to go, staff should be trained in the new processes to extract the benefits of the system as originally planned.
7. **Evaluate the success of implementation** e.g. positive or negative return.

Having a deployment model does not mean that the technology will be accepted (Hossain & Prybutok, 2008 ). A true adoption requires the buy-in of staff that uses the system on a daily basis, because it is them that generate the efficiency benefits from

the system (Cheung, Choy, Lau, & Y.K, 2006). For successful deployment, it has been suggested that users are given the chance to understand how these changes will impact them, and even provide collaborative feedback in areas where they think that it might reduce efficiency (Leong, Ng, & Cole, 2006 ).

Past experiments such as the one with Wal-Mart have demonstrated that RFID implementation also requires collaboration with suppliers as they are the ones that supply the products (Cheng, 2007). It has been shown that not all suppliers are able necessarily to meet the expectations and the required support from the company requesting the change. Moreover, it demonstrated that the more expansive the supply chain is (e.g. across different countries), the harder it is to manage the deployment. Ultimately there needs to be a line drawn as to what is feasible and what is unachievable.

#### **2.4 User Behaviour Review**

RFID will undoubtedly have an impact on the users of the system. Such users of the technology may be the IT staff in charge of maintaining the business infrastructure and systems, the operating staff that scan the items, warehouse staff who tags the items, the finance staff who relies on the correct data being collected by the system for financial reports.

Therefore it is important that before any decisions are made, all users are consulted

to ensure that they buy into the project (Dontharaju et al., 2009). This is an important exercise in project management because if the final user is unhappy about the changes taking place, it can cause unwanted problems in the longer term. User behavior reviews can be made using the following steps (Jones et al., 2006 ; Konomi & Roussos, 2007 ; Pagey, 2008 ):

**User consultations / collaboration** – this can take the form of meetings with users to take them through the processes of change, how it will impact them and give them a chance to contribute their comments and ideas. This is to get an initial response from users and generate a buy-in.

**User testing** – before the system is live, it is best to have users test the new system so that any fine tuning can be made and also to test for bugs and glitches.

**User review of the new system** – after the system is implemented, it is generally a good idea to get user feedback on the new system. This will enable the management to assess whether the system is having the desired impact an efficiency/productivity and cost savings.

Having user input throughout the process will eliminate adverse impacts in the long run and will ensure that users are happy with the system in order to fully realise the potential of the new system.

There are many different industries that deploy RFID some more successfully than others. Even though the number of applications of RFID has already greatly exceeded the creators' initial vision for the technology, new kinds of applications keep appearing.

*Examples of deployment:*

**In airports:** uses of RFID in airports are mainly in the area of e-passports. Where travelers who have e-passports can have their passports checked and validated automatically without having the official keying in the passport number and may also provide information such as visas for other countries etc. (Kim, Shin, & Park, 2007 ). This process will speed up processing times at airport immigration and reduce queues to create a better travelling experience. RFID was also used for baggage handling in airports (Kim et al., 2007 ; Paise & Vaudenay, 2008 ).

**In supermarkets:** uses in supermarkets are generally in the area of inventory control. Assuming that all products on the shelf and in the storeroom are RFID tagged, the store is able to determine the inventory count of the store with ease and with minimal staff input, it can also be used to alert the store manager that a certain product is running low and needs to be restocked. This type of control reduces storage space for stock and improves cash flow (Potdar et al., 2007 ).

The most common applications in supermarkets are the prevention of theft by activating the alarm when someone tries to leave the premises without having the item disabled at the checkout (Dong et al., 2007). This is a very useful tool for loss prevention of high value stock. Other applications linked to supermarkets or any type of merchant is the contactless cards where goods can be purchased with a card containing RFID chips with a dollar value loaded onto them for purchasing items in store (Lee, Cheng, & Leung, 2004).

**In hospitals:** Hospitals in Asia countries such as Singapore have implemented RFID to better manage patients and improve service levels (Vanany, 2008). This is because doctors and nurses need accurate up to date information about a patient and this can be done using RFID tags assigned to each patient containing the patient's personal details, medical history and treatment history, e.g. the last bandage change etc (Mun et al., 2007). Reminders can also be set that alert hospital staff when a patient requires following up and enable doctors and nurses to provide more effective diagnosis and treatment. These hospitals have also tagged the equipment that they use to improve the tracking of equipment within the thus hospital reducing waiting time and ensuring that the correct equipment is available for the treatment.

**In transportation:** Countries such as Japan have adopted RFID in its transport infrastructure, where commuters can travel on different modes of public transport by using transport cards that have a preloaded balance for use in subways, buses, taxis

and so forth (Technol & Dev. Agency, 2007 ). Toll collection is an application of RFID where drivers no longer have to wait for the operator to collect money before raising the bar thus saving time and reducing queues.

**In manufacturing:** manufacturers such as Beoing have adopted RFID technology particularly in assembly operations to ensure that the parts ordered and supplied to a particularly plane are ten correct ones, and also to ensure that they arrives in time for assembly (Juels, Rivest, & Szydlo, 2003 ). As a result of this, Boeing is able to track productivity and reduce inventory costs and minimize errors in parts therefore preventing reworks (Lee et al., 2004). This has greatly improved assembly line productivity for Boeing, and in some cases requires fewer personnel to do the work because the process is so efficient.

**In tracking:** RFID can be used in tracking animals whether they are domestic pets or animals out in the wild. Such applications can be used to track dangerous dog breeds to make the owners liable for any harm caused to innocent third parties or be applied to track endangered animals in the wild to keep count on the population and ensuring its survival (Nguyen, Kobsa, & Hayes, 2008). It has also been suggested that prison inmates be tagged in order to improve security risks and prevent prisoners from escaping. The technology has also been used in the monitoring of prisoners that are released on parole to prevent the breaching of parole conditions (Min, Wenfeng, Zhongyun, Bin, & Xia, 2007).

**In security:** applications in security have been around physical access to buildings etc. Another security application as pointed in chapter 2.2.1 is the for vehicle, where ignition can only be activated if a key containing the correct RFID tag is scanned (Gao et al., 2004 ). Even though this is a relatively new concept, there is no doubt that we will see more and more of this technology being applied to the automobile industry (Phillips, Karygiannis, & Huhn, 2005 ).

The above are only a few of the applications of RFID. The range of its uses is so broad that anything is possible, ranging from vehicle security to tracking miners, e-driver licenses, security access and so forth, the list just goes on.

## **2.5 Use of the RFID technology in retail businesses worldwide**

In assessing the similarities and differences between retail operations overseas and in New Zealand, one must not only assess the regulatory and commercial environment between the two countries, but also the size of operation and differences in the market fundamentals. Therefore, the comparison will be made based on the following factors:

### *Size of the retailer operations*

It is a fact that most businesses in New Zealand are small compared to countries such as United States or Asia. In this regard, these larger corporations will find it much more beneficial to implement RFID due to the benefits that can be realised in utilising

such technology (Chaves et al., 2008 ).

For better comparison, a typical corporation overseas may have over 100 stores across the whole country and have over 1 million product lines or Stock Keeping Units (SKU). Contrast this to a New Zealand operator with 20 stores and two hundred thousand product lines. The benefit in terms of labour cost saving during stock take is more in the larger corporation in comparison to the one operating in New Zealand. Another aspect is the reduction in storage area and loss sales due to products out of stocks (Raman, DeHoratius, & Ton, 2001).

As a result, even though the fundamentals of the business are the same, the realisable benefits in dollar terms are drastically different, and are probably one of the reasons why companies in New Zealand have not adopted the technology.

### Market Assessments

This assessment is linked to the size of retail operations. Every market is driven by the population of consumers within each regions catchment zone. For instance, the size of the Auckland population is only just over 1.27 million covering 6,059 square kilometers, but compare this to countries like Japan, where its city Tokyo alone has 35 million people across an area of just 13,500 square kilometers (Azuma & Fernie, 2001).

Given the differences in population density, the likely benefits of implementing RFID are less beneficial in countries with low population densities. As an example, RFID used in transportation is more appealing given the number of consumers and the time and cost savings involved where commuters would swipe their RFID cards rather than lining up to buy tickets as they get onto a bus or train (Hossain & Prybutok, 2008 ).

This means that the bigger the market, the greater the realizable benefit of RFID, e.g. for every dollar of investment, the potential dollar of return is greater whereby ROI is a major factor in the decision making process concerning the adoption of RFID (Huber & Michael, 2007 ; Ketprom et al., 2007 ).

Therefore, countries like Japan with a high population density will benefit more than New Zealand which has a low population density. Using public transport as an example, the number of people that would use RFID transport cards within a 30km radius would be significantly higher in Japan in comparison to New Zealand. Thus, the realizable benefits are much greater in the Japanese case.

### *Business Models*

Business models between countries will vary even when they are operating within the same industry. For retail, the business model is to maximise sales and profit but also has the aim of retaining customer loyalty (Wamba, Lefebvre, & Lefebvre, 2006).

Many retail operators such as Wal-Mart place an emphasis on ensuring customer

satisfaction. This philosophy is not different to many New Zealand retailers.

Sales maximisation is achieved by understanding what drives your customers to buy your products, and to also understand their spending patterns, which in turn drives the promotions and marketing campaigns (Chaves et al., 2008 ). This type of marketing is achieved through using RFID for companies like Wal-Mart where RFID will help retailers provide the right products at the right places and at the right times. Ultimately, it will achieve maximising sales and profits. However, as most New Zealand retailers do not have access to RFID, the analysis is done using loyalty card schemes. In some supermarket environments, RFID technology has been built-in into the loyalty card, in order to improve product tracking service and e-payment service (Smith, 2008). Maximising sales is one objective, but reducing cost and improving efficiency is also important, and RFID can assist to achieve this outcome, particularly in supply chain management.

In summary, the motivators of retail operations overseas using RFID do not differ too much from those in New Zealand, although there are significant differences in terms of the size of market and size of operations (Willis & Ortiz, 2004).

## **2.6 Role of Government**

The New Zealand government would be interested in RFID applications in retail due to the efficiency gains that can be realized. These gains are anticipated to translate into lower cost of goods for end consumers and improved spending power which is

beneficial to the economy (Tan & Foo, 2006).

Having an RFID industry would not only create jobs and tax revenue for the government, but would assist New Zealand manufacturers and exporters to realise efficiency gains to make New Zealand's exports more competitive in the world market (Aitoro, 2005).

In summary, the motivators for overseas retail businesses using RFID do not differ too much to those in New Zealand, although there are significant differences in terms of the size of market and size of operations.

## **2.7 New Zealand Case Studies**

This section describes and analyses four case studies of RFID use in New Zealand businesses.

### *2.7.1 EastPack – Kiwifruit Packer (Ferret, 2009)*

#### Brief description of the case

EastPack is in the business of providing packing and warehousing solutions for New Zealand kiwifruit growers for export around the world. The company has numerous performance targets set by its overseas business partners and any breach of targets would result in hefty penalties. Targets include on-time delivery targets and quality targets of which it had already incurred significant penalties of \$250,000 to \$280

million per annum respectively prior to implementing the RFID technology.

### Outcome of the implementation

Since its implementation, the company has reported immediate delayed delivery penalty reduction from \$250,000 to nil and its quality penalty has dropped from \$280 million to just around \$100 million, which is considered to be a very significant achievement within the first year of implementation. It has also achieved significant saving in its operational costs, e.g. 33% reduction in forklift capital expenditure due to improved efficiency.

Other than financial gains, it has improved the working environment for staff as warehouse managers spend less time looking for stock and more time on improving productivity. This reduction in stress levels has also reduced staff turnover for its warehouse managers.

It has also meant that the company can shift their focus in locating pallets and improving its quality assurance objectives.

### What are the impacts?

The impacts to EastPack upon RFID implementation are associated with end user behaviour, primarily its forklift drivers. RFID is seen by them as a way to track their movements and to record information such as the staff member loading a particular

pallet of fruit, the time and date. This means that they are potentially exposed if damage occurs to the fruit whilst in their care.

To avoid this, most drivers would attempt to turn off the equipment to prevent their movements from being tracked, therefore loss of visibility of stock may occur. However, upon recognition of this problem, management has attempted to create buy-in from the drivers by attempting to make them appreciate the benefits that the system could bring to their work, e.g. reducing the time spent locating a pallet.

#### Issues from this Case

This case demonstrates the ROI justification for companies in implementing RFID in their supply chain. Even though the payback and ROI period may be different for different businesses, this study showcases the realisable value of RFID for companies contemplating the adoption of the technology.

#### Conclusion

In conclusion, the EastPack's example demonstrates that RFID implementation can be extremely profitable, and the ROI definitely justifies its implementation. However, as pointed earlier in issues from this case, this return on ROI can be different across different companies due to differences in business processes and models.

#### *2.7.2 Libraries (Scoop, 2009)*

### Brief description of the case

Several libraries in Auckland have undertaken projects to re-catalogue their collection using RFID tags. In contrast to most profit-oriented businesses, the objective for libraries are improved efficiency such as processing time and improved customer experience. Staffs now spend less time on processing items and more time interacting with customers.

### Outcome of the implementation

Implementation of the technology has meant that the library is able to reduce processing time and offer customers the option of self checkout where they are able to process several books at once compared to the conventional method of scanning the barcode of each individual item.

The library has also improved the way the books are retrieved and the ease with which a stock take can be undertaken. Staffs are able to identify whether a particular book is out of sequence simply by running the RFID scanner across the shelves.

### What are the impacts?

The impact of this technology is the improved one-to-one customer interaction and results have shown that this is an important factor for a library. Other impacts are around the improved security and the ability to locate a misplaced book efficiently.

Job satisfaction for staff and working environment is improved as a result of the introduction of the technology.

#### Issues from this Case

This case shows the non-financial benefits that RFID can bring to non-profit organisations like libraries such as improved service quality and customer satisfaction.

#### Conclusion

In summary, it is seen that RFID in libraries is a very efficient way to maintain the large collections of books effectively, allowing more one-to-one interaction with customers which is regarded as an important factor by many library users.

#### 2.7.3 *Yakka Apparel (Istart, 2009b)*

##### Brief description of the case

Yakka apparel is a primary supplier of clothing, sleeping bags, and boots to the New Zealand Defence Force including the Army, Navy and the Air Force. It also supplies products to the NZ Fire Service and Aviation Security Services.

In the past, the company employed a labour intensive process of manually recording the fitting sizes of all Defence Force personnel and manually creating orders into its systems. This process is prone to data entry errors and is inefficient when there are

large numbers of officers that need to be fitted.

The new RFID system involves a unique RFID wristband being designated to a Defence Force officer and each item of clothing is tagged with an RFID tag. Once the officer has tried on clothing that is suited to his/her size, the system scans the RFID of the clothing and the officers unique RFID, recording such information as the officer and each size of clothing and creates a purchase order to the Defence Force.

#### Outcome of the implementation

The outcome of the implementation is a process that is accurate and fast in comparison to barcode technology, where individual items of clothing are scanned into the system. In comparison, the new system is able to scan all items simultaneously, including under garments.

#### What are the impacts?

The main impacts to Yakka and the NZDF are the efficiency gains as a result from the lead time reduction from fitting, to raising an order to delivering of the product.

#### Issues from this Case

This case demonstrates the efficiency gains that RFID can bring to the supply chain of many businesses, including the high levels of accuracy and automation that can be realised.

## Conclusion

In conclusion, Yakka's initiative to implement RFID is beneficial to both the company and its customers (NZDF) in terms of reduction of both labour hours as well as errors and improved lead time for deliveries.

### *2.7.4 Farming (Istart, 2009a)*

#### Brief description of the case

The case demonstrates the applications of RFID in New Zealand's farming sector by using individual RFID tags to identify a single animal and to record information such as weight, age and so on.

This process will enable a farmer to easily draft each cattle as they pass through the weighing station and the RFID reader. This reduces the need for farmers to manually draft animals and also assists to reduce human errors.

The ability to individually manage stocks will lead to better prices being commanded in comparison to flock management where prices are determined based on the overall condition of the flock.

#### Outcome of the implementation

The farmer, through the use of RFID, is able to single out stock that is parasite-resistant to assist in breeding parasite resistant animals. The technology has also improved efficiency in grading/drafting of farm stocks, for breeding higher quality stocks and for greater profit margins.

Having individual animals tagged will assist in accounting for the neck as the farmer will know exactly how many animals are on hand at any point in time, their age and weight for better stock management and demand planning.

#### What are the impacts?

Impacts from RFID adoption is in the added value of RFID in farming. It is anticipated that the ability to micro-manage farm stocks will increase the sale value in the market place as a result of improved animal quality, for example, tenderness, improved fleece grading and so forth.

#### Issues from this Case

This example has shown that the RFID technology has the ability to create added value for animal-farming, although the case study does mention that the cost of individual tags need to be lower than \$1 per unit for the concept to be viable. However, given technology advances, RFID will become the mainstream technology in farming given the correct factors.

## Conclusion

It is shown that RFID in farming has many positive benefits with the main being improved stock quality and increased value per unit. Although barriers are present in the adoption of the technology such as cost. It is envisaged that in the near future when cost of investment is reduced, RFID in farming will become a reality.

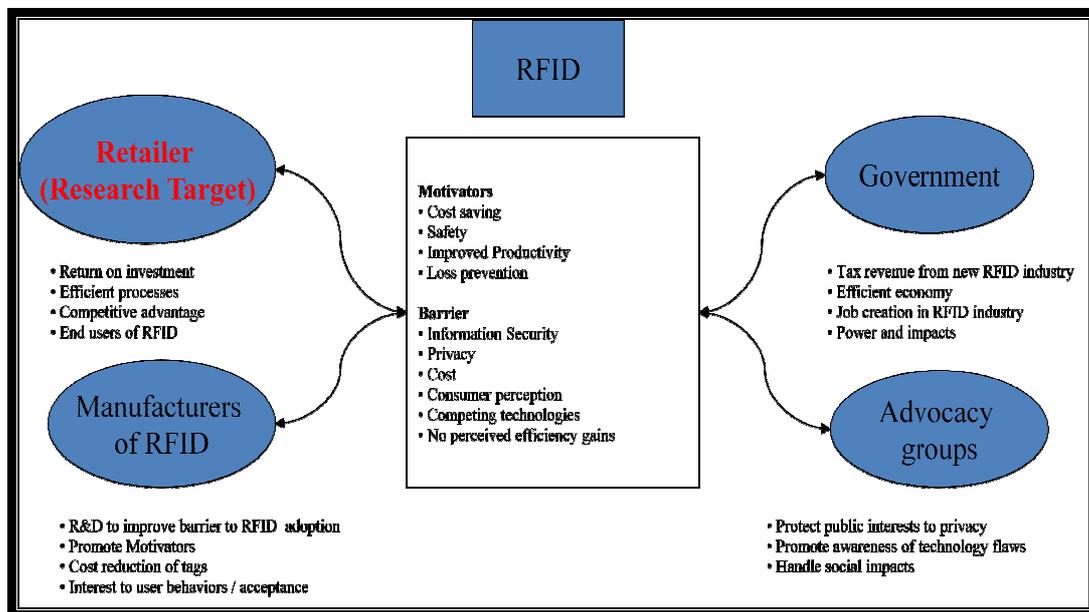
### **2.8 Identify Research for New Zealand Retail Sector**

The motivators of retail operations overseas using RFID do not differ too much to those in New Zealand, although there are significant differences in terms of the size of market and size of operations. The main application of RFID in New Zealand is in the areas of supply chain and inventory management, where increased efficiencies and cost reduction are the main factors influencing the adoption of the technology.

Apart from that, the main focus of this research is to evaluate the viability of New Zealand businesses in implementing RFID into their retail operations. The following is an outline of the research model and analysis for achieving the desired outcome.

Firstly, I identified the stakeholders and interest groups. I also outlined the research objectives in order to answer the two main questions about this research topic. These two questions are: 1) What are the main motivators and barriers for the deployment and adoption of RFID in the New Zealand retail sector and which factors will compel a retail operator to implement RFID technology; 2) What are the retailers'

expectations from the implementation of RFID technology? Moreover, it is valuable to evaluate the business operations e.g. the value/supply chain and where RFID may contribute towards efficiency and cost savings; financial analysis to determine whether RFID will provide a positive financial outcome; finally I build a research model and assesses the outcome. Figure 2 depicts the proposed research model for this study.



**Figure 2 – Research Model: RFID Stakeholders and Deployment Requirements**

In this model, retailers, governments, RFID service providers and advocacy groups are the stakeholders identified for the research study. The main purpose of the study is finding out the deployment motivations and barriers for RFID technologies in the New Zealand retail sector. The literature review for this dissertation shows that no previous research had been done on the use of RFID in the New Zealand retail sector, although some studies had examined RFID deployment models overseas. The outcomes of the interviews provide some insights from the New Zealand retail

industry. This is a unique research study and its contribution would be to outline a requirement model for using RFID in the retail sector (or SMEs) in New Zealand. This model might also be applicable to other sectors. The following section will describe and explain the research design and methods.

### **3. Research Design and Methodology**

This section describes the research approach and methods that have been used for this dissertation. The objectives are reviewed and analysed, the research model is discussed and modified, and the research questions are evaluated and analysed. In addition, data collection techniques and data analysis methods are described and discussed; finally risk management for this research study is examined.

#### **3.1 Research Approach**

This research uses a qualitative research study approach in order to find out the deployment and adoption requirements (motivations and barriers) for using RFID technologies in the New Zealand retail sector. Six structured interviews were conducted in order to collect qualitative data from the retail management or business owners. Structured interviews were chosen because of potential difficulties with conversational English, and because of the desire to provide some comparative data with a small sample. Based on their insights and opinions as well as the business environment and requirements, the aim of this research is to identify some of the critical success factors for RFID deployment in the retail industries in New Zealand, and to identify whether the use of RFID in New Zealand is different from other countries.

#### **3.2 Objectives Review**

This section takes a further step to analyse the research objectives I - VIII that were

identified in the Chapter 1, and that need to be completed in this qualitative research study.

*Objective I:* From the literature (Literature Review / Research Background) I have attempted to identify the relevant stakeholders. The research attempts to confirm that this is correct by using data from the interviews.

*Objective II:* To investigate the supply and demand of RFID technology. The demand and supply of RFID technology for NZ retail sector is also important. The aim of this objective is to analyse the motivation for this research study.

*Objective III:* To investigate the context and cases of using RFID in the retail sector. It involves three case studies from literature and describes and analyses the motivators for RFID adoption in New Zealand.

*Objective IV:* To examine the existing deployment and adoption model for RFID technology. It is extremely valuable if some retailers can provide some real life examples or successful deployment models for RFID technologies. Similar to the previous point, I attempt to obtain some insights, with the purpose of drawing conclusions for both technical and business perspectives, through the interviews with the participants.

*Objective V:* To identify the motivations and barriers for using RFID technology. This objective is related to the research questions for this research study. In order to find out correct answers to the research questions, research design and methods should be used appropriately. Furthermore, it is strongly recommended that risk factors are carefully identified and possible solutions are proposed.

*Objective VI:* To assess the cases of using RFID technology in retail or other relevant sectors. Based on the deployment and adoption models mentioned previously, this research study collects data related to cases of using RFID in retail sector from both the literature review and the conducted interviews.

*Objective VII and VIII:* To review the user behavior and expectations of using RFID technology, where users are viewed from the point of view of the retailer, rather than the customer. User behavior and expectations are vital terms for assessing the user acceptance of technology such as RFID. I focus my research scope to the area of the retail sector in New Zealand, which allows me to make more specific conclusions for user behaviors and expectations of the use of RFID technologies. Direct research questions are asked to the participants in the interviews, and the responses are used to draw out a summarised statement.

By reviewing the research objectives, it is concluded that the aim of this research is to identify some drivers and barriers to the adoption of RFID in the retail sector in New Zealand.

### 3.3 Research Model Analysis

Section 1.5 identified the main stakeholders that would be interest in the research outcomes; also, the possible terms to the motivations and barriers for using RFID technologies were outlined. The designed research study aimed to investigate RFID deployment requirements, including motivations and barriers for using such technology, in particular in the New Zealand retail sector.

#### 3.3.1 *Stakeholders / Interest Groups*

This section examines the stakeholders and interest groups identified in the research model previously. These stakeholders have direct or indirect relationships to RFID deployment in the New Zealand retail sector; however, all of them would have some interest in the research outcomes of this study.

In this study it is assumed that retailers are the user of the RFID technology as they will decide whether the technology is purchased and used in their business. The main goals of this dissertation are to collect and analyse empirical data in order to understand users' expectations of using RFID technologies, to identify factors that will influence their intentions of using RFID technologies, and to understand the impacts of using such technology. Therefore, the research study plans to conduct multiple interviews with this stakeholder group, and it is expected that the outcomes from the interviews can be analysed and will answer the research questions.

### 3.3.2 *Research Objectives*

This section describes some factors that are related to motivators and barriers for the RFID deployment and adoption. There are two major terms linked to the requirements analysis: motivators and barriers. Some of the terms have been identified in the reviewed literature; however, these terms are not particularly related to the NZ retail sector. This research study conducted several interviews with the RFID end users in the New Zealand retail sector, in addition it tried to find out the specific requirements of deploying RFID in this particular industry sector; therefore the outcomes may have some terms that have identified in other literatures, and we expect more terms are identified from the interviews And this is the primary contribution of this master dissertation.

#### *Motivators (Deployment and Adoption)*

There are some motivators for using RFID by businesses that are identified in chapter 2 in the reviewed literature: cut the operational cost (long term), improve safety, enhance productivity and prevent loss. Several business examples were examined and some useful research outcomes were drawn from the literature and supported with empirical data. However, it is difficult to measure the success of using an innovative technology if it is used in a different business environment (e.g. New Zealand retail sector), thus more and different motivators may be found as part of the outcomes of this research.

#### *Barriers (Deployment and Adoption)*

Similar to previous section, there are several barriers to deploying and adopting RFID

technologies in business environment. These factors may or may not be applied to the New Zealand retail sector. However, in my point of view, New Zealand market has its particularity, that is most of the NZ business are SMEs (Small and Medium Enterprises). Thus the outcomes of this research may apply to New Zealand retail sector, as well as the New Zealand SMEs sector, and perhaps can be a general snapshot of New Zealand businesses.

### **3.4 Research Questions Analysis**

There are two research questions identified previously repeated below.

A. *“What are the main motivators and barriers for the deployment and adoption of RFID in the New Zealand retail sector and which factors will compel a retail operator to implement RFID technology?”*

B. *“What are the retailers’ expectations from the implementation of RFID technology?”*

This section provides some analysis of these questions, and the expected outcomes are also stated:

Question A is concerns the requirement analysis for the use of RFID in New Zealand retail sector. When we are looking at deployment and adoption issues, RFID deployment emphasises the push direction from service providers to end users and adoption emphasises the pull direction from end users to service providers. In addition, motivators and barriers can be applied in both directions (deployment and adoption).

Therefore, the research outcome for this particular question can be a requirement framework (2 dimensional / theoretical matrices) with 4 terms as below:

- i. Deployment (push approach)
- ii. Adoption (pull approach)
- iii. Motivators (drivers)
- iv. Barriers (preventers)

### **3.5 Data Collection**

This section describes the data collection process as part of the research design; data collection approach is a critical success factor for the research study. Appropriate data collection approach allows the researcher to obtain most suitable and relevant data for answering the research questions. This research study received ethical approval issued on 27/09/2009 (see appendix I).

#### *3.5.1 Data Collection Technique*

Due to the research design, interview with retail shop owners was used as primary technique for gathering qualitative data. The interview questions were formulated as follows:

1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?
2. Does your business presently use RFID or plan to use RFID?
3. Do you know any specific RFID related application in the retail sector? If yes,

please say what they are and explain what benefits they bring

4. Do you think the cost of using RFID is higher than its expected benefit? Can you explain further?
5. Do you think RFID can improve the business performance of your company and how?
6. What are the main drivers that make you think about adopting RFID? What application areas do you think most potentially useful to your business operations?
7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?
8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?
9. What are specific requirements for using RFID in the New Zealand retail sector in your opinion?
10. What do you think is going to happen with regard to RFID used in the New Zealand retail environment?
11. What else do you want to talk about regarding this topic?

### 3.5.2 *Interviews*

Six face to face interviews were conducted for this study in Auckland from late April 2009 to mid May 2009. Invitation letters were sent to candidates, and they accepted

the invitation by signing the consent form given. The participants were chosen as they are the business owners (or managers) in New Zealand retail stores or have knowledge of the area. They should have the basic understandings of RFID technology. The participants were chosen randomly in Auckland area, and the interviewees were generally the business owners or managers of retail shops. Ethical approval was obtained from the Auckland University of Technology Ethics Committee on 07/04/2009, and AUTEK Reference number is 09/27.

### **3.6 Data Analysis**

This section describes the data analysis process as part of the research design; the data analysis approach is a critical success factor to the research study. Interviews have been taped and transcribed by the author. Appropriate data analysis approach allows the researcher to evaluate the primary data gathered from the interviews appropriately, and would also ensure a good quality discussion of the results:

#### *3.6.1 Raw Data Presentation*

The raw data is presented in the Appendix III section; however, I did some primary analysis of the data and also included a description for each case (e.g. information about the participants). The analysis of the data is not of great depth in this section as the purpose of having this section is to build a bigger picture of the qualitative research study and to demonstrate the most significant content for each case. Future sections discuss and refer to the raw data while drawing conclusions.

### 3.6.2 *Findings and Themes*

By analyzing the case contents, this section outlines all themes as research findings in this dissertation. However, the findings should be relevant to the research questions, i.e. the themes outlined here should have a direct link to the following terms:

- Deployment and adoption
- Motivators and barriers
- Expectations and behaviors

The research themes and findings are referred by the Chapter 4, in order to draw some conclusions and answers to the research questions. Also, the significance of each theme is measured by the number of participants who referred mentioned that.

### 3.6.3 *Prepare for the Answers to the Research Questions*

Answers to the research questions contribute to the solution of problems related to the use of RFID technologies in real life business environment. This study conducts a requirement analysis for using RFID in the New Zealand retail sector. In order to increase the research value, it also attempts to find out the applicability of the research outcomes; for instance, whether the research outcomes can be applied to other New Zealand business sectors, such as SMEs, since many retail businesses are SMEs in New Zealand are SMEs.

## **4. Findings and Analysis**

### **4.1 Qualitative Data Analysis**

The raw data from the interviews is summarised below by using a horizontal approach.

#### *4.1.1 Interview 1*

Mr. S is an IT manager in a Telecommunication company, which is planning to use RFID to manage their inventory and stock.

This interviewee has a good understanding of RFID technology and the different types of tags that are available on the market, such as 'passive' or 'read only'. The participant is also aware of the main benefits that can be realised by utilising the technology, such as:

- Security and shrinkage prevention where unauthorized removal of goods beyond the security scanners will trigger an alarm, making it a deterrent for thieves;
- Improved efficiency of stocktaking since it can be performed quickly or with minimal labour hours, not to mention the accuracy of the results;
- Improved supply chain planning due to better visibility of stock on hand at any one time, accuracy of orders dispatches and minimised out of stock or stock misplacement.

However, the participant is reluctant to adopt this technology at present with the main barrier being the cost of implementation. The participant also states that he would implement the technology if his suppliers also adopted the technology within their

supply chain which would provide even greater supply chain benefits to both parties.

Other suggestions from the participant are around reducing the retail costs of goods. For instance, if a supermarket were to implement such a technology, it would reduce the checkout labour and inventory management costs which he believes are a major component of costs. It would then help reduce the cost of our daily grocery shopping. In terms of government intervention, the participant is of the opinion that Government should not play a part in the technologies adoption, but rather let market forces dictate it.

#### 4.1.2 *Interview 2*

Mr. J is a retail store owner selling mobile phones and related equipments. He has particular interest in security and reducing loss.

This participant has a relatively good understanding of the RFID technology in terms of the type of information that can be stored on the tags compared to that in the barcode and also its applications to retail and supply chain management such as supermarkets.

He is also aware of the potential efficiency and cost saving gains for supermarkets, where in his opinion, the processing of grocery will be near instantaneous, hence reducing queue time for customers and checkout labour costs. This would improve

customers shopping experience and satisfaction along with increased productivity and cost reduction for the retailer.

But these perceived benefits are not enough to make him adopt the technology for his business, purely due to the cost of implementation and operation. However, his company will conduct further studies and research to evaluate the technology for future applications to its retail operations.

The participant is also of the opinion that the Government should play a part in promoting the technology and encouraging its adoption. He believes this would increase productivity which would be beneficial to the New Zealand economy, particularly in the current economic environment. However, he also believes that the Government would need to carefully evaluate the ROI generated from its intervention before making the decision to promote the technology. He also believes that one of the critical success factors for adoption and acceptance is through public education around the benefits of the technology and how it could improve their daily lives.

#### 4.1.3 *Interview 3*

Miss W is an IT officer in a retail warehouse. Her business is planning to use RFID for tracking goods and assets.

She has fairly good understanding of the technology and its applications to retail and

supply chain. She suggests several applications of the technology in areas such as:

- Automatic charging – automatic scanning of multiple products using RF signals without the need to scan each item's barcode separately;
- Anti-Counterfeiting – prevents illegal counterfeiting of products;
- Logistics Management – track the movement of goods from the supplier into the warehouse or to the retail store;
- Better visibility of arrival time for better operational planning;
- Warehouse Management – improved stock visibility in the warehouse, reduced stock take costs, improved stock accuracy and more efficient stock management.

Her business currently does not use the technology with the main reason being the high cost of implementation in comparison to the benefits generated. However, she is very keen to adopt the technology given the right factors.

The main reason why she is very motivated to adopt the technology in her business is due to the perceived benefits and the contribution that it will have to the bottom line of the business, such as:

- Product tracking and security – it is perceived that RFID would greatly reduce loss through shrinkage or stock misplacement. This is particularly important for high value products;
- Process efficiency – the technology could assist in reducing the time spent looking up books and documents saving valuable admin hours for more productive activities.

In addition, she is of the opinion that the government should be involved in promoting the technology. Also, businesses would benefit from its adoption through improved profits and productivity, which in turn would be beneficial for both the government (in the form of taxes) and the consumer (through lower cost of goods).

#### 4.1.4 *Interview 4*

Mr. C is a retail business owner and his business is involved in some international trading. He has a relatively good understanding of the technology e.g. active and passive tags and the components used in their manufacturing. He is also aware of the benefits of the technology and its applications to industries such as airports, libraries and retailers.

Although his company does not use the RFID technology. Cost is cited as one of the main factors for not adopting it as it is pointless adopting the technology if the costs of the tags exceed the cost of the product. His other concern is the stability in the performance of the tags.

In his opinion, the benefits of RFID applied to the supermarket context are:

- Automatic scanning of goods: no need for the operator to scan each barcode individually;

- Product information: since information about the product is stored in the tags. The RFID technology can protect the company's reputation through the prevention of counterfeit products;
- Improved supply chain management: mainly in the areas of stock control and dispatch accuracy.

The participant is also of the opinion that the government should not only play an active role in the technologies adoption, but should also legislate to prevent inappropriate uses of the technology (e.g. information theft).

He also points out that most tags are not reusable and will in turn have an impact to the environment. In his opinion, this is an area that needs to be addressed and the government should play a part in this.

#### 4.1.5 *Interview 5*

Mr. S is a retail shop warehouse manager.

The participant has a relatively good understanding of the technology in terms of the type of information that can be stored on the active or passive tags in contrast to the barcode currently in use.

He indicates that many retail businesses utilise RFID technology in the areas of loss prevention, and this is one the main reasons why his company has adopted RFID. However, he is aware that RFID has many other benefits and applications and will conduct further research on future applications in the areas of inventory tracking and

management within his organization.

His understanding is that a supermarket is the ideal business where RFID would have the most impact in terms of efficiency gains at the checkouts and better inventory management in the retailers supply chain through improved stock takes and shrinkage/loss prevention.

Although the cost of the RFID technology is high at present, increases in demand will eventually reduce the cost of tags as more businesses adopt the technology. However, he also believes that in order for more business to adopt the technology, issues surrounding information security need to be addressed.

Lastly, he thinks the government should play a part in promoting the technology through education, legislative support about unlawful uses of RFID and R&D investment to improve the technology.

#### 4.1.6 *Interview 6*

Mr. A is an associate professor at a university and specialises in the field of retail studies. He has a strong background in retailing and consumer behavior.

The participant understands the RFID technology relatively well including its for tracking inventory at the Stock Keeping Unit (SKU) level for better inventory visibility and management.

He believes the companies do not use the technology due to its high cost in comparison to barcode. He acknowledges that there are benefits of the technology in the areas of shrinkage and loss prevention, supply chain and inventory management. He is motivated to adopt it if it can be proven that RFID will provide benefits in the areas of inventory management, where further research is needed.

He is also knowledgeable about its application for retailers like supermarkets and the benefits that can be derived from not only efficiency gains in its supply chain and operations, but also for the understanding of customers' shopping habits through tracking their movement patterns for a more effective marketing strategy.

Even though there are many cited benefits that RFID could contribute to an organisation, the participant is of the view that adoption is only feasible if the value creation exceeds the cost of implementation, effectively ROI.

He does indicate though that the added value of the technology is the need to understand a business in more detail (e.g. analysing shrinkage, space management etc). For example, the ability to trace an individual item back to its supplier or grower for improved visibility on quality control.

In addition, he points out that at present retailers are effectively replacing one technology with another one, that effect performs the same functions for with a higher

cost. Therefore, any benefits gained are eroded by the high cost of the technology.

Also, he is of the opinion that there is simply not enough volume demand to justify adoption (e.g. economies of scale) given the size of business in New Zealand.

In summary he concludes that there are three factors influencing the adoption of the technology:

- Customer demand – demand for the technology in retail or other applications;
- Volume of distribution – size of business operations;
- Coherence with Australia – RFID standards in line with Australia, allows for more efficient flow of goods between the two countries.

Overall, there are similarities and differences in responses from the 6 participants in terms of how they view the technology and its application to their organization.

#### **4.2 Research Findings and Themes**

The following section will analyse the results from the interviews in relation to a few significant themes for RFID adoption in organizations. Table 1 shows the identified themes and their occurrences in the conducted interviews:

Themes	Interviews						Total
	1	2	3	4	5	6	
Cost	✓	✓	✓	✓	✓	✓	6
Security & Loss Prevention	✓	✓	✓	✓	✓	✓	6
Inventory Management - Stock take	✓	✓	✓	✓	✓	✓	6
Supply Chain productivity	✓	✓	✓	✓	✓	✓	6
Benefits to justify costs (ROI)	✓	✓	✓	✓	✓	✓	6
Public Education is important for technology adoption and acceptance					✓	✓	2
Government should drive adoption	✓	✓	✓		✓	✓	5
Volume of distribution (size of business)				✓			1
Lower cost of goods	✓						1
Security of information						✓	1
Environmental effects				✓			1
Manufacturer to implement RFID	✓					✓	2

**Table 1: Research Themes in the Conducted Interviews**

#### 4.2.1 *Cost*

All six participants cite cost as being an important factor in their decision to adopt the technology in their organisation, with most respondents indicating that further study and research is required to determine whether it is feasible to adopt.

In most participants' opinions, cost is one of the most important factors for the RFID technology success to several reasons:

- **Capital Investment:** New Zealand is a country with small to medium size enterprises that have limited access to capital funds. As such, most are unable to provide the upfront capital to implement the solution.
- **Competing technology:** the current competitor to RFID is the barcode, which is a standard used by nearly all organisations in New Zealand and is significantly cheaper. Hence, this makes investment in RFID unlikely, even though there may be many potential benefits.

#### 4.2.2 *Security & Loss Prevention*

All six participants mentioned loss prevention to be one of the motivators in its adoption with one participant having already implemented the solution solely for this purpose.

It is clear that although loss prevention is an important factor, it is unlikely that an organisation would implement the solution solely for this purpose. This is simply due to the fact that there are many more cost effective ways that loss prevention can be managed without implementing an RFID solution.

For example, current practice around loss prevention include better internal control processes, video surveillance, re-arranging store layout or introducing locked display cabinets to reduce theft (particularly for the high end products). These are all very cost-effective and generally one-off cost solutions to minimise loss through shrinkage.

Having said that, in retail operations such as supermarkets where margins are low, the loss of one product through theft would mean that the retailer would have to sell additional 10-20 items of the same product to breakeven.

In this regard, loss prevention can be seen as a critical motivating factor for the adoption of RFID in the absence of a better cost effective solution. However, this

motivator would be different amongst various businesses due to the nature of their operations and setup. Once again, RFID should not be seen as a one-size-fits-all solution for loss prevention.

#### 4.2.3 *Inventory Management and Stock take*

All six participants mentioned efficient and accurate stocktaking as an influencing factor for adoption. This is due to reduced stock take times, improved stock visibility at any point in time and improved accuracy in stock numbers.

Therefore this is a relatively important factor but the decision for adoption would still be dependent on the size of the organisation due to the cost of implementation relative to the benefits achieved, in particular cost reduction. For example, an organisation such as a supermarket that has millions of units of products in its warehouse and stores will benefit more from a cost-saving perspective (such as labour hours in counting stock and processing the results into the system) compared to a company with 3 stores and only 10,000 units. The difference in labour savings between these organisations can be very significant.

#### 4.2.4 *Supply Chain productivity*

All six participants agree that the technology would provide supply chain benefits in terms of greater efficiency and productivity in their warehouse operations. This could include things such as accurate stock visibility and accurate dispatches, improved order processing and reduced misplacement of stock.

It also comes down to the size of the organisation in order for it to become a critical factor in an organizations decision to adopt the technology. As pointed out in section 2.1, this is due to the fact that supply chains can be a very complicated operation and not all organisations can benefit from RFID. For example, a clothing manufacturer in comparison to a farmer or supermarket would derive different benefits within their supply chain when utilising the technology. In this regard, even though supply chain productivity is a factor, it is not a one-size-fits-all for organisations contemplating the technology.

#### *4.2.5 Benefits to justify costs (ROI)*

In all six interviews the respondents indicate that in order for the technology to be feasible, it has to satisfy the benefits criterion relative to the investment, also known as the ROI. This criterion has been mentioned in numerous literature sources and is the basic principle of capital investment for many organisations.

The ROI is intertwined closely with the cost factor mentioned above. As such, any benefits that can be realised should exceed the cost of investment. In addition, all six respondents affirmed that when the cost of implementing such a solution decreases, they would readily adopt the technology within their business operations.

The ROI is one of the most important factors in the decision making process on par with the cost aspect discussed earlier, as the goal of running a business is to maximise

profits. Therefore, any investment should be justified by a return in excess of the capital invested.

#### 4.2.6 *Public Education is important for technology adoption and acceptance*

Only two out of the six respondents think that public education is important in the adoption of the technology, with some respondents stating that the government has a role in promoting this.

It can be argued that one of the reasons why educating the public is important may be due to the fact that RFID is not a very well known technology in New Zealand, and consumers need to be educated about the benefits such technology can bring. For example, RFID applications in libraries means customers are able to easily locate information and self check out, or alternatively, the RFID applications in airports would mean that the chances of losing baggage are greatly reduced

However, public acceptance of the technology does not necessarily equate to the technology becoming mainstream. This is because in my view, it is the businesses and governments who dictate the implementation.

For example, a consumer going into a supermarket to buy grocery will not pay too much attention to whether a can of baked beans contains an RFID tag or barcode, they just want the product.

#### 4.2.7 *Government should drive adoption*

Five of the six respondents think that the government should play a role in the adoption of the technology. This can be in the form of providing research and development funding to improve the quality and security of the RFID technology. Some respondents also mentioned that there should be legislation surrounding the technology in the areas of unlawful use of the technology for example, counterfeiting and information theft.

Only one of the six responses is of the opinion that government should not intervene in the adoption of the technology, but rather let the market dictate the rate of deployment as it is purely a commercial activity.

It can be argued that the government should play a part in the adoption as RFID is not limited to commercial applications. Governments can also utilise this technology in government administrations such as e-passports, e-driver licenses and so on. This approach in my view would both educate the public about the technology because they will use it in their everyday lives and also drive user acceptance and adoption (Sarma, 2004).

#### 4.2.8 *Volume of distribution (size of business)*

Only one of the six respondents is of the opinion that the size of the business is a factor in the adoption of the technology. One reason could be due to the small size of their businesses, where there is limited potential for economies of scale that can be

realised in comparison to a large organisation.

It can be argued that this is a very valid argument and is closely linked to the supply chain productivity, cost and benefits (ROI). This is because large organisations are better able to utilise their size to gain incremental benefits within their operations compared to a small retailer.

#### 4.2.9 *Lower cost of goods*

Only one in six respondents states the lowering of cost as being a factor influencing the adoption of the technology. This can be due to the fact that the lowering of cost would only be realised when businesses implementing the solution can reduce their cost of production/operation in excess of the initial capital investment, e.g. lower cost of goods sold.

The remaining five that did not mention lower cost as a potential factor. This can be due to the fact that with the current cost of the technology, it would be hard to achieve lower cost of the product. In addition, any benefits derived are a gain for the business, whose aim is to maximise profits. As such, they would be unlikely to pass on these savings unless they absolutely have to.

It can be argued that the main driver of lower cost is not a major factor in businesses implementing the solution. The reason being that product prices are usually dictated by the market (e.g. supply and demand). Therefore, companies are reluctant to pass on

cost savings to the end consumer simply because the consumers would purchase the product (in the absence of substitutes) regardless of whether it is \$10 or \$9.

However, competitive pricing may be an influencing factor in the adoption of the technology to lower the organisation's cost of goods sold to match or better that of a competitor's product in terms of retail pricing or even quality. Even in this regard, it is possible that not all the savings from the solution will be passed to the end consumer simply because the aim of the profit-oriented entities is to maximise profits.

#### 4.2.10 *Security of information*

One of the drawbacks of RFID technology revolves around the security of the tags themselves, with only one of the six respondents mentioning that this is an area where the industry needs to look for a solution. This may be due to the lack of understanding in the areas of security by these five respondents or because, due to the nature of their business, it is not seen as an issue.

It can be argued that different businesses/organisations have different levels of security requirements surrounding the information stored on the tags. These levels of acceptable risk are linked to the nature of their business. For example, a bank issuing EFTPOS/Credit Cards containing RFID tags/chips would require a more stringent set of security requirements to prevent sensitive information stored on the tags being exploited by criminal groups. This is particularly important given that RFID does not

require a contact point to “skim” information from the tags, as it can be done through radio frequency at a distance.

In contrast, a clothing retailer would not worry too much about the information stored on the tags being obtained by criminals, due to the nature of the information and the potential harm that this may have towards the business.

Overall, functionality and security are seen as very important factors in RFID adoption and manufacturers and users need to collaborate and establish a standard around the security of the technology (Wua, Nystroma, Lina, & Yu, 2006).

#### 4.2.11 *Environmental effects*

Only one respondent mentions the adverse environmental impacts of RFID due to the reusability issue of the tags, therefore contributing to increased waste product.

In this regard, it is clear that is not warranted due to fact that some tags are recyclable as they can be reprogrammed to store new data. In addition, the size of the tags is generally very small in comparison to the product packaging, therefore, the environmental effects are not a convincing argument.

On the contrary, it does have the effect of competing for limited natural resources used in the production of the tags, as such it would accelerate the depletion of our natural resources such as silicone, metals etc. On this note the environmental factor is

not about the waste in disposal but the depletion of resources and how these resources are managed (Dobkin & Weigand, 2005).

#### 4.2.12 *Manufacturer to implement RFID*

Two participants mention that for the retailer to adopt the technology, the manufacturer who supplies the products to the retailer should be the one adopting the technology in the first instance. That would prompt the retailer to introduce the technology in their organisation.

It can be argued that this is a valid point, although there are several issues with this concept. There are many suppliers to a retailer all with different levels of capital investment capability and some might not necessarily be able to afford such investment. In addition, there is a competing barcode technology that is working just fine and is fully integrated into the business operations.

## **5. Discussion**

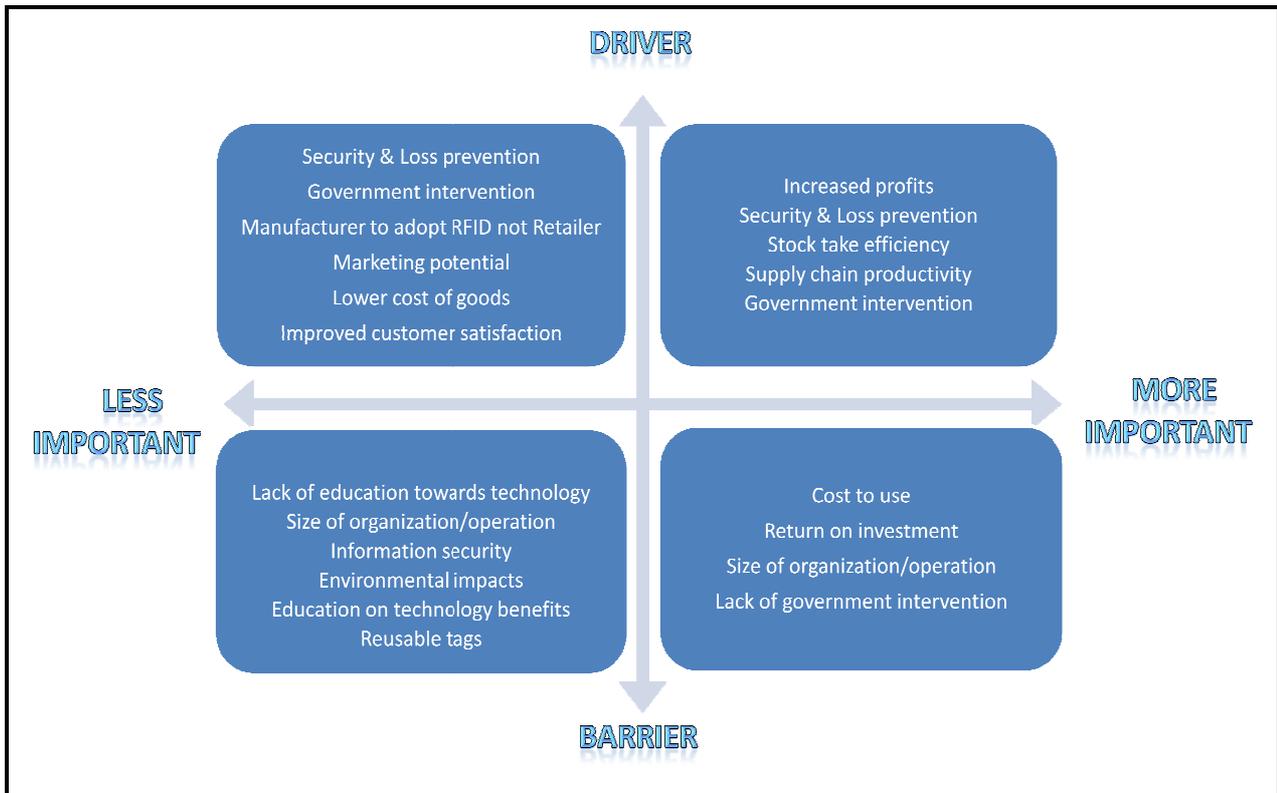
This chapter attempts to combine all research findings and to answer the two research questions. This report has combined information from various academic literatures related to the implementation and applications of the RFID technology around the world as well as the information acquired through interviews.

### **5.1 Application of a Theoretical Framework for Research Question A**

*“What are the main motivators and barriers for the deployment and adoption of RFID in the New Zealand retail sector and which factors will compel a retail operator to implement RFID technology?”*

In order to answer the above question, I will consolidate all the researched and interview information using a framework in the form of a matrix (Figure 3) to analyse barriers and motivators in the deployment and adoption of RFID in New Zealand retail sector.

### 5.1.1 RFID Deployment Matrix



**Figure 3: RFID Deployment Matrix**

### 5.1.2 Barriers Discussion

From the analysis of the data obtained from six interviews, it can be concluded that one of the major barriers is undoubtedly cost, with all participants stating that cost is an influencing factor in their decision to adopt the technology. This is due to the fact that the perceived benefits from such a solution would not generate enough returns to justify the initial capital investment.

This factor is discussed in many literature sources as being the main cause for companies rejecting the technology. The cost seems to be unjustified by the potential benefits that can be realised. In addition to the high cost of RFID, companies have

been reluctant to adopt the new technology due to the entrenchment of barcode as the preferred technology in businesses today.

Such costs include the initial research studies on the technology, the engagements of consultants, dedication of internal resources to designing a solution, training of users to use the new system and also the purchase of equipment such as middleware, servers, software and scanners. This can become a very expensive exercise for businesses that do not have the amount of funding required.

This is particularly true in times of economic downturn with one of the participants stating that due to lack of funding from the corporate headquarters in the US, they had to halt all further studies into the technology solution for their organisation.

As aforementioned, the ROI is a criterion on which all project expenditure is based and is closely linked with the cost factor in the sense that if the cost is too high, the return or benefits in excess of the capital investment is eroded to a point where there are no perceived benefit gains. The point was highlighted by a participant during the interviewing process.

The other barrier as mentioned by some of the participants is the size of the organisations that want to implement the solution. This factor was indicated by one participant as a key factor in an organisations decision to adopt or reject the

technology. This argument is valid as the larger the organisation, the greater the potential savings and benefits, such as labour cost, improved service levels, reduced theft and shrinkage relative to the cost of investment when compared to that of a smaller business.

Aside from the cost and benefit barrier associated with the technology, there are non-financial barriers towards the technology in the area of information security. This barrier is a very important factor affecting an organisations decision to adopt the technology due to sensitive information that can be placed on the tags e.g. in ePassports and eLicenses.

The results lead to the conclusion that the government has a role in providing support and guidance in the deployment of the technology, mainly in the areas of legislation and education. It is deemed important that companies or organisations that adopt this technology are given a certain level of protection from exploitation by criminals.

This aspect is important due to the misconceptions that the public have towards the technology as revealed through literature reviews, particularly if an individual's personal information appears to be at risk of being exploited by criminal groups. Therefore, it is the Government's duty to provide assurance through legislation that the right to privacy of law abiding citizens is protected.

In addition to providing legal protection to users of RFID, the government should be involved firstly in educating them about the benefits of the technology and secondly, in providing reassurance that their interests are looked after.

The last factor mentioned is the effects the technology would have on the environment around issues with the reusability of tags. This factor in my opinion is not warranted, as discussed previously, due to the size of the tags produced today but would be an issue in relation to increased use on our already dwindling natural resources.

### *5.1.3 Motivators Discussion*

Motivators are what drive business to adopt RFID in their operational processes for financial or non-financial reasons.

This study found through relevant that literature reviews and interviews data analysis. The main compelling factor driving businesses to adopt the technology is the cost saving benefits that the solution could bring to the business to maximise its profits. Such benefits range from reducing labour costs in stock takes, reducing stock on hand and warehousing costs. However, the labour cost savings should be taken in consideration relative to the size of the business, as discussed in the barriers section.

Supply chain productivity is another major factor influencing RFID adoption due to the substantial benefit potential as found from literature reviews. The solution is

regarded as the next step technology for businesses seeking operational efficiency gains in areas such as automatic stock receiving, order tracking, inventory tracking and management (e.g. stock expiry), improved service levels (e.g. reduce error on order dispatches), reduce stock misplacement and so forth.

In this regard this solution is seen to provide supply chain automation possibilities where a lot of the manual processes could be replaced by RFID. Once again, this possibility is impeded by the high cost of implementation.

In addition to cost savings and supply chains benefits, data analysis shows that loss prevention is also a reason for their organisation's introduction of RFID. However, as previously discussed, implementing the solution solely for loss prevention would not be justified in my view due to the simple reason that there are many others cost effective ways to minimise stock loss.

Even though cost reduction and operational efficiency are one of the compelling factors for introducing RFID, data analysis has indicated that cost reduction is also a factor, either to stay competition or to increase market share. Lower cost of goods can be a by-product of cost savings and efficiency gains. However, due to the fact that prices are dictated by market supply and demand, it does not necessarily mean lower product costs. In this regard, this is not considered to be a factor for implementation.

Government intervention is seen as a motivator from data gathered in the area of legislation surrounding the technology to protect the industry from exploitation and abuse, either in information theft or counterfeit goods. In addition, education from the government is also seen to be a contributing motivator in compelling adoption.

## **5.2 Business / Technical Perspectives – Expectation Analysis - Answer to Research Question B**

*“What are the retailers’ expectations from the implementation of RFID technology?”*

From the data analysis, the retailers’ expectations can be categorised in the following four main areas:

- Cost savings
- Return on investment
- Loss prevention
- Productivity

### *5.2.1 Cost savings*

From the data analysis, cost reduction appears to be one of the main expectations of businesses adopting the technology due to the benefits that can be realised through utilising the solution in the areas of supply chain management.

Such cost reductions come in the form of labour efficiency in areas of stock takes, checkout operation for retailers and inventory management. This is not an unexpected

result due to the profit maximising nature of businesses as mentioned in numerous literature sources in many fields, not just those related to RFID.

It is through this cost reduction that consumers (in some instances) get the flow on effect of lower cost of goods and improved standard of living. This is also beneficial to the New Zealand economy and other economies around the world, where increase in productivity increases the wealth of the nation.

### *5.2.2 Return on investment*

In all business expenditure decisions, the ROI is the basis of nearly all investment decisions. This is simply the nature of business where projects that can generate incremental profits in excess of the incremental costs are pursued with the goal of profit maximisation.

It is logical that businesses would not adopt the technology due to the perception that the generated benefits are not warranted by the capital investment. In addition, due to the current competing technology (barcode) being far less costly to operate and maintain, the investment argument in favour of RFID adoption is fairly limited.

Another aspect of this is that, the potential benefits require extensive study to ensure that the correct benefits are identified. Such a feasibility study could become a cumbersome and expensive exercise requiring dedication of resources, both internal and external. This may have the impact of causing disruption to the business, and

could take considerable periods of time.

### *5.2.3 Loss Prevention*

Loss prevention is the other main expectation and in one instance this is the sole reason compelling the organisation to adopt the solution. The business views RFID as the end all solution in the area of stock security to prevent loss through theft.

This expectation in my opinion needs to be reviewed in the context of the business environment where the business operates purely because loss prevention can be managed in different ways, some of them cheaper than others.

Such beliefs seem to stem from the lack of understanding of the potential of RFID technology for the organisation, apart from theft. However, a well designed operational process and physical setup of retail or warehouse space is just as useful as an RFID solution for a fraction of the cost. In such a case, implementing an RFID solution would not provide the desired effects in loss prevention if there is a lack of internal control processes within the organisation.

### *5.2.4 Productivity*

Increased productivity is another expectation from retailers as the outcome of implementing the RFID solution in the business. This expectation can be tied back to the expectation of cost reduction as productivity undoubtedly improves efficiency and reduces operational costs.

Productivity means that for every dollar of input the dollar value output is increased. Improved productivity as mentioned in 5.2.1 has the ability to lower the cost of goods sold. This factor is important due to the level of competitiveness that this will bring to the business in gaining market share. From this, it can be easily seen why this is one of the main expectations from retailers.

Overall, the underlying expectation of businesses is very simple, revolving around cost savings, loss prevention and profit maximisation. All other identified themes can be considered to be a flow on benefit expectation.

## **6. Implications and Limitations**

This research study summarised all findings derived from the conducted interviews, and built a matrix which demonstrates motivations and barriers of using RFID technologies in New Zealand retail sector. In addition, due to the nature of New Zealand businesses structure, most of them are SMEs; therefore, the matrix constructed in the discussion section can be applied to other sectors in New Zealand, for instance SME sector.

The primary contribution of this research study is outlining and grouping factors that either motivate or de-motivate RFID deployment process and user adoption behaviors, known as the RFID deployment matrix. Moreover, the research study also examined personal insights and perspectives and identified user expectations from the participating retail businesses. Four categories of user expectations were described and discussed, which provided useful point of views for the RFID manufacturer as well as the service provided. The research outcome evaluates demands for RFID technologies in the New Zealand market, and also addresses people's intentions for using RFID in the New Zealand retail sector or SMEs.

There are several limitations in this research study. First of all, due to the limited time frame, the number of conducted interviews is small, and only six interviews were conducted. Thus, the arguments discussed when answering the research questions were not extremely strong. Secondly, all interviews were conducted in Auckland and

random retail businesses were chosen as participants. Thus, the quality of the collected research data was not excellent, since some interviewees were not very familiar with RFID technologies, and only one of the interviews were currently using this technology. However, published case studies were used to try and compensate for this.

## **7. Conclusion**

This dissertation has examined the motivators and barriers, as well as the user expectations of using RFID technologies in New Zealand retail sector. Based on the literature review, several research gaps were identified as a preliminary step for the conducted qualitative research study.

I conducted six interviews with randomly selected persons from the retail sector, or with knowledge of the sector, in Auckland. Research findings and themes were outlined and discussed. A RFID deployment matrix was constructed as the primary contribution to this research study. The matrix does not only outline the factors that motivate or de-motivate the RFID deployment process, but also compiles users' expectations of using RFID technologies in the New Zealand retail sector.

More specifically, I have identified 12 possible factors and themes from the collected data; these factors are summarized in Table 1(section 4.2) and influence either positively or negatively the RFID adoption and deployment process in the New Zealand retail sector. In addition, the matrix depicted in Figure 3 (section 5.1) outlines the significant motivators for the RFID deployment in the New Zealand retail sector: increased business profits, security and loss prevention, stock take efficiency, supply chain productivity and the government intervention. In contrast, the important barriers are: Cost to use RFID, return on investment, size of organization and operation and lack of government intervention.

Further research could investigate the RFID deployment requirements (motivators and barriers) for retail businesses in other countries, or a comparative study for RFID deployment models in multi-national companies. Moreover, it would be also valuable to investigate user behavior towards RFID in some particular area, also perhaps to construct a theoretical model or framework for RFID user acceptance. Research after RFID deployment would also contribute to a better understanding of the field.

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## Appendixes:

### *Appendix I: ethical approval*



# MEMORANDUM

## Auckland University of Technology Ethics Committee (AUTEC)

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To: David Parry  
From: **Madeline Banda** Executive Secretary, AUTEC  
Date: 7 April 2009  
Subject: Ethics Application Number 09/27 **How does RFID influence the retail environment in New Zealand: an investigation of the views of the retail sector.**

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Dear David

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by a subcommittee of the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 16 March 2009 and that I have approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 11 May 2009.

Your ethics application is approved for a period of three years until 7 April 2012.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/about/ethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 7 April 2012;
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/about/ethics>. This report is to be submitted either when the approval expires on 7 April 2012 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including

any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEK grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary to obtain this.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at [charles.grinter@aut.ac.nz](mailto:charles.grinter@aut.ac.nz) or by telephone on 921 9999 at extension 8860.

On behalf of the AUTEK and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely



Madeline Banda

**Executive Secretary**

**Auckland University of Technology Ethics Committee**

Cc: XiangNan (Simon) Feng [xiafen91@aut.ac.nz](mailto:xiafen91@aut.ac.nz), AUTEK Faculty Representative, Design and Creative Technologies

## *Appendix II: Invitation letter*



# An Invitation Letter

Simon Feng  
School of Computer and Information Sciences  
Auckland University of Technology  
Phone: 021673889, Email: xiafen91@aut.ac.nz

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April 1, 2009

### **Dear Prospective Participant:**

My name is Simon Feng; I am a Master of Computer and Mathematical Sciences student at Auckland University of Technology. I intend to conduct a research study for my Master's thesis, and I hope that you would agree to participate in my research. My research topic is "How does RFID influence the retail environment in New Zealand: an investigation of the views of the retail sector". As you maybe an expert in the field, I would like to invite you to my research, in order to gain further knowledge in this area.

I would like to invite you to be a participant in my study. I will send you a list of questionnaires via email if you accept this invitation, and then you could reply me by signing the consent form attached. A face to face interview will be conducted in Auckland and it will not take you more than 15 minutes. Please let me know if you are interested to be a participant in my research.

The information gathered from you will be considered as private, I will only use it for my dissertation. Your name as well as your company name will not be displayed on my report as well. I would like to adopt your professional ideas for my research, your participation in my research is very important and I really appreciate that. If you are not the right person to be participated, could you please pass this invitation to a suitable person in your company? Your participation is voluntary, if you accept my invitation, please email me and let me know, and then I will send you the questionnaires for preparations. I hope that I will be hearing from you soon.

For your convenience, here are my personal details:

**Researcher:** Simon Feng; **Gender:** Male; **University:** Auckland University of Technology

**Program:** Master of Computer and Mathematical Sciences;

**Phone:** 021673889; **email:** xiafen91@aut.ac.nz

**Dissertation supervisor:** dave.parry@aut.ac.nz

Kind Regards,  
Simon Feng

### *Appendix III: Interview Transcription*

#### **Interview One:**

**1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?**

Yes, I am aware that the retail stores use the RFID technology to track their goods for security purpose.

My understanding of RFID is that it is short for radio frequency identification, a technology similar in theory to bar code identification. With RFID, the electromagnetic or electrostatic coupling in the RF portion of the electromagnetic spectrum is used to transmit signals.

**2. Does your business presently use RFID or plan to use RFID?**

We do not use RFID at moment but if RFID can be use to manage inventory, we are very keen to study more about it.

**3. Do you know any specific RFID related application in the retail sector? If yes, please say what they are and explain what benefits they bring.**

Retail store use RFID for security reason, it reduce the number of stolen goods.

**4. Do you think the cost of using RFID is higher than its expected benefits? Can you explain further?**

It is hard to measure the costs of putting RFID into our inventory control system but the benefit to have RFID is quite significant. Let me explain it using a real example: we have a very large range of inventory and high inventory turnover, it requires us to count and make sure the right level of inventory once a week. It involves 6 people and takes whole day to carry out the counting. But if prearranged RFID are in our stocks it takes few seconds to crystallize the stocks

**5. Do you think RFID can improve the business performance of your company and how?**

By the same example given above I believe that it improves our business performance.

**6. What are the main drivers that make you think about adopting RFID? What application areas do you thing most potentially useful to your business operations?**

The increasing of productivity drives us to move our stock management toward the use of RFID

**7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?**

Are the manufactures going to put RFID on their product by their own costs?

Increase productivities and improve the performance of business make me more likely to use it.

More costs to put RFID in the product make the business less likely to use it.

**8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?**

I do not think government should be involved to the RFID adoption. Because it is a pure commercial activity should left to the market to control the process.

**9. What are specific requirements for using RFID in the New Zealand retail sector in your opinion?**

Do not know what to say in this question.

**10. What do you think is going to happen with regard to -RFID used in the New Zealand retail environment?**

Using supermarket as an example, the largest costs in supermarket is the inventory

management as well as the check out process. If RFID was used in these areas we can expect a huge price reduction from daily goods shopping.

**11. What else do you want to talk about regarding this topic?**

This is a very interesting topic and it is so important in our future daily activities.

## **Interview Two:**

**1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?**

Yes, RFID refers to Radio frequency Identification. As my understanding of RFID can refer to a micro chip which transmit and receive signal via Radio Frequency. The difference between a typical barcode and RFID is RFID is able to carry more sophisticated data. It is widely used in supermarket industry as well as aviation industry.

**2. Does your business presently use RFID or plan to use RFID?**

Not currently, but we can perceive the benefits of RFID. When the cost of production comes down, we will definitely adopt RFID over traditional barcode system.

**3. Do you know any specific RFID related application in the retail sector? If yes, please say what they are and explain what benefits they bring.**

As far as I know in the States, Wal-mart as the pioneer and giant of supermarket industry is currently using RFID in some of their stores. The benefit is to provide customer with hassle free checkout, which means each products with RFID tags will be automatically scanned over the checkout counter. Meanwhile, the credit card which registers according to the shopper will scan simultaneously. Therefore, the shopper can walk out the store straight away rather than waiting at the long queue.

**4. Do you think the cost of using RFID is higher than its expected benefits? Can you explain further?**

The cost of production is still relatively high, in contrast with the number of usages. Due to a high number of usages, the cost of production needs to be come down in order to boost the use at the market place.

**5. Do you think RFID can improve the business performance of your company and how?**

Certainly, an RFID tag which stores original information about the manufacture, logistic company can help us to keep good track of information from supply chain. This will enable us to achieve better inventory management, operational efficiency and better customer satisfaction.

**6. What are the main drivers that make you think about adopting RFID? What application areas do you think most potentially useful to your business operations?**

Better supply chain management will enable us to achieve better inventory management, operational efficiency and better customer satisfaction. The potential or let's say initial use in our company is inventory management.

**7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?**

I will say cost of production. Furthermore, reusability – as far as I know some of the RFID nowadays are not robust enough to provide multiple usage.

**8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?**

I am pretty sure it will be better off when government can contribute and support organization to use RFID. In my opinion, this involvement needs to be carefully examined and put into careful analysis in terms of ROI (return on investment). If the expenditure of government involvement is greater than the benefit then I don't think it is a good time to deploy significantly. On the other hand, it will become feasible and practical.

**9. What are specific requirements for using RFID in the New Zealand retail sector in your**

**opinion?**

Good inventory management. Good confidentiality covers for credit card usage and good public awareness of the usage of RFID. The public has to be well informing in regards to the benefits of RFID, otherwise it will take a long time to implement the deployment of RFID.

**10. What do you think is going to happen with regard to -RFID used in the New Zealand retail environment?**

It will be gradually become popular in long term which relate to the huge benefit that brings by RFID system. The supermarket system upgrade and public awareness will take longer and more significant involvement by the government and organizations.

**11. What else do you want to talk about regarding this topic?**

I am amazed that the farming industry is one of the early adopter of RFID. It certainly enhances the productivity and help New Zealand to become the top farming country in the world.

### **Interview Three:**

**1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?**

Yes, I know that Automatic charging, Product anti-counterfeiting, Logistics management, Warehouse Management use the RFID. My understanding of FRID is that it is a technology for tracking goods and assets around the world.

**2. Does your business presently use RFID or plan to use RFID?**

Yes, we plan to use RFID.

**3. Do you know any specific RFID related application in the retail sector? If yes, please say what they are and explain what benefits they bring.**

Retail store use RFID to improve organization's efficiency in tracking goods and assets, and increase levels of product and asset visibility.

**4. Do you think the cost of using RFID is higher than its expected benefits? Can you explain further?**

I think the cost of using RFID is a little higher than it expected. But RFID can greatly reduce the loss or misplacement of goods, minimize shrinkage and provide additional security for tagged items. The use of RFID tags for document tracking greatly reduces the time spent searching for books or documents, so the benefit to have RFID is quite significant.

**5. Do you think RFID can improve the business performance of your company and how?**

As I mentioned in your last question, I have great confidence for FRID, and it really improve our business performance.

**6. What are the main drivers that make you think about adopting RFID? What application areas do you thing most potentially useful to your business operations?**

The increasing of productivity and misplacement of goods drives us to move our stock management toward the use of RFID.

**7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?**

May be the cost of RFID is a reason for us to be reluctant to use FRID

Increase productivities and improve the performance of business make me more likely to use it.

Also the costs to put RFID in the product make the business less likely to use it.

**8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?**

I think the government should be involved in the RFID adoption. Because it is a useful technology and enterprises will benefit a lot from it.

**9. What are specific requirements for using RFID in the New Zealand retail sector in your opinion?**

I really don't know how to answer this question.

**10. What do you think is going to happen with regard to -RFID used in the New Zealand retail environment?**

I think RFID will have a bright future in the New Zealand retail environment.

**11. What else do you want to talk about regarding this topic?**

It's a significant topic and it means a lot to our future daily life.

#### **Interview Four:**

**1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?**

Yes, I know RFID (Radio frequency identification). Two parts comprise a RFID system, RFID reader and RFID tags. There are two kinds of tags: active tags and passive tags. RFID readers can be combined with PDAs. Each RFID tag has a unique ID. Different sensors (e.g. temperature sensor) can be attached to tags. Information caught by sensors is stored in the tag memory. Readers can gather data from tags by scanning them. RFID can be adopted in industry, such as supply chain and airport.

**2. Does your business presently use RFID or plan to use RFID?**

RFID can be used in library. Students can search learning sources by scan RFID tags attached to books in libraries.

**3. Do you know any specific RFID related application in the retail sector? If yes, please say what they are and explain what benefits they bring.**

Yes. It can be used in super markets. Because RFID tags can be read automatically from several sides remotely, cashiers can count out how much customers need to pay without performing the process of scanning, which is required in Barcode applications.

**4. Do you think the cost of using RFID is higher than its expected benefits? Can you explain further?**

The price of tag is relatively high. It depends on the price of products which the tags attached to. If the cost of RFID tag is more than the price of product, we cannot get benefits from RFID.

**5. Do you think RFID can improve the business performance of your company and how?**

Yes, I think it can if the performance of RFID is stable. The tag can store rich information which is valuable for the company or/ and customers. The quality of products can be traced. Customers can trust our products by read relevant information stored in tags. The company also can protect the reputation by labelling their products using tags.

**6. What are the main drivers that make you think about adopting RFID? What application areas do you think most potentially useful to your business operations?**

I think RFID is an effective application in supply chain. The sensors integrated with RFID tags can provide rich information about the quality of products (e.g. cheese) to the consumers.

**7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?**

I think is the price of the deployment of RFID system.

**8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?**

Yes. This is mainly because of privacy issues. The traceability of RFID also lead to the people can be traced! The government should establish laws to prevent illegal usage of RFID.

**9. What are specific requirements for using RFID in the New Zealand retail sector in your opinion?**

I think is the environmental issues. The one-off tags can pollute environment. So how to recycle and reuse RFID tags should be considered.

**10. What do you think is going to happen with regard to -RFID used in the New Zealand retail environment?**

Some High price product companies will adopt RFID first. It also depends on customers'

perspectives and acceptance to the adoption of RFID.

- 11. What else do you want to talk about regarding this topic?**  
People may more accept RFID if they are educated about it.

## **Interview Five:**

**1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?**

Yes, The RFID is similar with the barcode technology, but it has more advantages than barcode. RFID have read or write capability, long read range and good for security.

**2. Does your business presently use RFID or plan to use RFID?**

Yes, We put each RFID tag on the item for security reason. I m still doing some research on tracking our stock, that will be the trend for inventory management, so we will chose in the future.

**3. Do you know any specific RFID related application in the retail sector? If yes, please say what they are and explain what benefits they bring.**

Many retail store use RFID for security reason, and it is very useful to reduce the number of stole. I also know some supermarket use RFID tracking stock and check out, it is not only saving time but also improving accurate and security.

**4. Do you think the cost of using RFID is higher than its expected benefits? Can you explain further?**

I know the cost of RFID is much higher than barcode, but from its advantage, you can save more money from other aspects. The price of RFID can reduce when the demand increase. The manufactory should use RFID to instead of barcode, not the retail shop owner

**5. Do you think RFID can improve the business performance of your company and how?**

Yes, saving time, security and accurate. I believe that it improves our business performance.

**6. What are the main drivers that make you think about adopting RFID? What application areas do you thing most potentially useful to your business operations?**

Currently the security aspect is the main driver for adopting RFID in my business. The inventory is the other important driver.

**7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?**

The cost of RFID is still high, that will increase the cost for each items. Also RFID need to face the security problem itself. Improving the security makes more people using it.

**8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?**

The government should encourage these kinds of new technology adoption, which will cause people easy to accept new technology and help them growth.

**9. What are specific requirements for using RFID in the New Zealand retail sector in your opinion?**

Do not know what to say in this question.

**10. What do you think is going to happen with regard to -RFID used in the New Zealand retail environment?**

Using supermarket as an example, the largest costs in supermarket is the inventory management as well as the check out process. If RFID was used in these areas we can expect a huge price reduction from daily goods shopping.

**11. What else do you want to talk about regarding this topic?**

This is a very interesting topic and it is so important in our future daily activities.

**Interview Six:**

**1. Are you aware of the use of RFID? Can you please tell me your understanding of RFID?**

RFID is ready for identification. Basically the idea from my point of view is for retail, RFID is a tracking mechanism, so you can follow through particular SKU – stock keeping unit, basically from source through to sale.

**2. Does your business presently use RFID or plan to use RFID?**

We do not use RFID at moment but if RFID can be use to manage inventory, we are very keen to study more about it.

**3. Do you know any specific RFID related application in the retail sector? If yes, please say what they are and explain what benefits they bring.**

Well, I know a couple of examples I looked at one RFID implemented to trial stage, and one looked at but not implemented at this stage. One at trial stage has done to the max. What they have done is through distribution centre which handle up to 3000 items a month. And it's fairly automatic but not fully automatic system. They still have human pickers for a lot of small items such as stationery like pencils, a lot easier to pick by hand. But never the less they have put in RFID system, through there primarily because they see the benefits regarding – they have thousands of clients who all have extremely diverse stock requirements in terms of what their peak would be at distribution centre. So by using RFID, the mechanics can actually track doing resource to sale track a lot more efficient than the current process of hand picking. Now having said that, I have to just clarify slightly that they have stopped RFID at this point primarily because of the credit crash in the economy and final investment required to put automatically through. The American parent company holds off NZ Company because they haven't got enough money. They will do it for the benefit of efficiency of multiple diverse stock picks. But at this stage they haven't got enough money to put it through. The supermarket has investigated the whole nation environment. There are a number of different points of view actually, not only from stocking point of view but also from understanding consumers' point of view and understanding, consumers' movements and tracking through supermarkets and that sort of things, but at this stage, my understanding is that expense outweighs benefit of tracking through consumers. So the idea is they pick up what are in the isle that can be tracked through the store, and you can see where they go, where they are stored and how long they'll stay in the particular shelf in the store, etc.

**4. Do you think the cost of using RFID is higher than its expected benefits? Can you explain further?**

I think generally at the moment, and it is from retail perspective, the sorts of benefits RFID of components suggest there are can actually be sought from other mechanisms of RFID. So they haven't demonstrated the value in dumping the existing technology in replacing whether RFID in retail because the cost they put there in simply give them what they're getting now any way. The benefits may be still there as they've already receiving benefits. So that's why the current cost of RFID is too high. It's not the actual expense of RFID as such, it's because RFID doesn't give extra benefit.

**5. Do you think RFID can improve the business performance of your company and how?**

Well, again from retail point of view, it's probably on fronts from stock keeping aspect as in stock taking and that sort of stuff and understanding shrinkage, etc.

Probably from trace back point of view, from supermarket, for example, there are requirements now that have become more stringent in the next few years about your ability to trace back. For example, a steak, a piece of meat, you are going to meet and able to trace actually from which cow, which field, which farm that steak came from. Presumably if you have RFID through from that source, then you can do that quite simply because you will be able to check it through.

**6. What are the main drivers that make you think about adopting RFID? What application areas do you think most potentially useful to your business operations?**

From retail point of view, it's shown that RFID can provide benefits that existing technology can't. And at this stage it's not sure. The other can be through track and track system. RFID primarily is efficiency driver.

**7. What are the main barriers to prevent you from being willing to use RFID? In terms of the potential use of RFID, what aspects make you more or less likely use it?**

The barriers are costs not warranted. The other thing is in NZ there are not volumes yet at that level, to create a big enough margin of efficiency. The benefits do not exceed the current technology, not like states and UK the volume is there.

**8. Do you think the government should be significantly involved to the RFID adoption or deployment process? Why?**

I am not sure why government would not want to be involved.

**9. What are specific requirements for using RFID in the New Zealand retail sector in your opinion?**

Volume of distribution, customers demand and coherence with Australia.

**10. What do you think is going to happen with regard to -RFID used in the New Zealand retail environment?**

Not much until RFID suppliers can demonstrate enough benefit outweigh the cost. Not much use of it in NZ, increasing use in distribution end, not retail sector. Retail won't absorb the cost.

**11. What else do you want to talk about regarding this topic?**

Notion from retail point of view if you can track identify an item in store, what does that do for you? Only distribution, what's coming and what's going out.