RADIO FREQUENCY IDENTIFICATION:

ADOPTION OF RFID

IN NEW ZEALAND SUPPLY CHAINS

By

Chin Boo Soon

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Information Systems and Operations Management, The University of Auckland, 2010

ABSTRACT

In the last decade, Radio Frequency Identification (RFID) technology has been widely used in industries for controlling and monitoring purposes but has limited application in supply chain management. Passive tags are used in commercial offices for access control, while a more active and powerful tag is deployed in highways for electronic road toll collections. Other non-contact, close range methods are popular in subways and other public transport systems.

The use of RFID in supply chain management is an emerging technological trend that has attracted a lot of attention in the U.S., Europe, and Asia. This is largely driven by the potential benefits that RFID technology is perceived to deliver in the supply chain, particularly, supply chain visibility. Major retailers and leading corporations around the globe are already testing and implementing RFID, and claiming to have achieved competitive advantages and return on their investments. It is, therefore, important to understand the adoption of RFID in New Zealand supply chains, so that appropriate actions can be taken to ensure that New Zealand companies are not lagging behind.

This research study explores and explains the adoption of RFID in supply chains using exploratory survey and case study. The research questions are:

1. What specific benefits can be achieved in organisations by using RFID?
2. What are the barriers to realising these benefits?
3. How and why do organisations adopt or not adopt RFID in supply chains?

Three factors were found to be important in the adoption of RFID in New Zealand supply chains. They are the compatibility of RFID with existing organisation's systems and values, the availability of supports to facilitate RFID adoption, and the readiness of the internal and external organisation's environment. It was also found that complexity of the technology and the relative advantage of using RFID were to a certain extent influencing users' perception of RFID compatibility. Dependency on trading partners was found to have some effects on RFID adoption.

A theoretical framework of RFID adoption in supply chains is proposed. This framework helps to bring out the important factors in the adoption of RFID in supply chains. While most IS research is focused on individual technology adoption or on intra-organisational technology adoption, this research is focused on technology adoption that involves or has impacts on trading partners, that is, at supply chain level. It provides a three-dimensional evaluation framework which includes technological, organisational, and environmental aspects of inter-organisational technology adoption.

ACKNOWLEDGEMENTS

First and foremost, I want to thank and praise God for providing what I needed to accomplished this. He has been providing me with the strength and peace to work on this research. There were difficult times during the course of this research but God had through His ways provided comfort as always. One of the ways was sending someone to my help when needed. Below are people that have helped in some way.

I like to thank Jairo for his encouragement and supervision I needed to accomplish this thesis. Thank you very much.

I like to thank GS1 New Zealand for their generosity in awarding the EPCglobal Scholarship to me. Special thanks to Gary Hartley, Dr. Erik Sundermann and Dr. Peter Stevens for their advice and support throughout the research.

I like to thank Bill English and Professor Tava Olsen for taking their precious time out to read my thesis. Bill, the eleven hours we had together correcting my thesis, I have never learned so much about writing before. Thank you.

I like to thank the Heads of Department of Information Systems and Operations Management (ISOM) for rendering the financial support much needed. Thank you to Associate Professor Don Sheridan and Professor Michael Myers.

I like to thank Associate Professor David Sundaram for his post-examination advice and support in putting this thesis in order. Thank you.

I like to thank all fellow PhD candidates at ISOM for making the last three years not just about research but also about fun. A few discussions we had have contributed to this thesis. Thank you.

I like to thank my wife for her unfailing support and understanding as we have to live with limited resources during this period. Christine, you have been a good wife and a friend. Thank you for taking good care of our adorable son and me.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

3G	Third Generation
AIDC	Automatic Identification and Data Capture
AS/RS	Automated Storing and Retrieving System
CFO	Chief Financial officers
CPFR	Collaborative Planning, Forecasting and Replenishment
CRM	Customer Resource Management
DOD	Department of Defence
EAN	European Article Numbering
EAS	Electronic Article Surveillance
EC	European Commission
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
EPC	Electronic Product Code
EPCIS	Electronic Product Code Information Systems
ERP	Enterprise Resource Planning
ETSI	European Telecommunications Standards Institute
FDA	Food and Drug Administration
FHSS	Frequency Hopping Spread Spectrum
FMCG	Fast Moving Consumer Goods
GLN	Global Location Number
GPS	Global Positioning Systems
GRAI	Global Returnable Asset Identifier
GSM	Global System for Mobile Communication
ISM	Industrial, Scientific, and Medical radio bands
ISO	International Organisation for Standardisation
JAN	Japanese Article Numbering
LBT	Listen Before Talk
MAF	Motivation/Ability Framework
MICR	Magnetic Ink Character Recognition
ONS	Object Naming Service
PML	Physical Markup Language
POS	Point of Sale
QR	Quick Response
RFID	Radio Frequency Identification
RFID/SC	RFID for Supply Chain Management
ROI	Return on Investment
RPV	Resources, Processes, Values theory
RTLS	Real-time Locating Systems
SGTIN	Serialised Global Trade Item Number
TAM	Technology Acceptance Model
TEU	Twenty-foot Equivalent Unit
TOE	Technology-Organisation-Environment

TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTF	Task Technology Fit
UCC	Uniform Code Council
UHF	Ultra High Frequency
UPC	Universal Product Code
WAN	Wide Area Network
WMS	Warehouse Management Systems