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RFID TECHNOLOGY: SETBACKS IN IMPLEMENTING RFID IN THE RETAIL INDUSTRY

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ABSTRACT

The Retailing is considered as buying and selling of both consumer services and goods. Since there are more number of literate and educated consumers entering the market and economy, there is a very essential need to read the pulse of the consumers. Radical restructuring of Retail marketing is in progress. This is because of increase in gross domestic product, per capita income, purchasing power and also the changing preferences and tastes of the people. For the evolution of retail marketing, ATMs, credit cards, the entry of plastic money, debit cards and all other consumer finance options, the aspiration for the branded goods had been a major factor. Retail marketing is also rendering all other personalized consumer services and not just buying and selling. Various fast moving capital goods (FMCG) goods have been given a new outlook with the Retail Market picking up. This has increased the demand for various goods in the market and also made retail marketing the second largest employment area, after agriculture. There will be multiple regional warehouses, offices and retail outlets for a typical pan national retail operation.

Key Words: Retailing, RFID, Setbacks, Customers, Supply Chain, Services

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INTRODUCTION

Both national as well as regional legislative bodies have begun to discourage use of RFID through Legislation limiting or even preventing the deployment of RFID. Taking into account some of the more recent enhancements previously mentioned, RFID signal and reader technology operates at a low semantic level and the volume of signals generated is large at the same time. Vendors will need to develop (and organizations will need to implement) a rich two dimensional infrastructure to actually make use of much of the information contained within the signals. These challenges will need to be effectively addressed by industry in order for the potential benefits of RFID to be realized by the economy. A serious concern for retail store owners is shoplifting. One option is to direct staff. There are two major disadvantages in the option to directing staff to watch customers closely. Customers hate being watched and the extra work distracts staff from other responsibilities. An elegant solution is offered by RFID technology as they leave your store a remote scan of shoppers can reveal if they are leaving with stolen merchandise. This security solution becomes a highly cost-effective way of retarding theft as the cost of RFID technology decreases. Scanning their shopping carts or persons remotely or that the shop can track their movements throughout a store may not be liked by customers. It is not yet clear on where consumer opinion and consensus will land since RFID technology is still in its infancy. Privacy issues are a growing concern for retailers to recognize.

The important indicator of overall economic growth is private consumption expenditure; the decline in consumption has further affected the global economic downturn in the last couple of quarters. Moreover, credit available and household spendable income is severely hit by the widened financial crisis. Reduced availability of capital and consequent diminishing of investments further weakened the consumer demand. The loss of retail goods not accounted for the difference between the book value and the actual stock is known as Retail shrinkage. Thefts by employees, administrative errors, shoplifting by customers or vendor fraud are the constituents of these losses. Nearly 3-4% of the Indian chain’s turnover is lost on account of shrinkage according to industry estimates. To overcome the problem of shrinkage, the organized industry players have invested on IT, CCTV and antennas.

Predicting product demand is also made easier by tracking capabilities. Store managers ensure that their inventory supply is stocked accordingly so that they can monitor quick-selling items with increased accuracy. By using RFID, satisfied customers mean better business for retailers since their staff can know the exact location of any retailing item at any point of time. Through easy access to a centralized database the customer service team can handle customer requests quickly. Items can be located immediately with the touch of a button since RFID tagged items offer store-to-store visibility. This level of product accessibility offers a better shopping experience since it results in shorter wait times for customers. This results in greater savings to customers since overall store efficiencies are ultimately improved.

1. LITERATURE REVIEW

Cleopatra Bardaki et al. (2012) conveyed the practices learned during the installation of two RFID retail applications namely real time pricing of fresh goods and management of promotional offers in the supermarket floor in two real life pilot sites in Greece and Ireland. The lessons are presented in three inter-connected disciplines; engineering problems and associated solutions, personal adoption factors, and organizational success factors. The authors argue that these findings might indicate the design experts to develop better RFID solutions. Dane, et al. (2010) examined the impact of radio-frequency identification (RFID) technology on the inventory control practices of a small-to-medium retailer using a proof of concept (PoC) approach. They found that in a small-to-medium retail environment, RFID technology could act as a loss prevention mechanism, a method for identifying misplaced stock, and make a significant contribution to the overall enhancement of the delivery process. However, by simulation they found that the items with overlapping RFID tags wrapped around them could not be read by the reader when they moved through the entry/exit. It was also found that concealing items had an effect on whether they would read or not. The study revealed that the readability of RFID tags was not affected when applied to products of varying compositions, except for metal products.

Gupta and Pal (2012) examined issues faced by Indian retail industry in the adoption of RFID technology as an enabler of efficient retail supply chains by an in-depth case study of Big Bazaar (Future Group) conducted for about two months for finding and classifying the problems in RFID adoption. The authors argued that Indian retail landscape has also seen major

transformation in the last decade. The emergence of global and multinational supply chains coupled with the emergence of organized retail outlets has transformed the scenario. With the emergence of organized retail, Indian retailing industry is also witnessing issues, particularly related to supply chains calling for an all-round transformation of supply chains in India. While global supply chains have improved through web-integration, supply chains in India are still far-behind in the competitive landscape. The main objective of this paper is to identify issues that preclude widespread adoption of RFID in Indian retail industry and to offer solutions that may help overcome these issues.

Heim, Wentworth, and Peng (2009) noted that RFID service applications offer both advantages and disadvantages for customers. These are important insights to managerial decision making regarding how RFID might be used to implement or enhance service operations. Useful decision-making tools and frameworks may help managers to prioritize between potential RFID applications for service process improvement, evaluate the feasibility and ROI for each application, and make appropriate and timely decisions. However, they also describe the potential problems in item level RFID tagging. Implanting RFID devices in customers' loyalty or frequent shopper cards to identify people could enable system login and charge the shopping bills directly to the customer's account at the point of sale unless removed at the POS, item level tags will inevitably follow the consumer home. This scenario undoubtedly raises numerous privacy concerns.

2. BACKGROUND OF THE STUDY

3.1 Problems in implementing RFID

In various industries, Radio frequency identification, or RFID technology is used for the tracking of inventory, payment systems and other resources. It is also used in access control tools, manufacturing, retailing and has the flexibility for use in different capacities. Retailers use RFID for item level tracking while in government departments it is used to identify particular documents by embedding key identification data in them. The benefits and drawbacks of using the RFID technology in the retail industry are explained by Milton Kazmeyer, (2013). Though RFID systems provide greater benefits over other tracking systems, they also have vulnerabilities that can be exploited, and drawbacks that need to be considered before adoption and deployment.

3.1.1 Ease of use

The retail business entities that use RFID systems in place of barcode scanners boast of considerable benefits over barcodes. RFIDs do not have line of sight access and proximity constraints like barcode and can handle multiple tags concurrently. A user can scan An entire carton of items can be scanned without opening the container, or the entire contents of a shopping cart can be scanned without removing the items from the cart.

3.1.2 Range

Though passive RFID tags can be read from a distance of few meters, active tags inbuilt with battery have a better range for reading and enable them to send the signal over a time interval and not just at the time of reading. This will enable users to track the items in an entire building using fixed RFID receivers. With the help of a powerful reader and tags, RFID technology can be used to track items, people or even animals across a vast area.

3.1.3 Expense

To implement an RFID system tags, readers, server software and associated infrastructure need to be purchased. This can turn out to be very costly and tedious, based on the scale of the company. The RFIDJournal.com website suggests that the cost of the RFID tags range from 7 and 15 cents a piece, based on the type of the tag and the cost of the readers range from a couple hundred dollars to several thousand dollars. It requires purchasing and restructuring throughout the organization, for adopting RFID systems, which might turn out to be an expensive affair to the company.

3.1.4 Interference

There will be interference in the functioning of the RFID system when devices like forklifts and walkie-talkies are in their vicinity. Since RFID uses radio frequency to send and receive information, any device that operates in the same electromagnetic spectrum posed interference related issues for the proper functioning of the RFID technology. Interference may lead to errors like, tags will be read more than once or not read at all.

3.1.5 Damage

Since tags must be physically fixed, injected into the products and hence they are made up of electronic components, conditions that damage other electronic devices like water seepage, static discharge, lightning strikes and high magnetic fields can be challenging for RFID systems as well.

3.1.6 Lack of an international standard

Different frequency ranges are used for RFID systems in the United States and Europe. The working environment in each nation should be known to the global organizations when they do business. It might be costly and tedious to ensure an RFID system is compatible across international borders.

3.1.7 Privacy Concerns

Since the cost of RFID systems have come down and have become more sophisticated, there are also a lot of privacy concerns being raised. Consumers are unaware when companies are tracking their shopping patterns or movements since owing the covert properties of RFID it has the ability to being attached to any item. Also there is a possibility of relating individuals to specific purchase patterns. There are raising concerns are that particular information regarding the purchasing history of individuals will be collected and stored by RFID. CASPIAN, The advocacy group, which is a short form of Consumers against Supermarket Privacy Invasion and Numbering, explains various issues related to the illegal sharing of people's personal data collected via RFID technology. Since RFID is used to collect data about people without their consent, and if cashiers fail to disable tags on the goods at the point of sale, consumers can still be tracked for long after they leave the store, which poses a serious threat to their privacy.

3.1.8 Security Concerns

Users, leveraging on the long-range abilities of RFID technology can collect data covertly from a distance, without the knowledge or any consent of the victim of the information theft. Encrypting of data in RFID tags could prevent this up to some extent. Since the RFID tag responds to a signal of a certain frequency, it would be possible for anyone who could generate that signal to

read the tag data. This could allow people to illegally access and use the data stored in the RFID tags.

3. METHODOLOGY

Fundamentally, the study is designed as descriptive research. The phenomenon of study are not controlled or modified. They are just measured and reported to highlight the facts. As descriptive research mainly uses interview or survey technique to collect the data, it is proposed to use a self administered questionnaire. Before research instrument is developed, a thorough review of literature and series of interview was conducted among the subject experts and possible respondents to find the items that need to be measured. Multi item constructs that measures phenomenon are framed. Proper scales such as five point agreeableness likert scales, importance scale and satisfaction scales are used. The sources of data include both primary and secondary. The primary source includes opinions of top management of the respondent retail stores and the opinion of customers visiting retail stores. The secondary source includes reports, standard textbooks, journals, magazines, web sites, newspapers etc. The population consists of retail outlets, which are operating in India. For convenience the sample framework was created limiting samples to the major cities in south India, Bangalore, Chennai, and Coimbatore. Though Indian retail sector has majority of retail stores in unorganized sector, the application of technology was found relevant in the organized retailing. Therefore, sampling framework restricted to retails stores of various product categories of modern format. 300 stores were randomly selected for collecting data. However, only 268 stores responded the survey.

4. ANALYSIS AND DISCUSSIONS

Table 5.1: SUMMARY ON SETBACKS OF TECHNOLOGY ADOPTION

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Deviation
VISIBLE BENEFITS ARE LACKING	35 (13.1)	69 (25.7)	84 (31.3)	49 (18.3)	31 (11.6)	2.85	1.163
COSTS OF OPERATIONS ARE	19 (7.1)	41 (15.3)	91 (34.0)	69 (25.7)	48 (17.9)	3.55	1.125

NOT CONTROLLED							
UNDERSTANDING AMONG THE STAKEHOLDERS IS LACKING	31 (11.6)	73 (27.2)	105 (39.2)	41 (15.3)	18 (6.7)	3.14	1.135
KEY PERFORMANCE INDICATORS ARE NOT QUANTIFIED	32 (12.0)	59 (22.0)	85 (31.7)	45 (16.8)	47 (17.5)	3.25	1.226
FUNDS ALLOCATION IS DIFFICULT	41 (15.3)	63 (23.5)	86 (32.1)	43 (16.0)	35 (13.1)	3.15	1.261
TECHNOLOGY(SOFTWARE AND HARDWARE) COST IS HIGH	21 (7.8)	43 (16.0)	96 (35.8)	65 (24.3)	43 (16.1)	3.42	1.196
TAGGING INCREASES PRODUCT COST	25 (9.3)	33 (12.3)	104 (38.8)	43 (16.1)	63 (23.5)	3.74	1.162
ELECTRO MAGNETIC INTERFERENCE IN THE STORE DETERS USE OF RFID	15 (5.6)	48 (17.9)	99 (36.9)	83 (31.0)	23 (8.6)	3.027	1.235
APPROPRIATE STANDARDS ARE LACKING	33 (12.3)	72 (26.9)	101 (37.7)	40 (14.9)	22 (8.2)	3.15	1.183
INEGRATION WITH SOFTWARE	9 (3.4)	25 (9.3)	121 (45.1)	67 (25.0)	46 (17.2)	3.65	1.163

AND OTHER PROCESSES ARE LACKING							
CERTAIN TYPES OF PRODUCTS ARE NOT SUITABLE	18 (6.7)	55 (20.5)	97 (36.2)	49 (18.3)	49 (18.3)	3.48	1.245
CUSTOMER ACCEPTANCE ISSUES DUE TO PRIVACY	23 (8.6)	45 (16.8)	108 (40.3)	73 (27.2)	19 (7.1)	3.12	1.157
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Mean**	**Std. Deviation**
ADOPTION OF TECHNOLOGY NOT FEASIBLE FOR SUPPLIERS	19 (7.1)	55 20.5)	85 (31.7)	65 (24.3)	44 (16.4)	3.35	1.297
COMPETENT STAFF AVAILABILITY	25 (9.3)	65 (24.3)	97 (36.2)	59 (22.0)	22 (8.2)	2.85	1.186

* The numbers indicated in the brackets are of %

The respondents were of the opinion that few of the setbacks are high and few are low as inferred from the analysis of the mean value. The mean values that are measured lower than the mid value of 3 on a 1 to 5 scale is an evidence of that opinion. The setbacks such as tagging increases product cost (Mean = 3.74), costs of operations are not controlled (Mean = 3.55), Integration with other software and process are lacking (Mean = 3.65), certain types of products are not suitable for tagging (Mean = 3.48) are viewed as the main setbacks. Nevertheless, the respondents were not of the opinion that there are setbacks from lack of obvious advantages (Mean = 2.85), understanding among the stakeholders is lacking (Mean = 3.14), customer

acceptance issues due to privacy (Mean = 3.12), funds allocation is difficult (Mean = 3.15) and competent staff availability (Mean = 2.85). The consistency of viewpoints of the respondents is good as indicated by the standard deviations being less than 1.3. The respondents were asked to indicate the percentage of use of RFID in product receipt and processing, replenishment at the item level, pallet level store replenishment and check-in, embedding RFID in home based applications and store checkout to study the rigor of RFID usage in the different facets of the operational aspects of the retail stores. The Table 5.8 presents the outcome of the study.

The analysis and study of the principal component leveraging the rotation of varimax was conducted on the multiple item constructs attributed to the setbacks parameters. The extraction of the un-rotated principal component is shown in Table 5.1 and the matrix which is rotated with varimax is shown in Table 5.2. Sampling Adequacy is indicated by the Kaiser-Meyer-Olkin value as inferred to be 0.964. The factors are described enough by the items as indicated by the Bartlett's Test of Sphericity as found to significant at 0.008. The discriminant validity (The extracted constructs are different from other constructs) and the convergent validity (Items reflecting the construct and does not cross load) of the instrument are interpreted to be good.

Table 5.2: Principal Component Analysis for Setback variables

KMO AND BARTLETT'S TEST					
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.964			
Bartlett's Test of Sphericity	Approx. Chi-Square	1919.195			
	df	87			
	Sig.	.008			
Component Matrix[a]					
		Communalities		**Component**	
		Extraction	**1**	**2**	**3**
FUNDS ALLOCATION IS DIFFICULT		.856	.911	-.075	-.283
TAGGING INCREASES PRODUCT COST		.775	.886	-.035	-.309
TECHNOLOGY (SOFTWARE AND HARDWARE) COST IS HIGH		.711	.883	-.165	-.265
VISIBLE BENEFITS ARE LACKING		.775	.887	-.054	-.245

COSTS OF OPERATIONS ARE NOT CONTROLLED	.897	.875	-.184	.019
CUSTOMER ACCEPTANCE ISSUES DUE TO PRIVACY	.878	.872	.015	.093
APPROPRIATE STANDARDS ARE LACKING	.885	.872	.085	.165
INEGRATION WITH SOFTWARE AND OTHER PROCESSES ARE LACKING	.787	.865	.053	.123
COMPETENT STAFF AVAILABILITY	.783	.863	.031	.131
ADOPTION OF TECHNOLOGY NOT FEASIBLE FOR SUPPLIERS	.763	.865	.219	.127
ELECTRO MAGNETIC INTERFERENCE IN THE STORE DETERS USE OF RFID	.955	.847	.065	.312
KEY PERFORMANCE INDICATORS ARE NOT QUANTIFIED	.763	.825	-.164	.285
UNDERSTANDING AMONG THE STAKEHOLDERS IS LACKING	.793	.815	-.242	.032
CERTAIN TYPES OF PRODUCTS ARE NOT SUITABLE	.753	.543	.812	-.123

	Communalities	**Component**		
	Extraction	**1**	**2**	**3**
Eigenvalues		7.925	1.861	1.353
% of Variance		56.52	13.33	9.75
Cumulative %		56.52	69.85	79.60
Method of Extraction: Analysis of Principal Component.				
a. Extraction of 3 components.				

The extraction of the 14-items which are attributed to the setbacks of RFID, were done. We have taken into account the components having eigen value greater than 1. There were 3 components with greater than 1 of eigen value. For the precise identification of the factors (Table 5.2) using varimax technique, the factors were rotated even more. 5 items contributed to 35.135% of the variability in the entire 14 items and the first component is loaded with them. 4 items contributed to 32.917% of the variability in the entire 14 items and the second component is loaded with them. Another 5 items contributed to 11.42% of the variability in the entire 14 items and the third component is loaded with them.. A contribution of 79.6% of variability of the items is from the three factors

To recognize the factors, the items present in each of the component are studied. Interference, suitability for various products, standards, competent staff, integration with other processes and associated software reflects in the first component. The technical aspects of the RFID technology are indicated by the items. Hence, the label of technical setbacks can be given to the component. Cost of product due to the tags; technology costs, sufficient allocation of funds and control of the cost of operations reflect in the second component. Financial setbacks can be the label given to the component since the items are related to cost and finance. Quantify Key Performance Indicators, customer acceptance, visible benefits, and supplier capacity reflects in the third component. Strategic setbacks can be the label given to the component since the items depict the stakeholders; advantages and their performance.

Table 5.3: ROTATED COMPONENT MATRIX FOR SETBACKS VARIABLES

ROTATED COMPONENT MATRIX[a]			
	Component		
	1	**2**	**3**
ELECTRO MAGNETIC INTERFERENCE IN THE STORE DETERS USE OF RFID	**.795**	.331	.275
CERTAIN TYPES OF PRODUCTS ARE NOT SUITABLE	**.783**	.415	.075
APPROPRIATE STANDARDS ARE LACKING	**.685**	.435	.311
COMPETENT STAFF AVAILABILITY	**.683**	.485	.275

INEGRATION WITH SOFTWARE AND OTHER PROCESSES ARE LACKING	**.672**	.492	.293
TAGGING INCREASES PRODUCT COST	.393	**.825**	.283
TECHNOLOGY(SOFTWARE AND HARDWARE) COST IS HIGH	.453	**.819**	.153
FUNDS ALLOCATION IS DIFFICULT	.437	**.715**	.265
COSTS OF OPERATIONS ARE NOT CONTROLLED	.625	**.642**	.095
KEY PERFORMANCE INDICATORS ARE NOT QUANTIFIED	.187	.183	**.845**
VISIBLE BENEFITS ARE LACKING	.455	.273	**.775**
CUSTOMER ACCEPTANCE ISSUES DUE TO PRIVACY	.265	.525	**.661**
ADOPTION OF TECHNOLOGY NOT FEASIBLE FOR SUPPLIERS	.441	.434	**.656**
UNDERSTANDING AMONG THE STAKEHOLDERS IS LACKING	.034	.387	**.584**
Eigenvalues	4.925	4.617	1.595
% of Variance	35.132	32.93	11.45
Cumulative %	35.13	68.06	79.51
Method of Extraction: Analysis of Principal Component. Method of Rotation: Kaiser Normalization with Varimax.			
a. Convergence of rotation in a number of 5 iterations.			

5. CONCLUSION

The unorganized retail players are confronted with the setbacks in technology adoption, though they are conscious about the advantages. Their IT implementation is deterred by return on investments that are not sure, major support expenses, threats of data security, cluttered product portfolios that are haphazard, and issues with connectivity Synergy with telecom providers, technology resellers and device OEMs is one of the efficient methods to improve the footprint of SMB retailing in smaller Indian cities. (Sohini Bagchi, 2012). Lack of appropriate warehousing and refrigerated facilities, poor road infrastructure and lack of communication facilities like GPS

enabled goods tracking, third part logistics that are not reliable will lead to inefficiency in the processes of the supply chain, which in turn will result in expensive and ineffective logistics processes. Considering the type of technology implemented currently, the tracking and transfer of the merchandise is very challenging. To further refine the supply chain operations, IT can be leveraged in predicting, reordering, planning and managing the vendors. Supply Chain Visibility can be enhanced by RFID implementation along with IT. Pallet level implementation of RFID will be economical and efficient at the operational level logistics, though the item level implementation will be expensive and complex.

To bring down the technology cost, further research needs to be done on the RFID sensor and the tags to reduce the overall cost of implementation. Other forms of tags need to be developed in addition to the conventional forms of tags, stickers and labels. To further reduce the cost of tagging and for protecting the environment, RFID tags that are reusable and recyclable can be developed to minimize cost and environment pollution. Further research needs to be done to make the RFID technology rock solid, from the setbacks of electromagnetic interference, store environment and climatic conditions and also on the constraints in implementing RFID for specialized products like refrigerated food items, meat, vegetables etc.,

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