



A Study on Efficiency of Retail Supply Chain with the application of RFID Technology with Special Reference towards selected Clothing Stores in Coimbatore City

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Abstract

Organisation-wide applications are appreciated by the companies nowadays. For better planning of resources and optimizing the process and profit, these implementations are very much beneficial. Also, it synchronizes the data and helps the information flow at ease within the organization. However, capturing and tracking the actual data is a major concern which has encouraged the companies to focus on the effective supply chain management. Radio Frequency Identification (RFID) as an advanced technology can address these challenges very well. This research paper aims at finding out the increase in efficiency of retail supply chain with the application of RFID Technology in 25 selected branded clothing retail stores in Coimbatore city. Convenient sampling was used and the data was collected through a well-structured questionnaire. The results obtained could give a good outlook and suggestion for the retail shop floor business owners to achieve supply chain efficiency and increased customer responsiveness with RFID technology.

Keywords: *RFID: Radio Frequency Identification Tags, Technology, Supply Chain Management, Customer Responsiveness*

Introduction

Organisation-wide applications are appreciated by the companies nowadays. For better planning of resources and optimizing the process and profit, these implementations are very much beneficial. Also, it synchronizes the data and helps the information flow at ease within the organization. However, capturing and tracking the actual data is a major concern which has encouraged the companies to focus on the effective supply chain management. Radio Frequency Identification (RFID) as an advanced technology can address these challenges very well. A retail firm's objective of achieving efficiency and customer responsiveness can be fulfilled by the implementation of RFID technology. RFID though helps in collaborating the trading partners along the supply chain in an effective way and makes the process more efficient and responsive. RFID hereby, helps the organization to enhance its overall efficiency.

Applications of RFID

RFID helps in identifying, locating, controlling and monitoring the people, process and product. RFID plays a very vital role in supply chain management as it is solely responsible for processing the entire supply chain information on the electronic databases.

RFID system is very much useful for **Asset Tracking** in case they are lost, stolen or not properly utilized. This application is highly appreciated and widely used in **Manufacturing companies** for integrated system flow.

Earlier this RFID tracking was used only in the primary units to keep on track with their supply chain process. Now it has extended to the level of tracking their **Supply Chain Partners** also.

Today, the **Retail Shop floor** owners use RFID in order to strengthen and enhance their supply chain capability to satisfy their potential clients on time with right quality and best price. This would help a retailer to reduce the customer diversion towards next shop floor. Eg: Walmart, Tesco, Metro etc.,

RFID is also used the **Vendors** for security and access control, where they have introduced a high-gain antenna which can be used to read tags from long distances.

RFID in Retailing can provide various benefits like operational efficiency, improved visibility, cost reduction, tight security, enhanced customer service levels, better information accuracy, and increase in sales volume.

Objectives of the study

- To study the various ways in which the stock accuracy is managed while the consignment in transit
- To understand the various factors responsible for the choice of RFID towards older methods
- To find out the ways in which RFID helps in better customer engagement and improve efficient customer response
- To analyse the overall enhancement in inventory flow process from warehouse to retail floor and to the final customer

Methodology

Convenient sampling technique was used to collect information using a well-structured questionnaire. The data was collected from 25 branded retail clothing stores in Coimbatore city who have implemented RFID tags for their better stock accuracy while in movement and warehouse. Descriptive statistics, Friedman Ranking and correlation is used to analyse the collected data.

Review of Literature

Nabi, A.A et.al (2023), This study focuses on the impact of extent of RFID technology adoption and customer experience in the shop floor pertaining to Pakistani retail industry. Quantitative approach is employed, specifically a correlation study that deploys the linear regression technique to quantify and evaluate the strength of associations among the respective variables. The findings of the study confirm that there is an increase in competitiveness, building and strengthening customer trust, and foster lasting loyalty.

Cesar Munoz-Ausecha (2021), This paper presents a review of the most cited topics regarding RFID focused on applications, security, and privacy. A total of 62,685 records were downloaded from the Web of Science (WoS) and Scopus core databases and processed, reconciling the datasets to remove duplicates, resulting in 40,677 unique elements. The results are discussed in the following sections: the first is the Applications Section, whose subsections are the Internet of Things (IoT), Supply Chain Management, Localization, Traceability, Logistics, Ubiquitous Computing, Healthcare, and Access Control; the second is the Security and Privacy section, whose subsections are Authentication, Privacy, and Ownership Transfer. This paper intends to provide the reader with a

global view of the current status of trending RFID topics and present different analyses from different perspectives depending on motivations or background.

Ma Junhong (2020), The research of warehouse management system based on RFID technology plays an important role in the information processing of logistics industry in China, and has a great impact on the accuracy of warehouse information storage management. In this paper, the related technology of warehouse management system is studied, the intelligent warehouse management system based on radio frequency technology is built, and the software and hardware system is designed. The application of this intelligent system will reduce the manual workload, make the inventory statistics and management more efficient, convenient for relevant personnel to query and use, and also provide the procurement department with more reasonable procurement strategy to provide real-time updated accurate reference data, energy saving and efficiency improvement.

S. Nikolicic et al (2015), The challenges that logistics faces in the retail industry must be investigated in the context of the specific retail sector as well as the degree of development of the retail market. The research focus in this paper is on logistic processes in supermarket supply. The aim is to deepen the understanding of logistic processes and then to investigate the possibilities of their enhancement by applying radio frequency identification (RFID) as a higher level of information technology for product identification in retail supply chains. The research was conducted in one of the top ten trade companies in the emerging Serbian market. Simulation modelling was performed for one supply chain category, followed by quantification of time and cost performance of the current logistic processes (AS-IS model). Then, in accordance with the capabilities of RFID system, improvements are proposed and integrated into a new simulation model (TO-BE model). The obtained results can be utilised as part of a broader research when deciding on the implementation of modern information technologies in supply chains.

Jerrel Leung (2014), Many large retailers decided to adopt RFID as their new supply chain technology, but RFID adoption by all industries did not spread as rapidly as initially expected. The researcher believes that its benefits constituted the major barrier to its adoption, and argued that a major contributor to the delay has been its inappropriate implementation. Our study reports the result of six in-depth case studies, which, together with case content analysis of 88 reported RFID applications, provided us with a clear view of the RFID implementation landscape, suggesting that organizations often mindlessly adopted RFID applications that were misaligned with their supply chain strategies, leading to unsatisfactory benefits. Insights into how organizations should adopt RFID were developed from our results and were discussed.

Xiaoqiang ZHANG, Qin DONG (2012), Radio-frequency identification (RFID) is the use of a wireless non-contact system that utilizes radio-frequency electromagnetic fields to transfer data from a tag attached to an object for the purposes of automatic identification and tracking. This technology is especially suited for goods circulation and tracking. For a supply chain, the RFID technology can be used in several aspects, including warehouse management, inventory management, freight transportation, manufacturing, and retailing. With RFID technology, the supply chain can achieve high performance and tracking.

Katina Michael (2005), This paper presents the pros and cons of using radio-frequency identification (RFID) in supply chain management (SCM). While RFID has a greater number of benefits than its predecessor, the bar code, it currently comes at a price that many businesses still consider prohibitive. On the one hand, RFID is advantageous because it does not require line-of-sight scanning, it acts to reduce labour levels, enhances visibility, and improves inventory management. On the other hand, RFID is presently a costly solution, lacking standardization, it has a small number of suppliers developing end-to-end solutions, suffers from some adverse deployment issues, and is clouded by privacy concerns. Irrespective of these factors, the ultimate aim of RFID in SCM is to see the establishment of item-level tracking which should act to revolutionize SCM practices, introducing another level of efficiencies never before seen

Methodology

Percentage Analysis

The following table shows simple percentage analysis of number of employees, far is the warehouse from your retail shop, frequency of stocks transfers from warehouse to retail floor, long you have been using RFID tags for your products in your store.

Table No: 1 Business profile of the respondents

Variables		No respondents	of Percentage
Number of employees	Less than 10	10	40.0
	Between 10 to 20	7	28.0
	More than 20	8	32.0
	Total	25	100.0
Far is your warehouse/stock room from your retail shop floor	Warehouse as an annexure	3	12.0
	Less than 2 Kilometres	17	68.0
	Between 2 to 4 Kilometres	3	12.0
	More than 4 Kilometres	2	8.0
	Total	25	100.0
Frequency at which the stocks get transferred from warehouse to retail floor	Everyday	7	28.0
	Once in 2 days	4	16.0
	Weekly once	8	32.0
	Once in 2 weeks	4	16.0
	Others	2	8.0
	Total	25	100.0
Long you have been using RFID tags for your products in your store	Less than 5 years	9	36.0
	Between 5-10 years	10	40.0
	More than 10 years	6	24.0
	Total	25	100.0

Source: Primary Data

Majority of the respondents (40%) have quoted that they have less than 10 number employees working in their organisation where their warehouse ranges less than 2 kilometres (68%) far from their retail floor. Most of them (32%) have mentioned their frequency at which their stocks get transferred from warehouse to retail shop floor as once in a week. Majority of the respondents (40%) were using RFID tags for their products between 5 to 10 years.

Descriptive Statistics

The following table shows regarding the maintenance of stock accuracy for a consignment which is in movement

Table No: 2 Maintenance of Stock Accuracy while on Movement

Descriptive Statistics					
Particulars	N	Mini.	Maxi.	Mean	Std. Deviation
Count the number of crates/items before truck loading	25	1	2	1.08	.277
Weigh the crate/package	25	1	2	1.56	.507
Check for Marks and sealing	25	1	3	1.64	.810
GPRS vehicle tracking	25	1	3	1.80	.645

Counter check on receipt of goods at destination	25	1	3	1.80	.707
Check for damage or any breakage of boxes	25	1	3	1.96	.676
Access real time information using CCTV camera in vehicle also	25	1	3	1.52	.653

Source: Primary Data

The highest mean score has been found for “Check damage or any breakage of boxes” with the Mean Value of 1.96 and Standard Deviation of .676. the lowest Mean Score has been found for “Count the number of crates/items before truck loading” with the Mean Value of 1.08 and Standard Deviation of .277

Table No:3 Factors Responsible for the Choice of RFID towards Older Method in Shop

Descriptive Statistics					
Particulars	N	Minimum	Maximum	Mean	Std. Deviation
Reset store economics	25	1	4	2.00	.957
Create efficiency and lower costs	25	1	4	2.48	1.005
Real time tracking	25	1	5	2.56	1.417
Improves inventory accuracy	25	1	5	2.36	1.075
Process a wide range of data	25	1	5	2.68	1.215
Prevents inventory shrinkage and shop lifting	25	1	5	3.00	1.000

Source: Primary Data

The above table shows that the highest Mean Score has been found for “Prevents inventory shrinkage and shop lifting” with the Mean Value of 3.00 and Standard Deviation of 1.000. the lowest Mean Score has been found for “Reset store economics” with the Mean Value of 2.00 and Standard Deviation of .957.

Table No: 4 Application of RFID helps to improve the overall Retail Inventory Flow

Descriptive Statistics					
Particulars	N	Minimum	Maximum	Mean	Std. Deviation
An alarm sound to alert still the tag is active	25	1	5	3.12	1.301
Can scan 100s of items in very short time	25	1	5	2.20	.957
Highly secure with access control	25	1	4	2.00	.957
Vehicle tracking	25	1	4	2.48	1.005
Greater level of accuracy in counting and tracking assets	25	1	5	2.56	1.417
Quickly replace merchandise to avoid lost sales	25	1	5	2.36	1.075
To develop better stock plans	25	1	5	2.68	1.215
Reduce human errors	25	1	5	3.00	1.000
Identify brand and product authenticity	25	1	5	3.12	1.301

Recognise loyalty accounts	25	1	5	2.92	1.077
Facilitate mobile transactions	25	1	5	2.52	1.122

Source: Primary Data

The above table shows that the highest mean score has been found for both “Identify brand and product authenticity” and “An alarm sound to alert still the tag is active” with the mean value of 3.12 and standard deviation of 1.301. the lowest mean score has been found for “Highly secure with access control” with the mean value of 2.00 and standard deviation of .957.

Table No: 5 Importance of having RFID tags in Retail Store

Ranks		
Particulars	Mean Rank	Rank
Out of stock	1.64	7
Less attentive sales person	2.96	6
Long queue and delayed billing time gives less satisfaction	3.72	5
An impersonal experience	3.88	4
Could never able to locate the items they want	4.72	3
Found a better deal elsewhere	5.64	1
Bought/can buy from the competitor	5.44	2

Source: Primary Data

Test Statistics ^a	
N	25
Chi-Square	64.423
df	6
Asymp. Sig.	.000
a. Friedman Test	

From the above table it shows that highest mean rank is found for “Found a better deal elsewhere” with the value of 5.64, followed by “Bought/can buy from the competitor” with the mean value of 5.44, followed by “Could never able to locate the items they want” with the value of 4.72, followed by “An impersonal experience” with the value of 3.88, followed by “Long queue and delayed billing time gives less satisfaction” with the value of 3.72, followed by “Less attentive sales person” with the value of 2.96, followed by the least mean rank has been found for “Out of stock” with the value of 1.64.

Table No:6 Factors that help RFID to engage with Customers and improve Customer Responsiveness

Ranks		
Particulars	Mean Rank	Rank
Customer driven shopping experience	2.40	6
Greet customers by name	2.80	5
Impress them with a wider selection of merchandise	3.72	3

Serve them with faster assistance	3.36	4
Deeper product information	4.24	2
More personalised promotions	4.48	1

Source: Primary Data

Test Statistics ^a	
N	25
Chi-Square	23.400
Df	5
Asymp. Sig.	.000
a. Friedman Test	

From the above table the highest mean rank has been found for “More personalised promotions” with the value of 4.48, followed by “Deeper product information” with the value of 4.24, followed by “Impress them with a wider selection of merchandise” with the value of 3.72, followed by “Serve them with faster assistance” with the value of 3.36, followed by “Greet customers by name” with the value of 2.80, followed by the least mean rank has been found for “Customer driven shopping experience” with the value of 2.40.

Correlation

Table No:7 Factors responsible for the choice of RFID towards older method in shop and Application of RFID helps to improve overall retail inventory flow

Correlations			
Particulars		Choice of RFID	Improve overall inventory flow
Choice of RFID	Pearson Correlation	1	.937**
	Sig. (2-tailed)		.000
	N	25	25
Improve overall inventory flow	Pearson Correlation	.937**	1
	Sig. (2-tailed)	.000	
	N	25	25

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Primary Data

It is revealed from the above table the mean value is 0.937 found for both the factors responsible for choosing RFID towards older method in shop and application of RFID helps to improve overall retail inventory flow. Hence it is positively correlated.

Findings of the study

Majority of the respondents (40%) have quoted that they have less than 10 number employees working in their organisation where their warehouse ranges less than 2 kilometres (68%) far from their retail floor. Most of them (32%) have mentioned their frequency at which their stocks get transferred from warehouse to retail shop floor as once in a week. Majority of the respondents (40%) were using RFID tags for their products between 5 to 10 years.

Maintenance of stock accuracy is so important while the consignment is on move. The highest mean score (1.9) is obtained by Check damage or any breakage of boxes and the lowest mean score (1.1) is obtained by Count the number of crates/items before truck loading.

Among various reasons for the choice of RFID tags in retail stores, the highest mean score (3) is obtained by “helps to Prevents inventory shrinkage and shop lifting” and the lowest mean score (2) is obtained by “Reset store economics”.

Application of RFID helps to improve the overall Retail Inventory Flow. Firstly, “Identify brand and product authenticity” with the highest mean score of 3.0 followed by “An alarm sound to alert still the tag is active” with the mean score of 2.0 and “Highly secure with access control” with the least mean score of .957.

Majority of the respondents have mentioned as the importance of having RFID tags in Retail Store is to find a better deal elsewhere (Mean Score:5.6), Bought / Buy from the competitor (Mean Score:5.4) , Could never able to locate the items they want (Mean Score:4.7) and Out of stock being the last reason (Mean Score:1.64)

The following are the factors that help RFID to engage with Customers and improve customer Responsiveness with the respective mean scores and ranks obtained. More personalised promotions (4.48), Deeper product information (4.24), Impress them with a wider selection of merchandise (3.72) and the least being Customer driven shopping experience (2.40).

There is a positive correlation (Mean Value: 0.937) for both the factors responsible for choosing RFID tags towards older methods in shop and application of RFID helps to improve overall retail inventory.

Summary and Conclusion

Radio Frequency Identification (RFID) Tags helps Retail Supply Chain to become more efficient in process and maintenance of products both in store and while movement. Earlier, shop keepers have to rely on information about number of crates, weight of consignment, check for breakages (if any) before and after transit, GPRS tracking, CCTV camera footages and so on. With the implementation of RFID, 100s of products can be scanned in a very short time, more accurate than human errors, live vehicle tracking, customers can even identify brand and

Product authenticity. RFID is so important that the billing counter waiting time is shortened for the customers, lost sale / out of stock condition can be totally avoided with proper inventory planning. More personalised promotions along with greeting them with names, providing them deeper product information, impress them with wider selection of merchandise and many more would help improve the customer driven shopping experience. So, with the study results it is proven that there is a high positive correlation between the implementation of RFID technology and improvement of Supply Chain Efficiency thus leading to efficient customer responsiveness.

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