



RFID IN INDIAN RETAIL SUPPLY CHAIN

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Abstract

Academic research into radio frequency identification (RFID) has proliferated significantly over the last few years as it offers tantalizing benefits for supply chain management, inventory control, and many other applications. This paper discusses the potential of utilizing RFID technology for increasing efficiency in the supply chain and the strategic benefits relating to the technology being accrued by three major Indian retailers. The data collected through questionnaires is analyzed by taking frequencies and means; the hypotheses are tested using one-way ANNOVA. The focus of the paper is to give insights into RFID practices of Indian retailers and find the benefits that are being accrued through deployment of the technology to enable a consideration through a focus upon its implications for competitive advantage.

1. INTRODUCTION

Companies constantly strive to be more efficient by reducing costs, improve services, and increase return on investment through better supply chain management. The supply chains are usually fragmented, as each link operates as an individual entity and hence there is absence of real-time data. The factor of limited visibility leads to slowing down the decision-making process. Visibility brings benefits such as streamlining the supply chain and also detecting, reporting operational anomalies. It enables tracking of assets and shipment status in real time. Radio frequency identification (RFID) can provide the manufacturers and retailers better visibility with data granularity and timely updates. (Rangarajan, 2010).

RFID has become a revolutionary element in supply chain management. It ensures that the right goods are available in the right place with minimum discrepancies and errors. It is used to make the supply chain precise by improving the efficiency and reliability of the entire chain. It enhances the administration and planning processes by providing real time information. RFID technology is widely being used to gain visibility in the supply chain. Application of RFID technology enables businesses to enhance business intelligence, handling of critical processes and collaborate across industries (Klein, 2006). With RFID large amounts of data can be stored in tags that are attached to components, it has transformed the way in which information is gathered and analyzed in real time. RFID technology has multiple uses, it provides visibility in the supply chain and production line helps reduce risks to employee health and also has a role to play in plant maintenance (Holloway, 2006). RFID also brings a solution for supply chains that are vulnerable to security threats and uncertainties (Ehsan, 2005). RFID increases the inventory and business process visibility by providing real-time, up-to-date information across the entire supply chain. These solutions can help lower operating costs, increase distribution center throughput, maximize on-time deliveries, and improve customer service and satisfaction. (Lieberthal 2011).

This study titled "**RFID in Indian Retail Supply Chain**" is an analysis of the benefits that RFID is bringing to the Indian retailers namely Big Bazaar (BB) Reliance Fresh (RF) and Spencer's Fresh and Daily (SF). The literature review presents the major benefits and also pitfalls of RFID implementation. The Analysis part is divided into three sub sections- in the first part the data collected through the administration of questionnaires has been analyzed using frequency and means; in the second part one-way ANOVA is used to test hypothesis, while the third sub section depicts a summary of the results of hypothesis testing.

2. LITERATURE REVIEW

Radio-frequency identification (RFID) has generated enormous interest in the area of supply chain, as it is a recent and emerging technology. RFID technology enables inventory tracking in real time bringing reduced processing time and labor. It enables complete visibility of accurate inventory data throughout the entire supply chain, from manufacturer's shop floor to warehouses to retail stores, which in turn provides opportunities for improvement and transformation in various processes of the supply chain. (Lee, et al 2009). Retailers face various issues like stock-outs, inventory management, product recalls, theft, shrinkage and product counterfeiting. RFID deployment can help them in solving these problems as it provides supply chain partners with the ability to foresee the movement of inventory, goods and customer demand, allowing them to plan in advance. It helps the firms to enhance visibility in supply chain and checking movement of products. In brief it provides real time visibility in supply chain and hence strengthens communication between the trading partners. (Madhani, 2009). RFID has a wider range of benefits than its predecessor technology bar code though it currently comes at a price that is considered not very reasonable by many businesses. It is advantageous because it does not require line-of-sight scanning, acts to reduce labor levels, enhances visibility, and improves inventory management. The ultimate aim of RFID in SCM is to provide item-level tracking and act to revolutionize SCM practices, introducing another level of efficiencies never seen before. (Michael and McCathie, 2005). RFID has become one of the most discussed retail technologies as it promises to cut supply chain costs and also bring about other benefits to the chain.



Mehrjerdi, (2009) did this study with the purpose of understanding important supply chain (SC) strategies for a complete success. It reviewed key points about the radio frequency identification (RFID) and the fundamental concepts of supply chain management (SCM). The methodology was case study wherein some applications of RFID in SC are briefly reviewed and three large cases of RFID implementation in SC are discussed. The study provided key elements of SCM, a brief background on RFID, and the integration of SC and RFID to generate new systems with higher level of profitability and efficiency. It found that to make the SCM functional and successfully operational, management must be committed to high standard of performance including competitive lead times to customers, significantly reduced inventories, world-class product quality, and reduced process and product complexity. The basic issues related to RFID technology are explored, including its promises as well as its pitfalls. A conceptual discussion of the evolution of RFID is provided, its application in various industries is discussed, implementation challenges highlighted, and adoption phases and success factors have also been elaborated upon. It was found that RFID is the most recent prolific technology that provides supply chain collaboration and visibility, increasing corporate ROI and at the same time improving the retail supply chain communication.

This study by Visich et. al (2009) focuses on the benefits of radio frequency identification (RFID) on the performance of supply chains, It is based on primary study that is through investigational evidence. It classifies and reviews existing quantitative empirical evidence of RFID on supply chain performance. It concludes by classifying the evidence into operational and managerial and the processes by the effect they have had which are automation, informational or transformational. It concludes that RFID implementation has had automation effects on the operational processes through inventory control and efficiency improvements. It shows informational effects on the managerial processes which is reflected in observed for improved decision quality, production control and the effectiveness of retail sales and promotions. This research gives an understanding of the quantitative benefits of RFID in the supply chain.

Zelbst, et al (2010) undertook an evaluation of structural model that utilizes radio frequency identification (RFID) technology and supply chain information sharing as antecedents to supply chain performance. Data was collected from a sample of 155 manufacturing sector and service sector organizations. It assesses the model using a structural equation methodology. The research concludes that RFID technology utilization does not affect the supply chain performance directly but leads to improved information sharing amongst the supply chain participants leads to improved supply chain performance and improved customer satisfaction.

If handled properly, RFID technology can result in an evolutionary change incorporating legacy systems with the real-time supply chain management of tomorrow. It is that the stumbling point seems to be a variety of issues outside the technology itself, which include marketing problems, false promises, security and privacy considerations, and a lack of standards. It confirms that RFID is a powerful technology in its infancy with untapped potential for supply chain collaboration. The biggest implementation challenge is for IT experts to determine how to integrate RFID with existing supply chain management (SCM), customer relationship management (CRM), and enterprise resource planning (ERP) applications. (Attaran, 2007).

3. RESEARCH METHODOLOGY

3.1 Problem Statement

On the basis of extensive review of research already done in the area of RFID in retail sector in the developed countries, it has been identified as critical for successful operation and performance of retailers. RFID has formed the basis of research and have been discussed briefly.

The study has practical implications for food and retailers for better understanding the advantages that can be attained by deployment of RFID technology in the context of Indian retail market. The research is relevant to retailers and more specifically to the one operating in the Indian retail space, as it will give them an insight into the RFID advantages being accrued by the leading players in the market.

The problem areas that this research identifies are formulated and listed below.

3.2 Objective of Research Study

This paper titled “*RFID in Indian Retail Supply Chain*” is aimed at studying the RFID experience of three leading retailers from India which are Big Bazaar of the Future Group, Reliance Fresh of the Reliance Group and Spencer’s Fresh of the RPG Group. The research aimed to use primary data collected through questionnaires.

With the problem statement in mind, the following research objectives have been laid down.

1. To study the benefits accrued through RFID implementation by three leading Indian retailers.
2. To compare and find the retailer that is making the most of a particular advantage being attained from RFID deployment.

3.3 Hypothesis

Hypothesis is an unproven proposition or supposition that can tentatively explain the phenomenon. In order to carry out detailed analysis on the objectives of the study, a list of hypothesis were developed which were subject to testing in the questionnaire.

The following hypotheses were developed for testing this research study.

- Ho1:** There is no significant difference in the mean value of benefit of accelerated receipt of goods through RFID implementation.
- Ho2:** There is no significant difference in the mean value of benefit of reduced idle time through RFID implementation.
- Ho3:** There is no significant difference in the mean value of inventory management optimization through RFID implementation.
- Ho4:** There is no significant difference in the mean value of improved process flow through RFID implementation.
- Ho5:** There is no significant difference in the mean value of fewer shelving errors through RFID implementation.
- Ho6:** There is no significant difference in the mean value of shrinkage reduction through RFID implementation.
- Ho7:** There is no significant difference in the mean value of reduction of out of stocks through RFID implementation.

4. ANALYSIS

4.1 Mean and Frequency Analysis

The section presents the analysis of means and frequencies of answers gathered using the questionnaires.

1. Sample Distribution

Table 1, Distribution of sample (outlets)

Retailer	Frequency
Big Bazaar(BB)	42
Reliance Fresh (RF)	44
Spencer's Fresh (SF)	28
Total	114

Table 1 shows the distribution of the sample (outlets) located in NCR region. The maximum number of outlets is from Reliance Retail (44), however almost same number of outlets is from Big Bazaar (42). The third category of retailer is Spencer's fresh, which are 28 in number.

2. RFID implementation

Table- 2,RFID Implementation

	Frequency
Yes	114
No	0

Table number 2 indicates that all retailers surveyed have RFID installed in some for or other.

3. Benefits RFID implementation

Table- 3, Benefits RFID

	Accelerated goods receipt	Reduced Idle Time	Inventory management optimization	Improved process flow	Fewer shelving Errors	Shrinkage reduction	Out-of-stocks reduction
Mean	3.89	3.57	4.09	3.84	2.29	3.74	3.40

According to table number 3 RFID brings with it a number of benefits the major amongst them being inventory management optimization (4.09), accelerated receipt of goods (3.89), Improved process flow (3.84), and many other.

4.2 Hypothesis Testing

This section is a test of proposed hypotheses using ANOVA test. In this section each hypothesis is first listed which is followed by a table that shows the result of the administered ANOVA test. This is followed by an inference stating whether the hypothesis is supported or not supported.

BENEFITS THROUGH RFID IMPLEMENTATION

1) Accelerated receipt of goods benefit through RFID implementation.

Ho1: There is no significant difference in the mean value of accelerated receipt of goods benefit through future through RFID implementation.

Table 4, ANOVA test for accelerated receipt of goods benefit through RFID implementation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.584	2	1.292	1.449	.239
Within Groups	98.934	111	.891		
Total	101.518	113			

Table 4 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of accelerated receipt of goods benefit accrued through RFID implementation. It has been found that the value of $F = 1.449$ and $Sig = .239$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho1 is supported.

2) Reduced idle time through RFID implementation.

Ho2: There is no significant difference in the mean value of reduced idle time benefit through RFID implementation.

Table 5, ANOVA test for reduced idle time benefit through RFID implementation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.235	2	1.118	.928	.398
Within Groups	133.703	111	1.205		
Total	135.939	113			

Table 5 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of reduced idle time benefit accrued through RFID implementation. It has been found that the value of $F = .928$ and $Sig = .398$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho2 is supported.

3) Inventory management optimization through RFID implementation.

Ho3: There is no significant difference in the mean value of inventory management optimization through RFID implementation.

Table 6, ANOVA test for inventory management optimization benefit through RFID implementation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.178	2	5.089	.318	.728
Within Groups	1776.945	111	16.009		
Total	1787.123	113			

Table 6 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of inventory management optimization benefit accrued through RFID implementation. It has been found that the value of $F = .318$ and $Sig = .728$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho3 is supported.

4) Improved process flow through RFID implementation.

Ho4: There is no significant difference in the mean value of improved process flow through RFID implementation.

Table 7, ANOVA test for improved process flow benefit through RFID implementation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.467	2	.734	.851	.430
Within Groups	95.690	111	.862		
Total	97.158	113			

Table 7 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of improved process flow benefit accrued through RFID implementation. It has been found that the value of $F = .851$ and $Sig = .430$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho4 is supported.

5) Fewer shelving errors through RFID implementation.

Ho5: There is no significant difference in the mean value of fewer shelving errors through RFID implementation.

Table 8, ANOVA test for fewer shelving errors benefit through RFID implementation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.045	2	2.022	2.900	.059
Within Groups	77.403	111	.697		
Total	81.447	113			

Table 8 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of fewer shelving errors benefit accrued through RFID implementation. It has been found that the value of $F = 2.900$ and $Sig = .059$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho5 is supported.

6) Shrinkage reduction through RFID implementation.

Ho6: There is no significant difference in the mean value of shrinkage reduction through RFID implementation.

Table 9, ANOVA test for shrinkage reduction through RFID implementation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.355	2	.178	.254	.776
Within Groups	77.750	111	.700		
Total	78.105	113			

Table 9 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of shrinkage reduction benefit accrued through RFID implementation. It has been found that the value of $F = .254$ and $Sig = .776$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho6 is supported.

7) Reduction in out of stocks through RFID implementation.

Ho7: There is no significant difference in the mean value of reduction of out of stocks through RFID implementation.

Table 10, ANOVA test for reduction of out of stocks through RFID implementation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.572	2	2.286	1.881	.157
Within Groups	134.867	111	1.215		
Total	139.439	113			

Table 10 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of reduction of out of stocks benefit accrued through RFID implementation. It has been found that the value of $F = 1.881$ and $Sig = .157$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho_7 is supported.

8) Improved merchandise availability through RFID implementation.

Ho_8 : There is no significant difference in the mean value of improved merchandise availability through RFID implementation.

Table 11, ANOVA test for improved merchandise availability benefit through RFID implementation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.376	2	.188	.241	.786
Within Groups	86.405	111	.778		
Total	86.781	113			

Table 11 shows the results of ANOVA test, which is run to test the differences across different retailers on the dimension of improved merchandise availability benefit accrued through RFID implementation. It has been found that the value of $F = .241$ and $Sig = .786$, which is more than $.05$. Hence no significant difference exists.

Hypothesis Ho_8 is supported.

Table 12, Summary of hypothesis testing

Hypothesis	F	Sig	Remark
Ho1: There is no significant difference in the mean value of benefit of accelerated receipt of goods through future through RFID implementation.	1.449	0.239	Supported
Ho2: There is no significant difference in the mean value of benefit of reduced idle time through RFID implementation.	0.928	0.398	Supported
Ho3: There is no significant difference in the mean value of inventory management optimization through RFID implementation.	0.318	0.728	Supported
Ho4: There is no significant difference in the mean value of improved process flow through RFID implementation.	0.851	0.430	Supported
Ho5: There is no significant difference in the mean value of fewer shelving errors through RFID implementation.	2.900	0.059	Supported
Ho6: There is no significant difference in the mean value of shrinkage reduction through RFID implementation.	0.254	0.776	Supported
Ho7: There is no significant difference in the mean value of reduction of out of stocks through RFID implementation.	1.881	0.157	Supported
Ho8: There is no significant difference in the mean value of improved merchandise availability through RFID implementation	0.241	0.786	Supported

5. CONCLUSION

RFID has enabled the Indian retailers to automate their supply chains and enhanced the quality of information that is produced. Though a particular retailer might be attaining more benefits than the other but the technology has made the supply chains within the Indian retail space more efficient by reducing cost and time and increasing accuracy. The retailers are using RFID to their advantage and as a result getting more visibility through their supply chains. They are accruing benefits of counter shrinkage reduction, better degree of product replenishment, storage, retrieval, better tracking of goods, less shelving errors, accelerated receipt of goods and optimized inventory by deployment of this technology. The deployment RFID is contributing to success of Indian retailers.

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