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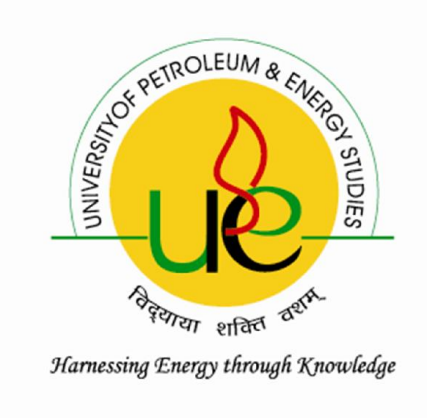

Research Report

On

Material Tracking in Retail: A Focus on RFID

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DECLARATION

I **Parag Angira**, MBA-L&SCM (SEM 4), College of Management & Economic Studies, University of Petroleum & Energy Studies, hereby declare that the Research Report titled "Material Tracking in Retail: A Focus on RFID" is an original work carried out by me availing the guidance of my mentor.

This report has no resemblance with any other report to any University or Institute published Earlier.

Parag Angira

MBA (Logistics and Supply Chain Management)

ACKNOWLEDGEMENT

I want to thank my HOD. Dr Neeraj Anand and my mentor Prof. Balaram Swamy J. for his continuous and unmatchable support during preparation of report, with different ways to approach a research problem and data collection sources.

I would also like to express my gratitude to my batch-mates for their kind support.

EXECUTIVE SUMMARY

The intention of this report is to get the reader to be familiar with RFID and its uses and importance in Retail Industry.

The report basically acquired information from Primary and secondary sources like the RFID Vendors, White Papers etc.

The report will answer questions of reader who has any queries about the importance of RFID in the Retail Industry as a whole. It also gives the key features for the improvement in the sector.

As the Indian Retail industry grows and transforms from unorganized to being Organised, material tracking plays an important role in inventory management and proper utilization of resources.

- If RFID is adopted Inventory Management will be improved.
- Western Retail Market has adopted RFID, whereas Indian Retailers are still reluctant to adopt RFID.
- Item Level RFID is still far away from adoption in Indian Retail Market.
- Cost of Implementation of Item Level RFID is very high.
- Item Level RFID will enable to scan huge lots in a single go, implementing it in Retail Industry will reduce time spent in Non-Value added activities like scanning each item.
- Multiple use tags can be used so as to reduce Operational Cost.
- Active tags can be used to track complete lot during transit.

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Business Problem

- High Cost of Tags and Readers in India.
- Negative mindset of the Retailers towards implementation of RFID.
- Operational and implementation roadblocks to Item Level RFID in India.

Research Problems

- Lack of RFID use in India
- Excessive use of Bar-Codes over RFID

Research Questions

- What are the benefits for RFID in retail?
- What are the key challenges for RFID in retail?
- What are the significant adoption drivers for RFID in retail?

Research Gap

- Research from End User view point has not been conducted

Research Objectives

- To Study the Current Scenario of RFID in the Retail Sector in India.
- To find the issues and challenges faced by Indian Retail Industry for proper implementation of RFID.

Literature Review

Authors/Associations	Year	Concept Introduced	Description/Inference
Mithu Bhattacharya, Impact of RFID on the Retail Value Chain: An Exploratory Study Using a Mixed Method Approach	2012	Retailer benefits by adopting RFID, Improved Customer Service Levels	Business Value of RFID in Retail, Major Challenges for RFID in Retail
Item-level tagging in the grocery industry - are we there yet?	2013	Item Level RFID	Uses of RFID at item level in retail industry
Bill McBeath The Explosion of Retail Item-Level RFID: A Foundation for the Retail Revolution	2013	Item Level RFID, End to End RFID implementation	Reducing complexity of RFID implementation, End to End Implementation of RFID and Item level material tracking
Kurt Salmon RFID in Retail Study	2014	Barriers for RFID piloting, Return on investment	ROI for RFID in retail industry, barriers that impede implementation of RFID in Retail.
An Empirical Study of Potential Uses of RFID in the Apparel Retail Supply Chain.	2011	Item Level RFID in Apparel industry	Problems with RFID in Apparel Industry. Benefits to the industry by using item level RFID in apparel industry.

Research Methodology

Purpose is to present the research design that will be used to conduct descriptive research for this study.

The project required in-depth (Descriptive) study of Retail sector in India. The study has been conducted based upon the white papers and articles published on RFID.

Data is collected from secondary sources such as articles, Journals and primary source such as Quotations from vendors.

Sources of Data	**Primary and Secondary**
Research Instrument	Documents, White Papers, Articles, Vendor Quotations.

1. Introduction

1.1 What is Retailing

Retailing is a set of business activities, which add value to the products and services sold to consumers for their personal use. Mostly people perceive retailing only as the sale of products, but it also involves the sale of services such as overnight lodging in a hotel, exam, doctor's consultation, a haircut, a rental store, or a home pizza delivery. All Retailing is not done in a store.

Examples: Non-store retailing includes Internet sales of hot sauces (www.firehotsauces.com), the direct sales of cosmetics by Avon, catalog sales by L.L. Bean and Patagonia, and DVD rentals through Redbox's kiosks.

1.2 Value Created by Retailing

Why retailers are needed? Wouldn't it be easier and cheaper to buy directly from manufacturers?
The answer, generally, is no because retailers are more efficient at performing the activities described below that increase the value of products and services for consumers. These value-creating activities include
(1) providing an assortment of products and services,
(2) breaking bulk,
(3) holding inventory, and
(4) providing services.

Providing Assortments: Supermarkets usually carry 18,000 to 30,000 different items made by more than 500 companies. By offering an assortment, companies enable their customers to choose from a wide range of products, brands, sizes, and prices at a single location. Manufacturing companies specialize in producing specific types of products.

For example, Frito-Lay makes snacks, Dannon makes dairy products, Skippy makes peanut butter, and Heinz makes ketchup. If each of these manufacturers had its own stores that sold only their self-manufactured products then consumers would have to go to various different stores to buy the groceries needed to prepare a single meal.

Breaking Bulk: To reduce cost of transportation, manufacturing companies and wholesalers typically ship cases of frozen dinners or cartons of blouses to retailers. Retailers in turn offer these products in small quantities tailored to individual consumers' and households' consumption patterns—an activity called breaking bulk. This is important to both manufacturers and the consumers, enabling manufacturers to efficiently manufacture and ship merchandise in larger quantities and enables consumers to purchase it in small and useful quantities.

Holding Inventory: A major value-providing activity performed by retailers is holding inventory so that the products will be available when needed by the customers. Thus, they can keep a small inventory of products at home because they know local retailers will have the products available when they need excess. This is important to consumers who have limited storage space.

Providing Services: Retailers provide services that make it easier for the customers to buy products and use them. Example, retailers offer credit such that consumers can have a product now and pay later. Products are displayed so that consumers can see and test them prior to buying. Retailers employ salespersons in stores or maintain Web sites to answer questions and provide additional information about products.

Increasing the Value of Products and Services: By providing assortments, breaking the bulk, holding the inventory, and providing services to customers, retailers increase the value that consumers expect and receive from their products and services. Consider a door in a shipping crate in an Iowa manufacturer's warehouse. The door cannot satisfy the needs of a do-it-yourselfer (DIYer) who wants to replace a closet door today. The DIYer finds this door more valuable and will pay more if it is available from a nearby home improvement center that also sells the brackets and tools needed to hang the door and provides sales associates who can explain which door is best for closets and how the door should be hung. In addition, many retailers are involved in designing innovative products and services. For example, a Macy's buyer designed the first tea bag, and a JCPenney buyer invented panty hose.

2. Challenges faced by Modern Retail Industry

The introduction of technologies like barcodes has not eliminated many issues such as:

1) Out of stock: Out of stock situation is a big problem for the retail industry. According to average out-of stock level for the retail industry in United Stated is about 8.3%. The root causes identified for the out of stock situation are inaccurate forecasting and store ordering, inadequate shelf restocking and upstream activities.

2) Inventory inaccuracy: For Retailers, inaccurate inventory is another problem that leads to huge losses. A case study results show that a US based retailer (Raman, 2013) claimed that there was inaccurate inventory for over 70% of the stock keeping units in the store.

3. Radio frequency identification (RFID)

A technology that allows an object or person to be identified at a distance by means of radio waves. The RFID devices or tags are attached to Shipping containers, cartons, or even behind the labels on single items. They transmit data to the system about the object in which they are embedded. The RFID technology has two advantages over bar codes. First, the devices can hold more data and update the data stored. For instance, the device can keep track of where an item has been in the supply chain and even where it is stored in a distribution center. Second, the data on the devices can be acquired in harsh environments without a visual line of sight—an environment in which barcode labels won't work. Thus, RFID enables the precise and real-time tracking of every individual product, from manufacturer to checkout in the store. It eliminates the manual point-and-read operations needed to get data from UPC bar codes. Thus, RFID can significantly decrease warehousing costs, distribution costs, and inventory costs and inturn increase margins and provide better in-stock positions. Several retailers are already taking advantage of this new technology. Walmart has requested that its Data about an item or carton can be encoded into an RFID chip and then can be accessed remotely to determine the presence of the item and where it should be.

To meet these demands, vendors have been forced to make significant investments to acquire the necessary technology and equipment. Retailing View 10.5 describes how American Apparel innovated use of RFID on individual items instead of cartons or pallets, which are the typical current application in retailing.

3.1 Types of RFID Tags

There are three types of RFID tags:

- active,
- semipassive, and
- passive tags.

Active and semipassive RFID tags use internal batteries to power their circuitry. An active tag also uses its battery to broadcast radio waves to a reader, whereas a semipassive tag relies on the reader to supply its power for broadcasting. Because these tags involve more hardware than passive tags, they cost more.

Active and semipassive tags are mostly used for costly items that require tracking from about 100 feet or more. When tags must be read from even farther away, additional batteries can increase a tag's range to over 300 feet. Passive RFID tags can be read from up to 20 feet away, and they have lower production costs, ranging from 7 to 20 cents each. The RFID industry is aiming to get the cost of a passive RFID tag down to 5 cents each once more retailers adopt them. These tags can be applied to less expensive merchandise such as cosmetics and some clothes. These tags can be disposed along with the disposable goods on which they are attached.

3.2 Benefits of RFID

3.2.1 Retailer Benefits

Real time Inventory Information: With RFID, retailer can have real -time inventory information that can help to prevent stock outs, locate stock within a store to avoid shrinkage of inventories, and can help to enable retailer to use more yield effective pricing strategies.

Decreased Labor Costs: RFID technology provides practical elimination of the need for manual stock checks. Reduction in labor will be realized in the following areas of retail operations:

- Stock receiving,
- Stocking,
- Check out,
- Cycle counting and
- Physical counting.

Prevention of Theft, Shrink and Inventory Write OffsIn retail industry: Shrinkage is a term used to describe inaccurate inventory counts as a result of theft by customers, employees, inaccurate inventory counts due to misplaced items, and reordered stock because items are on a display shelf in another area of the store. RFID technology has the potential to alert staff when items are being illegally removed, or if they are misplaced within the store. This can assist in theft reduction and also provide real-time accurate inventory counts automatically.

Integrated Opportunities: The RFID technologies will offer retailers new and unlimited marketing opportunities. The tracking of customers‟ purchases before they leave the store offers retailers information that can immediately be used for the cross selling other products that are related. Suggestive in-store selling allows retailers to communicate with shoppers while they are shopping in an effort to encourage them to buy an additional and complimentary item (USA Strategies, 2005).

3.2.2 Consumer Benefits

Consumer Savings: Most notably, consumer savings will result due decreased costs in the supply chain. Currently, companies approach supply and demand in the only way that they know how. They produce goods in the hope that customers will buy them. Of course, historical information and trends are utilized, but it is by no means an exact science. Conversely, RFID will allow companies to better match up supply and demand. Manufacturers will not produce vast quantities of product that will not sell and retailers will not overstock excessive amounts of product destined to sit on store shelves gathering dust. RFID will enable companies to more quickly identify goods that can need to be discarded or replenished. This in turn will give the customer access to a better and

fresher product. In the long term, this will also lead to a decrease in pricing for the consumer.

Authenticity and Improved security of prescription drugs: RFID can also be used to distinguish genuine products from counterfeit products. It is a key consumer benefit given that counterfeits could potentially contain decreased dosages and elements as opposed to the genuine. Currently, consumers have no fool proof method of vetting their prescriptions which could lead to potential health issues associated with ingesting counterfeit drugs.

Efficient Recalls will reduce Deaths and Injuries: More reliable and faster product recalls along with proved food safety. RFID can be used to identify and recall outdated products, which will further enhance consumer safety (USA Strategies, 2005).

3.2.3 Some other benefits of RFID include:

Reduced warehouse and distribution labor costs: Warehouse and distribution costs typically represent 2 to 4 percent of operating expenses for retailers. Replacing point-and-read, labor-intensive operations with sensors that track the pallets, product cases, cartons, and other individual products anywhere in the facility can significantly reduce labor costs by as much as 30 percent.

Reduced point-of-sale labor costs: Using RFID at the product level can help retailers reduce the labor costs needed for checking shelf inventory. In addition, RFIDenabled products will improve self-scan checkouts and increase the use of selfscans, thus shortening checkout times and reducing employee fraud.

Inventory savings: RFID reduces inventory errors, ensuring that the inventory recorded is actually available. By tracking pieces more exactly, companies have more accurate information about what was sold and what inventory is actually needed.

Elimination of counterfeit merchandise: Using RFID on individual items can help eliminate counterfeit merchandise.

For example:
California planned for pharmaceutical manufacturers to utilize RFID technology starting in January 2009 for its mass serialization and e-pedigree requirements; however, the deal has now been delayed and is scheduled to go into effect in a phased manner between 2015 and 2017. A drug pedigree is a statement of origin that identifies each prior sale, purchase, or trade of a drug, including the date of the transactions and the names and addresses of all parties to them.

The primary purpose of an e-pedigree is to protect consumers from contaminated medicine or counterfeit drugs. As the product moves down the supply chain, every company has to carry forward all previous e-pedigree information. In this way, the final point of sale has the complete lineage of every unit. Such a system would require fairly significant changes to the company's data interchange. The use of RFID forms the basis of such a secured supply chain system. Oregon and New York, as well as France, Japan, and Spain, are all making moves toward similar legislation.

Reduced theft: With RFID, products can be tracked through the supply chain to pinpoint where a product is at all times; this helps reduce theft in transportation, at distribution centers, or in stores. RFID has already been successfully deployed in stores, particularly on costly items prone to theft, such as Gillette Mach 3 razor blades.

Reduced out-of-stock conditions: Because RFID facilitates accurate product tracking, forecasts are more accurate and thus stockouts decrease. Using RFID, store managers can be automatically notified when specific SKUs are not on the shelves and need to be stocked

3.3 BENEFITS OF RFID VS. BAR CODES

Bar Codes	RFID Tags
• Bar Codes require line of sight to be read	• RFID tags can be read or updated without line of sight
• Bar Codes can only be read individually	• Multiple RFID tags can be read simultaneously
• Bar Codes cannot be read if they become dirty or damaged	• RFID tags are able to cope with harsh and dirty environments
• Bar Codes must be visible to be logged	• RFID tags are ultra thin, and they can be read even when concealed within an item
• Bar Codes can only identify the type of item	• RFID tags can identify a specific item
• Bar Code information cannot be updated	• Electronic information can be over-written repeatedly on RFID tags
• Bar Codes must be manually tracked for item identification, making human error an issue	• RFID tags can be automatically tracked, eliminating human error

Source: THE ADOPTION OF RFID TECHNOLOGY IN THE RETAIL SUPPLY CHAIN (Michael A. Jones, David C. Wyld, Jeff W. Totten)

4. Impediments to the Adoption of RFID

Successful RFID implementation strategy takes time and effort. A full-fledged system implementation in a large manufacturing company can cost $10 to $25 million (Mohsen, 2012).

Considering the initial costs of RFID, there is no return on investment (ROI) for companies that implement the technology if compliance is the only pursuit.

RFID technology faces numerous implementation challenges.

4.1 Major challenges include:

- Technological maturity,
- Global standardization,
- Government regulations and
- cost

4.2 A biggest obstacle to the widespread adoption of RFID has been:

- The high costs, which make lowers the present return on investment.

  The cost of RFID tags is about Rs. 12/- per tag.

  However, with increasing demand and reducing tag production costs, tags are expected to reach only Rs. 5/- per tag, and they may be reusable in some applications.

- It generates more data than can be efficiently and easily processed, so retailers find it difficult to justify the implementation costs.

- Most retailers are not capable of transmitting, storing, and processing the data that would be available about the location of pallets, the cases, the cartons, and individual products in the supply chain.

Vendors are pushing back as well. Some claim that instead of saving labor, RFID tagging actually increases it: Bar codes are printed on cases at the factory, but because most manufacturers have yet to adopt RFID, manual tagging of products has to be done.

Radio Frequency Identification (RFID) is an example of automatic identification technology which is much more advanced than the barcode technology and can address these issues effectively through reduced manual intervention and thus reduced errors.

RFID has stochastically dominated the use of barcodes. The basic idea of using RFID technology is to revolutionize the way business is conducted today, RFID tags uniquely

identifies objects. There is a numbering scheme proposed by the Auto-ID center used for unique identification and that is called the Electronic Product Code (EPC).

4.3 Current Adoption

- The current adoption of RFID is primarily at the case and pallet levels.
- But the future is with item level tagging, as it will allow extreme visibility (Zhou, 2009).
- RFID adoption rolled out with large retailers such as Wal-Mart, Tesco, Best Buy, Marks and Spencer, Home Depot, Metro and government agencies such as DOD (US department of defense) and FDA (Food and Drug Administration) mandating their suppliers to tag their products at a pallet or case level with the objective of streamlining their value chain.
- Widespread use of RFID could automate individual items, cartons, cases and pallets, and also reusable assets throughout the value chain processes.
- Accuracy and Real-time visibility could be a reality with RFID which was not possible with the use of bar-code technology.

Although it has been claimed that RFID is going to revolutionize the way businesses are done today, the rate of adoption for the technology has been relatively slow. Guiding decision makers and informing consultants about relative importance of going forward for future adoption decisions is important. Rogers' technology diffusion model is used to conceptualize the way decision makers and organizations are persuaded to make the adoption decision and the focus is on key drivers and possible benefits. Also Perceived and actual implementation challenges are important for the overall decision to adopt RFID.

5. RFID in Retail

5.1 Apparel Industry

The apparel industry represents a rather complex supply chain. Most supply chains in this industry are unique, though some similarities mark them. These chains are both global and domestic, depending on the specific items, manufacturers or retailers involved.

- **Inventory flows** through domestic and global supply chains differently.

  For example, some manufacturer–retailer combinations send inventory from production facilities to supplier distribution centers (DCs) to retailer DCs and finally on to the retail store.

  Others move inventory to the retail store directly from the factory.

- Finally, retailers usually have multiple channels of distribution. For example, a retailer may have ―dot.com‖ site and mobile channels, in addition to traditional brick-and-mortar retail stores, and some retailers maintain multiple brick-and-mortar store formats.
- Therefore, the various retail channels and formats, together with the multiple methods of moving inventory through the supply chain, result in a vast number of possible combinations.
- The apparel supply chain contains two structures for demand consideration:
  - The replenished apparel supply chain (RASC) and
  - The fashion apparel supply chain (FASC).

Examples of items in the RASC include underwear and intimates, that is, items that are produced year round and whose styles do not change much from year to year. Orders for items in the RASC usually are based on inventory positions at the retail echelon of the supply chain, and stores often receive their replenishments from inventory held in the retailer's distribution center (RDC).

Examples of items in the FASC instead include dresses, winter coats, and sweaters. These items have styles and colors that change from season to season or year to year. Demand often is estimated 12 to 18 months or more in advance of actual demand, ordered from overseas suppliers, shipped into country, and then pushed to RDCs and stores. The most significant costs include markdowns, shrinkage, transshipments, and the cost of lost sales. Furthermore, one of the most significant challenges in the FASC is the ability to forecast size/color/style combinations well in advance of any sales. Overall then, the complexity of the logistics decisions in the FASC is greater than that of the RASC.

However, even the RASC tends to be more complex than other consumer goods, because few apparel manufacturers own their own manufacturing facilities, and most contracted manufacturing facilities are offshore. Manufacturers ship inventory into their U.S. distribution network, which likely includes a national or set of regional distribution centers, and then sends it on to RDCs, which replenish the retail stores. Because apparel manufacturers typically do not own their production facilities, they often outsource assembly to producers with very low barriers to entry.

Furthermore, apparel manufacturers generate the preponderance of their profits from design and marketing features, including their brand equity. Some apparel manufacturers, especially those in the RASC, appear especially interested in reducing costs because the value of their brand equity is not as high as it is for their compatriots in the FASC, nor as high as it has been in the past.

Thus, the appeal of RFID strategies to apparel manufacturers in the RASC involves both the potential for cost reduction and top-line revenue growth. The contract manufacturers that assemble RASC inventory will use RFID—if they are required to do so and receive sufficient compensation.

Otherwise, they are generally indifferent, because the globally competitive nature of the contract apparel industry offers them very low profits, and business comes and goes over time with few guarantees. Yet there is a twofold value proposition for contract manufacturers. First, RFID could offer significant value through improved inventory control practices. Second, it is possible that a contract apparel manufacturer could differentiate itself by demonstrating its RFID capabilities and thus secure more profitable contracts. Textile or fabric manufacturers represent the next echelon in the apparel supply chain. They are more capital intensive and confront higher barriers to entry, which allows them to earn higher profits. Textile manufacturers include companies that take cotton, silk, and wool and spin it into yarn. These same companies might take the yarn and weave and knit it into fabric, or they may send their yarn to other specialized fabric producers. Still others take petroleum or chemical products and produce petrochemicals for manufacturing synthetic fibers, woven into fabric or mixed with natural fibers for weaving and knitting. If there is business value in tagging the lots of natural or synthetic fibers, when the yarn gets spun, each lot could be tagged. The identity of the fiber lot then could be associated with the tagged yarn lot, allowing for tracing and tracking.

Similarly, the lots of fabric could be tagged, such that the lots of yarn and synthetic fiber used in their manufacture might be clearly associated with the lot tag in a database. The result would be potential logistics cost reductions, though perhaps the more significant opportunity entails marketing benefits. A textile company offering RFID capabilities that can trace the lots of natural and synthetic fibers allows the apparel

supplier to exploit this information in its marketing strategy. In the long run, this information might even represent a necessary condition for competing. For example, if consumers come to expect this level of visibility, additional entry costs would be created throughout the apparel supply chain, which in turn might increase profits throughout the supply chain. Thus, some of the cost savings secured at the lowest levels of the apparel supply chain might be counterbalanced by additional profit reaped at higher levels.

Finally, beyond a marketing strategy, there could be regulatory measures that necessitate RFID throughout the supply chain.

Previous apparel studies already have documented the benefits of RFID to retailers. Published studies of large companies such as Dillard's, Bloomingdale's, and JCPenney have calculated the significant benefits. In particular, these studies indicate store inventory accuracy improvements ranging from approximately 5% to 27%. The use of RFID also substantially reduced cycle time (96% less time in the Dillard's study) and positively affected out-of-stock situations, due to the improved inventory accuracy.

Because it is already clear that many retailers can make significant gains at the store level by using apparel RFID, they have a greater incentive to contract for RFID capabilities throughout the apparel supply chain. Perhaps there is thus an opportunity for modern apparel retailers to be the first to create an RFID branding strategy. Such a strategy might include a claim such as, ―we know where every fiber in this shirt came from.‖ Whether such a strategy would work is an empirical and strategic fit question. Yet a retailer would enjoy less risk with such a strategy,because if it failed, the retailer at least gets to enjoy the reduction in store logistics costs. If the strategy fails for the supplier, no cost-level savings offset it, though perhaps there are costs at other points in the supply chain that provide savings.

Overall then, the apparel industry seems poised to offer a significant opportunity for expanding the use of RFID. First, many retailers have piloted RFID programs and achieved substantial successes (e.g., Bloomingdale's, Dillard's, JCPenney). Others such as American Apparel and Walmart are in the midst of implementing its widespread use. Collectively these retailers are in a position to not only drive RFID adoption but also increase the supply chain benefits of RFID use by apparel manufacturers, such as through collaborative efforts to create significant standardization in its usage and processes across the industry. Second, apparel has exceptionally high read rates, often reaching 99.9% accuracy. Such a high degree of accuracy yields reliable data that can be used to enhance supply chain benefits for all partners.

Ultimately, apparel manufacturers may have more to gain than any other set of manufacturers, considering the operating efficiencies of other manufacturing industry segments today. To estimate the operating efficiency levels of various consumer

product manufacturing segments, we collected publicly available data that spanned the apparel, domestics, electronics, grocery, and hardline segments, with sales and assets by quarter for each firm. From these data, we estimated efficiency frontiers for each industry segment. Apparel manufacturers are the least efficient. Apparel manufacturers require the highest level of assets to generate sales, in comparison with other groups of consumer product manufacturers.

Thus, they have to and also they do offer the greatest relative opportunity to improve business processes through the use of RFID.

5.2 Grocery Industry

Wal-Mart also announced that they require all of their larger suppliers to implement radio frequency identification (RFID) on every box and pallet shipped to Wal-Mart by 2005

Other key players driving the development and adoption of RFID include the US Department of Defense, Proctor and Gamble, and the European retailer Metro Group

Over the past decade, grocery retailers have acknowledged that their supply chains are not responsive enough. To deal with this, they have invested millions into new techniques such as automatic replenishment programs (ARPs). Unfortunately, grocery retailers have actually increased average inventory levels and their related costs (Stank and Crum, 1999; Bowersox and Closs, 1999; Brown and Bukovinsky, 2001). RFID provides the opportunity to reverse this trend and truly integrate the grocery supply chain

Item level identification must be the foundation for item level supply chain management. Item level identification, therefore, is only possible if each item has its own identity that can be recognized easily and efficiently within the entire supply chain.

Wireless product identification has recently garnered the interest of researchers (Karkkainen and Holmstrom, 2002). The general technology can be viewed as a wireless barcode. Because of its flexibility, this technology provides the technical basis to manage individual items in a supply chain.

First and foremost, no physical contact is needed to interact with the product items, allowing for increased handling efficiencies. Even Bar-code readers are no longer needed to update inventories, and theoretically, even checkouts could be eliminated. Recent research reports that checkout costs account for approximately 3 percent of retail revenue in supermarkets in the industrialized world (Hennessy, 2000).

Currently some supermarkets are experimenting with selfcheckout capabilities. Wireless technologies using electronic payment methods could allow shoppers to walk out of the store without stopping at a checkout station, having their goods scanned automatically and their credit cards charged.

This could lead to reducing (and possibly even eliminating) the entire process and cost of customer checkout (Chain Store Age, 1999).

Identification of item level products also allows effective customization of products. In e-grocery retailing, wireless product identification can allow new offerings to customers in addition to making it easier to assemble and deliver the order.

In the physical store, since products can be identified remotely, inventory could be managed from the distribution center. These capabilities allow for true VMI.

Finally, this effective information sharing also allows for better control of the supply chain. When companies move from focusing on functional requirements to supply chain solutions, visibility of the supply chain increases and allows for greater control and efficiencies. In case of grocery stores, store inventory could be managed from the distribution center. This is something that many grocery supply chain managers have wanted for some time. In personal interviews for this research, managers from both Kroger (Carson, 2003) and Albertsons (Salmon, 2003) grocery store chains expressed their desires for the benefits that RF technologies can provide. Automating inventory replenishment decisions would result in significant cost savings to the stores, by freeing up time that department managers spend walking the floor checking the shelves to see what is needed.

5.3 UPC to EPC (Item Level RFID)

Visibility: Most retailers use product-level data

UPC (Universal Product Code) – It tells you about the product, but not about an individual item for product identification and pallet or case-level data. Data for Item level barcode is usually only read at the origin (manufacturer) and at point-of-sale, in between it is very rare. Instead of that, pallet and case barcodes are read at the handoff points during the process, and with the assumption that the items that are supposed to be in them are there for sure. Its not economical to unpack cases and read item-level barcodes during the process. Barcode reading, whether item level, case level, or pallet level, is done manually, one label at a time.

With item-level RFID, the manufacturer and retailer have visibility to each unique item throughout its end-to-end process. Also the visibility can be provided automatically as goods are loaded and unloaded on the vehicles that are traveling on a conveyor belt, Loaded on or taken off the shelves, and any other movements through the chain and the

store. Result is dramatic reduction or elimination of the labor required to capture the data, also increased data accuracy, with item-level granularity at many more points within the process. Implications of this are profound.

Its this pervasive and granular item-level visibility from RFID that enables many of the transformative capabilities in the retail revolution.

5.4 Benefits of Item level RFID

Increased Sales and Reduced Markdowns

RFID has been shown to reduce out-of-stocks by 20%-30%, thereby increasing sales by 1%-2%.

By improving promotion and execution item level RFID can increase the revenues from promotions by 10%-18%.

Further, the customer loyalty is improved when shoppers consistently find what they are looking for in the available stock. Resulting in improved inventory accuracy of RFID also lowers the need for markdowns, and in-turn the Sales associates spend less time managing stock and more time providing service to the customer they are serving. And No wonder that we are seeing such enthusiasm for this technology among retailers.

Lean, Cost Control, Profitability

The retail sector has been in transformation in the last decade with consolidations, mergers, also rethinking merchandise strategies, the new store formats, and customers changing how and where they go to shop. The Promotional pricing pressures, also combined with an uncertain economy, they have created a persistent shift to greater price-sensitivity among the customers. In turn this has increased margin pressures on all but not on the highest-end luxury brand products, this has driven the need to reduce costs on all aspects. There is also a renewed interest therefore in lean principles and lowering inventory and labor costs wherever possible. However, inventory has to be reduced intelligently—across-the-board reductions only erode levels of service, and increase out-of-stocks, and hence reduce sales.

RFID decreases the requirement for labor. Example, RFID lowers the manual labor required for receiving by 50%-80%. Inventory cycle counts can be done 10-30 times faster with RFID than manually. The inventory accuracy is improved due to more frequent cycle counting and reduced counting errors.

Improving inventory accuracy leads to improved replenishment and hence the forecast accuracy, this allows retailers to intelligently lower inventory levels and at the same time reduce out-of-stocks.

Brand Protection: For luxury items, item level RFID is an important weapon in verifying the authenticity of products. And this requires strict security and control over the tags, as well thinking through the supply chain and where in the chain authentication will and needs to be done. Moving further, it also requires RFID tag designs that can be very discreetly integrated into the product, it still performs very well. Today, all ultra-brands are educating their consumers and building out the systems and infrastructure for the distributors, the retailers, and the end consumers to verify the authenticity of the item using item level RFID, and often combined with other techniques. Various Luxury brands such as Burberry, Elie Tahari, Ralph Lauren and others are using RFID to protect their brands and confirm authenticity.

Customer Experience / Differentiation: With intense competition coming from all sides Amazon and other channels online, and new market entrants encroaching on others' territories—it is more important than ever for retailers to differentiate themselves and provide a unique experience to customers. Item level RFID can play a key role here with innovations such as automated/instant self-checkout system, also easier and more automated returns process, ensuring the right mix is always in stock, freeing up store associate labor (from mundane tasks like stock keeping) so they can have more face to face time with their customers, it also enables associates to give rapid, accurate and high confidence answers about what is in stock and where it is placed. Also, creative retailers discover new uses for RFID every day to transform the customer experience.

5.5 Impact on Supply Chain Performance and Suppliers

The Move to Source Tagging In early pilots, retailers largely tagged items themselves at the store or in their DCs. This still happens in a few cases, such as Borsheims' tagging of jewelry at the store. But in the majority of cases, once a retailer goes beyond the pilot and into production, it is more cost-effective to have tags applied by the manufacturer at the source. Suppliers are being asked to apply the tag at the point of manufacturing and in some cases the logistics service providers are expected to provide item-level visibility of goods in motion throughout the supply chain. Hence, RFID-related requirements have been added to the vendor compliance manuals of many major retailers.

What do these new mandate requirements mean for suppliers? How are suppliers adapting? How can they realize benefits to offset the costs? Piggybacking on Current Ticketing Processes— With a New Twist Most retail suppliers already have substantial experience complying with various retailers' mandates, including very specific

requirements for tagging and ticketing items. The new RFID mandates are, to a large extent, simply extensions of the current ticketing requirements. RFID may be integrated into the barcode label or tag or it may be an additional new hangtag or label. To avoid penalties/chargebacks resulting from the retailer receiving non-functioning RFID tags, suppliers need to test tags to verify they work— typically done in bulk mode (often by a service bureau) before the tags are applied. Diligent suppliers test again before shipping, to make sure there are 100% readable tags going into the carton.

A Microscope on the Supplier Some retailers find, as they start implementing item-level RFID, that the rate of supplier errors seems to rise suddenly. Of course suppliers aren't suddenly getting worse. Rather RFID exposes errors and lack of precision already existing on the supplier's side. RFID automates the receipt accuracy checking process for the retailer, comparing what was actually received against what was ordered and what was in the ASN. Once the supplier starts getting this feedback from the retailer, often within a month or two, many of those errors are reduced. The new process integrity helps expose and correct issues that were previously slipping through the cracks.

5.6 Reducing Disputes

RFID provides a level of electronic Proof of Delivery (e-POD) not previously attainable with barcodes— automated 100% verification of exactly what was received at the item level. Errors in the e-POD may occur when a tag malfunctions or cannot be read or an item was mistagged (e.g. wrong tag on the item, missing or duplicate tags on an item). This is another reason for suppliers to perform Pack Verification (see the Pack Verification section below).

Potential Benefits Can Offset Increasing Costs for Suppliers

RFID is not free for suppliers. Tags can add in the neighborhood of 10-30 cents per item shipped, depending on volumes, type of tag, and services provided by service bureau and/or label converter. In addition, there are one-time costs for readers and implementation costs such as retraining staff and IT integration (depending on what the supplier is trying to accomplish). The per-item cost can be hard to absorb for low margin items. It is in the supplier's interest to try and get some benefits from these investments.

Potential Improvements to Supplier's Operations

If the supplier does the bare minimum to meet a mandate, then it is all cost and no benefit to the supplier (except, of course, the overarching benefit of keeping that business with the retailer). However, there are potential process improvements that suppliers could make. Some of the more immediate and obvious ones involve using RFID for pack verification, ship verification, and ASN generation.

Pack Verification

Pack verification happens after a worker has packed a case or carton, usually just before sealing it. All of the RFID tags in the case are read and compared against the ship order. This read can happen automatically (if the packing station has a built-in reader) or by the worker using a handheld reader (less new infrastructure required, but more per-order labor required than the built-in reader). If everything matches, then the case is sealed. If there are discrepancies, then a worker manually investigates and fixes any issues. As mentioned above, the issue could be that the wrong items are in the carton, but it also could be that a tag is not working or an item is mistagged. All of those issues are much cheaper to catch at the supplier's shipping operations than at the retailer's receiving operations.

Ship Verification

Ship verification is similar, except that it happens as cartons are loaded onto the truck or onto a pallet and then again as pallets are loaded onto a truck. This confirms that the right items are being loaded into the right vehicle. This information can be fed to the system that will generate and send the ASN. This comes almost as close as possible to a 100% guarantee that the ASN will always match exactly what was shipped. Integrating With Retailers' Systems Chargebacks and penalties are reduced when there is strong integration between the suppliers' and retailers' systems. Combining pack and ship verification with automatic ASN generation helps assure that the data hierarchy within the supplier's system for item-tocarton-to-pallet-to-ASN are error-free and aligned. The supplier can then use this data in important ways to leverage EDI transaction data while keeping track of change orders from the retailer, assuring that all the documents and processes the supplier must adhere to are taken into account. Retailers provide specific guidance from the largest to the minutest requirements. Although it is a big task, the benefits of avoiding charge-backs, reducing order-to-shelf cycle times, and improved retailer relationships more than offset the cost of compliance vigilance.

Improving Supplier Inventory Management

As the use of RFID becomes more widespread at a supplier, there is also potential for RFID to be used earlier in the process. For example, if the tags are applied in manufacturing process, then they can be used during putaway of finished goods, during picking at the manufacturer's warehouse, and to enable more frequent and accurate inventory cycle counting in the manufacturer's finished goods warehouse.

Getting to Benefits for Suppliers

In spite of the potential benefits, it is hard to find suppliers that are currently doing more than simply meeting the minimum retailer requirements (adding the required RFID labels to their shipments). Partly this is because it takes time and investment to change processes and systems. As a larger and larger percentage of suppliers' outbound shipments are tagged with RFID, we expect it will reach a tipping point where some suppliers decide to implement those process changes and start reaping some of the rewards, so that RFID can become more than just an additional cost for them.

In fact, because of the benefits, a few manufacturers have decided to implement RFID without any mandate from their retail customers. One example is Rica Lewis, the top blue jean manufacturer in France. They do direct-store-delivery and manage the restocking at their retail customers' stores, which include Carrefour, and Auchan Group. Tags are applied at the manufacturing plant and then used to insure pack and ship verification at Rica Lewis' DC. At the store, the Rica Lewis sales person can now take a complete inventory within 10 minutes, instead of spending an hour or more scanning items. This gives the salesperson more time to interact with and sell to their retailer customer.

Maybe in the next couple of years, more than a decade after Walmart's original RFID announcements, other suppliers will follow the lead of progressive manufacturers like Rica Lewis and will begin to change their processes and actually turn RFID into a win-win for themselves and the retailers.

5.7 The Role of the 3PL

The use of RFID in DCs represents an opportunity for 3PLs to differentiate themselves, based on their knowledge and ability to implement advanced practices on behalf of their client. Within the DC, this could include receipt verification, automated put-away, pick and pack verification, and ship verification. More broadly, 3PLs can use RFID to help implement DC Bypass, merge-in-transit, and other advanced logistics capabilities in a more granular and precise manner.

1. What is the current state of RFID adoption in the soft lines industry?

Overall, almost one-third (32%) of respondents reported that their companies had performed full adoption of RFID, 2% are piloting and two-thirds (66%) reported not using RFID at this time. These numbers were substantially the same across the basics, fashion and accessories categories. Retailers with annual revenues over $1 billion were 4.3 times more likely to have implemented RFID (41%) than those with revenues between $500 million and $1 billion (17%). Ten percent of the respondents plan to pilot RFID within the next 12 months and 12% are considering RFID pilots sometime in the future.

2. What are the use cases and benefits reported by current RFID adopters, and how do they vary across different merchandise categories?

Survey results indicated that the basics, fashion and accessories categories have all seen RFID adoption, and Kurt Salmon has noted in its work with early adopters of RFID that many were companies in categories where retailers could achieve the targeted ROI through gains in inventory accuracy alone. For the most part, these are categories characterized by complex assortments (style/color/size) and low substitutability (such as denim), where RFID can enhance backroom to front-of store inventory accuracy and replenishment. RFID adopters able to measure ROI have seen gross margin improvement in some cases of more than 5%. Retailers responded that the most significant benefit was through back-to-front accuracy, with 40% reporting more than a 5% improvement in gross margins. Respondents also reported use

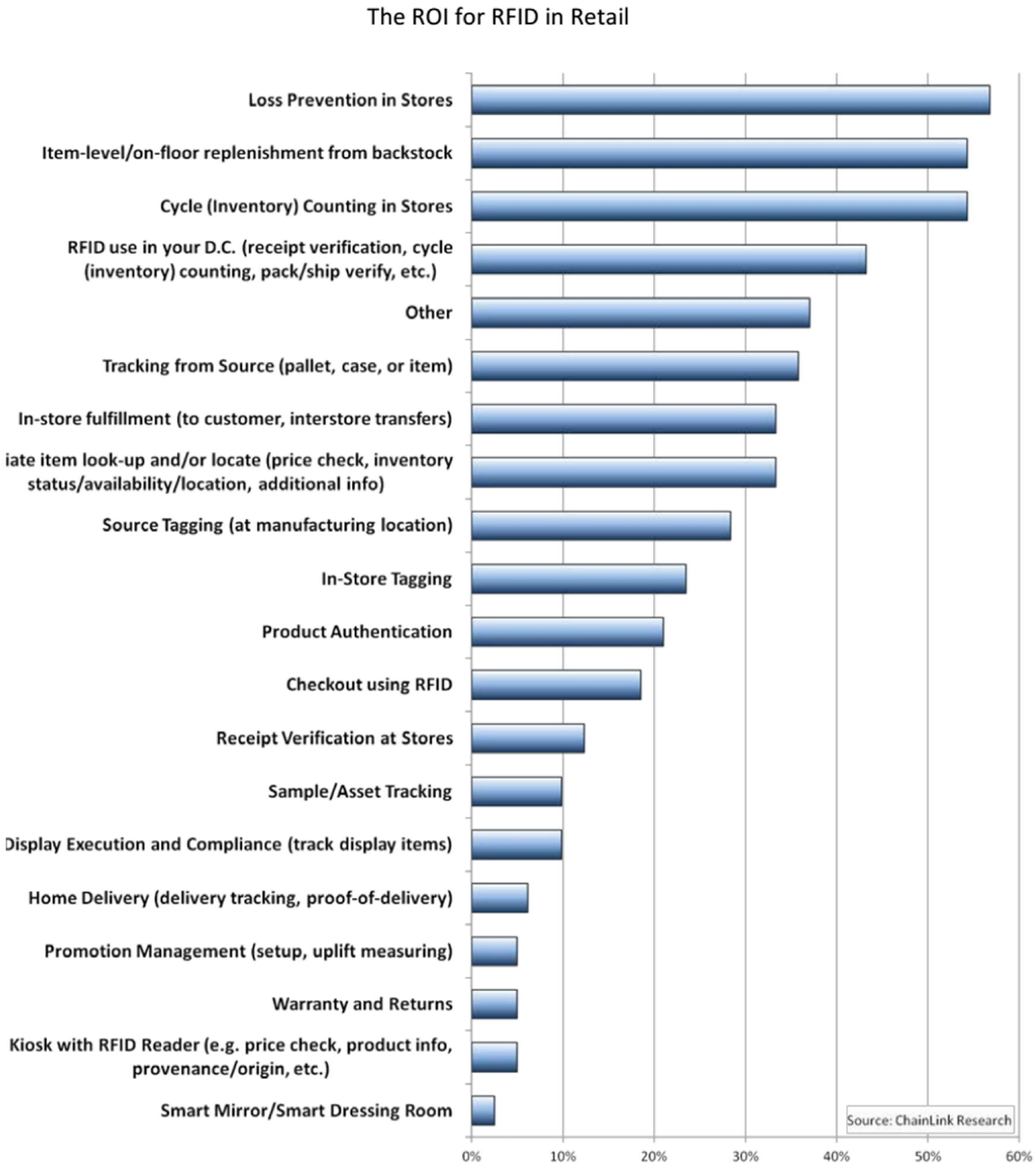
Back-to-front: Use of RFID tag data to determine which products, though in stock in the store, overall lacked presentation on the sales floor, triggering restock in real time from the backroom. Cases including Omni-channel fulfillment and shrinkage reduction, with benefits ranging from less than 1% to over 5%.

THE ROI OF RFID

	ROI your company has achieved from using RFID to improve backroom to front-of-store inventory accuracy and replenishment	ROI your company has achieved from using RFID to support omnichannel fulfillment, including ship-from-store and pick up from store	Describe the shrinkage improvement your company has achieved from using RFID
ROI NOT YET BEEN DETERMINED	27%	43%	36%
0%–1% INCREASE IN GROSS MARGIN	13%	14%	14%
1%–3% INCREASE IN GROSS MARGIN	13%	7%	21%
3%–5% INCREASE IN GROSS MARGIN	7%	14%	7%
GREATER THAN 5% INCREASE IN GROSS MARGIN	40%	21%	21%

* Percentages represent the percentage of respondents self-reporting ROI in these ranges.

Source: RFID in Retail by Kurt Salmon (2014)



Source: Chainlink Research (2014)

6. Findings

- If RFID is adopted Inventory Management will be improved.
- Western Retail Market has adopted RFID, whereas Indian Retailers are still reluctant to adopt RFID.
- Item Level RFID is still far away from adoption in Indian Retail Market.
- Cost of Implementation of Item Level RFID is very high.

7 Recommendations

- Item Level RFID will enable to scan huge lots in a single go, implementing it in Retail Industry will reduce time spent in Non-Value added activities like scanning each item.
- Multiple use tags can be used so as to reduce Operational Cost.
- Active tags can be used to track complete lot during transit.

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