The RFID as an Innovative Technology in Retailing: A Case Study

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Keywords:
RFID, Retailing; Case Study

Abstract
Customers are more demanding in terms of responsiveness, level of service, quality of products and costs. Firms only could reach these goals simultaneously if they invest in new technologies. A new technology that has received considerable attention from academics and practitioners, especially among retailers, is the Radio Frequency Identification (RFID) because of its large scope of application, advantages and potentialities.

This paper aims to present the potentials, requirements, advantages and disadvantages associated with the utilization of RFID both, in general and to the retailers. It intends to highlight the benefits associated with the utilization of the RFID technology in logistics field. That is, it wants to emphasize the importance of this technology to firms perform the logistics activities faster, with more quality, cheaper and with more responsiveness especially in the last echelon of the distribution chain, the retailer. To illustrate this, a case study is presented with a Portuguese fashion retailer about the introduction of the RFID technology and the analysis of the situations that motivate their adoption, as well as the gains reached, difficulties and improvements to the future.

Introduction
The Radio Frequency Identification (RFID) is the generic name attributed to the technologies that use the waves radio (Jones et al., 2005) for the automatic identification of objects, positions or persons through electromagnet answers and at a considerable distances (So and Liu, 2006). It allows that firms produce, store and deliver a high quantity of data quickly (Bange, 2006).

RFID is an emerging technology that intends to complement or replace traditional barcode technology to identify, track, and trace items automatically. RFID is claimed to add intelligence and to minimize human intervention in the item identification process by using electronic tags. The tags are significantly different from printed barcodes in their capacity to hold data, the range at which the tags can be read, and the absence of line-of-sight constraints (Meyerson, 2007).

This paper aims to highlight the potentials associated with the utilization of the RFID technology in logistics field. That is, it seeks to emphasize the importance of this technology to firms for them to perform their logistics activities faster, with more quality, cheaper and with more responsiveness. To attain this objective, and as a way of illustrating, the main motivations, gains and difficulties that could be involved in the introduction process of the RFID technology - a case study about a Portuguese fashion retailer is described.

The paper is structured as follows; first, we offer the characterization of the RFID System in terms of the elements that constitute it (readers, tags, software, and security programs). The following section focuses on the main advantages and disadvantages associated with the use of the RFID technology to all firms in general and to retailers in particular.

Next, a case study is presented about the application of the RFID technology in a Portuguese fashion retailer (Throttleman) who is considered a reference in this field since this brand gained the Retail Technology Award 2008 with its solution of RFID.

The RFID System

A RFID system is composed by several elements: readers, tags, software, and security programs for the readers (Atkinson, 2004). Instead of visible light used in ordinary bar code labels, these tags use radio waves to communicate with the readers. The readers generate signs that are able, by one hand to supply energy to the tag in order to generate data and, on the other hand, to send a sign of interrogation.

To produce radio waves tags require some source of energy to power its electronics. Active tags use a tiny battery, a microchip, and a tiny antenna built into them. The operating frequency of radio waves employed also varies. Low-frequency RFID tags (Table 1) operate at 125 to 134 kHz, for US and international use. High-frequency systems use 13.56 MHz. Frequencies of 866 to 960 MHz are used in UHF (ultra-high-frequency) systems, while microwave systems operate at 2.4 to 5.8 GHz (Dipert, 2004).

The key component of an RFID system is the tag itself. Tags come in a large variety of forms and functional characteristics. One useful way of classifying tags is to divide them into active and passive classes. Active tags whose read/write range is longer and passive tags with shorter range. However, passive tags are much cheaper than the active tags and are therefore more widely used. The active tags have more possibilities and bigger flexibility than the passive ones. This is because, they have their own internal power source which is used to power the integrated circuits and broadcast the signal to the reader

To distinguish tag types from each other, Electronic Product Code (EPC) Global has established five tag classes to indicate capabilities a tag can perform as indicated in Table 1. For instance, Class 0 tags are factory programmable. The EPC number is encoded onto those tags during manufacture and can be read by a reader. Class 1 tags can be programmed by the retailer and supplier. They are manufactured without the EPC number which can be encoded onto the tag later in the field (i.e., by retailer and supplier). The Class 3 tags have the Class 2 capabilities plus a power source to provide increased range or advanced functionality. The Class 4 tags have the Class 3 capabilities plus active communication and the ability to communicate with other active tags. The Class 5 tags have the Class 4 capabilities plus the ability to communicate with passive tags as well.

TABLE 1: Tag Classes

Tag Classes	Tag Class Capabilities
Class 0	Read only
Class 1	Read, write once
Class 2	Read and write many times
Class 3	Class 2 capabilities plus a power source to provide increased range or advanced functionality
Class 4	Class 3 capabilities plus active communication and ability to communicate with other active tags
Class 5	Class 4 capabilities plus the ability to communication and the ability to communicate with passive tags as well

Source: *Meyerson (2007)*

Antennas also come in a diverse range of form and technical factors. They are used in both the tags and the reader. The size could vary from under a square centimeter to several square meters. Technically speaking, UHF reader antennas can be classified as circular-polarised or linear-polarized antenna. The former emit and receive radio waves from all directions, while the later work best in one particular direction. Therefore circular-polarized antennas are less sensitive to transmit Readers could come in four types: handheld, vehicle-mount, post-mount, and hybrid (Meyerson, 2007). The first three are dedicated to reading of the tags, active or passive. The fourth type has the active/passive mode allowing it to switch from the passive to active mode and vice versa. Both handheld and hybrid readers are more expensive than the vehicle-mount and post-mount. Next generation readers are expected to have less power consumption and fewer voltage requirements.

Passive RFID readers create a radio frequency field when they are turned on. When a reader detects passive tags, it activates them. These tags draw their power from the radio frequency field; they do not require battery power. Because they have no battery, the passive tags are smaller and lighter in weight than active tags. Some are as light as or even lighter than the bar-coded labels (Meyerson, 2007).

When the active tags with power come into the reader's field, the reader switches to the read mode and interrogates the tag. However, the operating range of a linear-polarised antenna is more than that of a circular-polarised antenna (Intermec, 2004). When a tag communicates with an antenna, the radio frequency portion of the circuit between the tag and the antenna is called the air interface. This radio communication takes place under a certain set of rules called air interface protocol. Propriety protocols may cause interoperability problems with equipment from different vendors.

Readers read or interrogate the tags. In reading, the signal is sent out continually by the (active) tag whereas in interrogation, the reader sends a signal to the tag and listens. To read passive tags, the reader sends radio waves to them, which energise them and they start broadcasting their data. The reader reads all the tags within its read range in a quick succession. This automatic process reduces read times. In a field test, Marks & Spencer, UK, tagged 3.5 million bins with RFID tags. While it used to take 17.4 minutes to read 25 trays with bar codes, on 36 dollies, RFID reduced that to just three minutes. This result was in an 83% reduction in reading time for each tagged dolly (Wilding and Delgado, 2004). Software is the glue that integrates an RFID system which depends upon the industry context, but usually a front end component manages the readers and the antennas and a middleware component routes this information to servers that run the backbone database applications. For example, in a manufacturing context, the enterprise software will need to be made aware of RFID at various levels depending on how far downstream into manufacturing and out into the supply chain RFID is implemented. The middleware technologies could be into three levels: (i) software applications which solve connectivity problems and monitoring in specific vertical industries; (ii) application managers that connect disparate applications within an enterprise; and (iii) device brokers that connect applications to devices like shop-floor machines and RFID readers (RAGMS, 2004).

The enormous advantages associated with this technology, has justified its large application in several functional areas (Table 2). We can find the RFID technology in different contexts namely in: i) anti-terrorism initiatives (Albright, 2005); ii) electronic keys; iii) warehouses (Meyerson, 2007); iv) centers of distribution (Borck, 2006); v) points of sales and; v) security applications in the transport (Kevan, 2004), demotic (Kelly and Scott, 2005); vi) e-business; vii) Supply Chain Execution Applications; E-business (Meyerson, 2007).

TABLE 2: RFID in Functional Areas

Manufacturing	Tags will be applied during the manufacturing process. The information initially stored in the RFID tag should be written according to the requirements of the rest of the value chain.
Transportation	The main objective is to provide better overall supply chain visibility thus the transportation network will need to use tags correctly to update the supply chain monitoring system at critical points.
Distribution	…distribution must be heavily involved in determining which applications would be most beneficial, including which data carried is most useful.
Information Systems	RFID implementation requires systems development and support. Work will be required in areas such as database selection, capacity, interface creation, data summarization, and item data management tools
Store Operations	..RFID can have a significant impact on store operations, from learning to use the system for accurate receiving, backroom storage, and shelf replenishment, to use of smart shelves for theft deterrence and no-scan checkout.
Sales	… suppliers in particular will benefit from sales personnel focusing on sales rather than addressing product identification and invoicing issues.

Source: *Meyerson (2007)*

Advantages and Disadvantages of the RFID Technology

There is a high investment in the development and improvement of the RFID systems because of the important advantages that firms can reach with it when compared with bar code tags where the reading must be done by a visual contact using optical readers.

In this context, one of the advantages pointed out to the utilisation of the tags is its power of reading. The tags can be read independently of the environment conditions. They can be read in aggressive environments such as fire, ice, ink, noise and different temperatures (Knill, 2002). This system presents also a high, rigorous and simultaneous capacity of reading (So and Liu, 2006), what could become an important source of competitive advantage in the logistics field. This characteristic, contribute to increase the efficiency of the transport in terms of loads and unloads of cargo once the warehouse operators do not have to use optical reader for collect data about the products that are loaded or discharged in the vehicles. Moreover, this technology allows collecting information of objects in movement (Knill, 2002; Bange, 2006).

The application of the RFID technology can brings also some advantages to the warehousing activity. The collection of the information put in each tag, allows the automatic and rigorous replacement of the stocks' levels (Atkinson, 2004; Kelly and Scott, 2005), a easier identification of the places where products are stored in the warehouses (Kelly and Scott, 2005; Kinsella and Elliot, 2005) and a quicker collect of data (Sullivan, 2004; So and Liu, 2006) without any kind of visual contact with the products (Borck, 2006). Knowing that on average, and in case of bar codes, the warehouse operators read the bar code labels around 25 times, it is comprehensible the high productivity than can be achieved when in its substitution smart labels are used with all the processes' automation that it could involve (Kinsella and Elliot, 2005).

In terms of economics, security and marketing, the RFID technology can bring also some advantages. Economically we assist a decrease on stock levels due to a higher control of it and also a better productivity (Witt, 2006; Sullivan, 2004). Thanks to the application of this system, the firms in general and the retailers in particular can reach, by one hand, a decrease on stockouts, a better control of procurement and a development on cross-selling in a more efficient way (Kinsella and Elliot, 2005). The RFID technology makes also possible a better control of the packaging conditions from upstream to downstream of the supply chain (Kevan, 2004; So and Liu, 2006). This last question is related with the rastreability which is imposed by the European regulations to the products agro-food. In the development of the Picking activity the RFID can also contribute to increase its efficiency and productivity. Several antennas RFID, put strategically in the zones of picking, permit that a set of products references will be

identified and transferred for expedition, leaving a rigourness on the pick-and-pack sequence while provides a complete final listing of the references of each order (Trunick and Williams, 2005).

In the activity of transport, this technology can be used to identify a specific product or to monitor the temperature of the products during the transport. More, the RFID makes possible to verify also if the temperature or humidity of the products was broken during the transport chain (Kevan, 2004). In this way, it is possible to have access to all conditions under which the products were submitted during the transport and also to use security mechanisms (Kinsella and Elliot, 2005).

In the case of retailers, the tags allow them to do a more efficient management of stocks levels (Borck, 2006) since becomes much easier and quicker the identification of the products and also the control of products' life-cycle. The permanent control of the products putted in the shelves of the stores allows the development of specific marketing decisions to each product (Atkinson, 2004; Kelly and Scott, 2005). Under a widened viewpoint, the RFID permits a better visibility of all the supply chain, necessary for a better management of it (Witt, 2006). Among organisations, a supply network characterised by rich information exchange, which can be enabled by RFID, increases the feasibility of implementing alliances of firms that exchange information to coordinate production and distribution, outsource functions and services, and partner with suppliers and intermediaries (Lee et al., 1997; Straub et al., 2004). In cases in which the RFID System adopts a more open and integrated configuration, allowing that the information flows through all partners of the same chain (Figure 1), a lot of bottlenecks of information reading can be avoid.

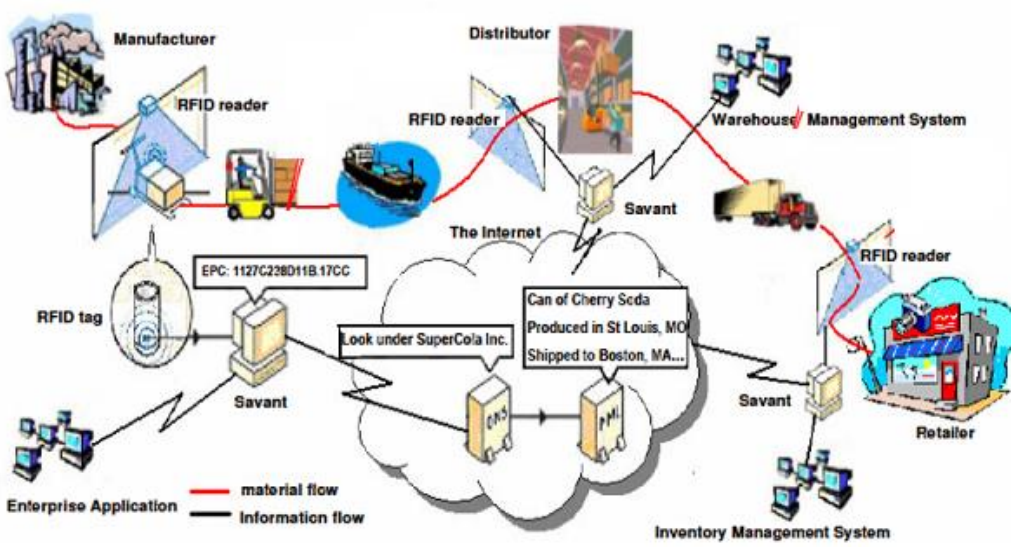

FIGURE 1: The RFID in the Supply Chain
Source: Meyerson (2007)

As can be seen in the figure above the merchandise goods can be tracked at various locations as they move from one end of the supply chain to another in the central warehouse and for the delivery and storage of goods and shelf filing. Using the data captured from the RFID tags, goods can be reordered according to demand and inventory safety check. All goods are sorted on RFID-tagged pallets in a central warehouse before they are delivered to the Future Store. Data captured from RFID tags are transferred to an electronic RFID merchandise management system, allowing the goods to be registered with the respective information in the system. Once registered, the locations of goods can be tracked throughout the entire logistic chain. When ready, the loaded pallets are moved to the exit zone of the central warehouse, where an electronic gate is installed with an RFID reading device.

When passing this gate, the data in the chips of the tags affixed to the cartons and pallets is transmitted to the merchandise management system. When goods are received at the Future Store, employees transport the pallets from the truck through an RFID gate at the backstore entrance. The data of the chips on each pallet and crate are read. Once the merchandise management system is updated, the supermarket employees can compare the received goods with the order to determine if the order was met or if the items were over-shipped, under-shipped,

or missing. After the goods are delivered for storage in the back room of the Future Store, each storage position is affixed with an RFID tag. When storing the goods, the employees use a handheld scanner to read this tag into the system. When taking goods to the sales room to refill the shelves, the employees pass an RFID gate at the exit of the backstore area, where the data on the RFID chips affixed to the cartons is captured for transmission to the merchandise management system. Cartons that could not be emptied due to a lack of shelf space are returned to the backstore area. As they pass at the gate, tag data is updated and then transferred to the system. When the merchandise is emptied from the carton, the RFID tags are deactivated.

According to Atkinson (2004), in the U.S.A. billions of dollars are lost annually, with the inefficiencies that occur on the supply chains motivated, to a great extent, by the incorrect locations of products in the store shelves or by a bad management of the information.

A wide range of benefits is being claimed for RFID technology within retailing including: (i) tighter control and management of the supply chain and of inventory management with attendant cost savings (Jones et al., 2004; Coltman et al., 2008); reduced labour costs; improvements in customer service; reduction in shrinkage and theft (Jones et al., 2004, Coltman et al., 2008; Veeramani et al., 2008); and clear targeting of customers and tracking of their purchasing behaviour (Jones et. al, 2004). Also, the real time data generated by the tags can provide manufactures, suppliers, distributors and retailers with up to the minute information on inventory, logistics and freshness (Jones et. al, 2004). RFID technology does not require a line of sight, since it can read many tags simultaneous. RFID will facilitate improved use of warehouse and distribution centre space in that goods will not need to be stored according to product type for manual location, but they can be stored in the most efficient manner. Retailers will be able to know where pallets and cases of goods are to (Coltman et al., 2008), to identify products that may have been recalled, to respond rapidly to unforeseen changes in the supply chain, to react quickly to problems within the supply chain, to check on expiry dates and to determine when products will arrive in store (Jones et al., 2004). RFID within a retailer enables a reduction in the number of incorrect manual counts, unreported stock loss, mislabeling, and inaccessible/misplaced inventory (Veeramani, et al., 2008).

Within stores many other benefits are also predicted for RFID. Many manufacturers have indicated as much as a 7% increase in sales because of the greater visibility of the inventory on the shop floor. RFID can not only detect if items are being moved from the store without being paid for but also they can alert security guards if a large volume of particular products have suddenly been removed from store's shelves. It also reduce check out times in that customers will able to push their trolley of carry their basket past a reader and get a complete list of all items purchased automatically charged to the customer's credit card (Jones et al., 2004).

Retailers will also be able to track products that are selling rapidly and to restock shelves several times a day with such fast moving items. RFID can also be used to promote products and stimulate upselling. It could be also used to trigger an interactive display of related products (Jones et al., 2004)

In general, the widespread adoption of RFID will allow retailers to spend more time selling products rather than stocking or tracking them.

As it can be seen, the new application of the RFID technology in a business and logistics context can bring a lot of advantages for the firms in terms of optimization and of efficiency. However, some problems have also been identified by the firms. Despite of the enormous advantages attributed to the RFID technology, some disadvantages are also pointed out. In this context, the main disadvantage attributed to the use of this technology is its cost. It involves a big investment (Borck, 2006) and the return of this investment is only recuperated in a long time (Kinsella and Elliot, 2005). If a short Return-on-Investment (ROI) was verified it could promote the use of this technology because according to Trunick and Williams (2005) this type of technologies presents a great level of obsolescence and innovation. Furthermore, the cost of each smart label is higher than the bar code one which lead firms with millions of SKUs to think about it.

Coltman et al. (2008) make the following questions related with the use of this technology: (i) can the cost per RFID tag reach feasible economies of scale for individual level tagging?; (ii) who will bear the cost of deployment in the supply chain and how will these costs be distributed in an equitable manner? In this context also Veeramani et al. (2008) refer that one of the barriers to the adoption of RFID by organisations is the difficulty in assessing the potential return on investment (ROI). Besides a set of authors had analysed the impact of the implementation of the RFID technology in ROI (Hardgrave et al., 2005; Rekik et al., 2008), there is a lack of a good understanding of the impact of RFID upper echelons of the supply chain. RFID can greatly affect the retailers and suppliers that manufacture and distribute goods for them (Veeramani et al., 2008).

The level of security provided by the RFID represents another disadvantage. From the point of view of Atkinson (2004) is relatively easy to have access to the information that flows in a RFID systems in a warehouse or in a center of distribution center of a competitor. It is only necessary to use a radio telescope in a relatively near distance. This can explain the fear of the firms to adhere to the RFID technology. The complexity of this technology, the lack of know-how and standardisation are some obstacles referred by firms for not use the RFID technology (Albright, 2005).

Once analysed the main characteristics, advantages and disadvantages associated with the RFID technology in a retailing context, we will focus on the challenges the firms are facing to implement this technology. There are many technical challenges associated with the deployment of RFID based solutions. Among the main technical challenges faced by firms could be highlighted the erroneous reads, the read collisions and the cost of handling large amounts of data generated by RFID (Coltman et al., 2008).

Retailers are starting to drive the introduction of RFID and it would seem to have the potential to revolutionise. Wal-Mart the world's largest retailer has introduced its top suppliers to place RFID tags on all its pallets and cases in order to improve the efficiency, effectiveness and security through the supply chain. Also, within the UK a growing number of major retailers such as Sainsbury, Marks & Spencer, ASDA and Tesco have been experimenting with RFID technology (Jones et al., 2004).

RFID is poised to fundamentally change the way companies in a supply chain track, trace and mange assets. This will have major impact on manufacturing, transportation, distribution and retail industries (Veeramani, et al., 2008).

The introduction of RFID will generate major training needs for retailers and their suppliers and distributors to allow their employees to use the new systems and master new job functions (Jones et al., 2004). Before the introduction of the RFID technology retailers will need to undertake a fundamental strategic review of their business process and of their relationships with suppliers and distributors. Retailers will also need to integrate their RFID systems and the data they generate with their other functional databases and applications such as accounts and customer relationship management (Jones et al., 2005).

Case Study: The Throttleman

The main objective of this section is to present a case study to illustrate the application of the RFID in the retailing with a special highlight on its challenges, advantages and disadvantages. The data necessary to elaborate this case study was gathered by secondary sources specially newspapers, conference presentations and Throttleman' website.

The firm chosen is the Throttleman. This firm is a Portuguese one that initially (1991) in its start up phase adopted the denominated of BOXER SHORTS and after 2000 changed to the Throttleman.

In the beginning the brand focused on mans apparel especially in underwear and after 2003 widespread its assortment to kid's apparel and in 2005 to women collections. Throttleman's manufacturer supplies 1.5 million men's and women's fashion items yearly.

The brand, in the last years, has growing substantially in terms of revenue, number of stores, commercial area, number of articles and quantity, as can be seen in the table 3.

TABLE 3 - The Growing of the Throttleman in the Last Four Years

	2003	Variation	2007
Revenue	8.614.000€	161%	22.503.000€
Nº of stores	46	30%	60
Commercial area	1.898m2	189%	5.477 m2
Nº of articles	1.695	244%	5.826
Quantity of articles	407.992	175%	1.122.440

Source: *Lopes, 2007*

Why Firms Feels the Necessity to Implement RFID?

In the world of Fashion retailing, the start up processes of a collection assumes, more and more, a determinant role in what concerns the determination of invoicing. When the number of pieces begin to increase, as was the case of Throttleman, becomes indispensable that firms find forms of become their processes more agile in order to avoid delays in the reception of pieces in warehouse and the bottlenecks in the lunching phase of a collections.

Prior to installing the RFID system the distribution process was handled manually. When shipments from the manufacturer in India arrived at the retailer's distribution center, employees had to open each box and visually check to ensure the items listed on the advance shipping notice were in fact inside the box. When shipments were sent to the stores, the items were hand packed and manually recorded. In the development of all of these processes a lot of mistakes were identified.

Beyond the internal problems Throttleman faces also others related with the supply chain management, mainly the high lead time with orders reception, the lack of capacity to do the reposition of the stores in time; the overstocks in warehouses; the lack of reliability on stocks levels; and the difficulty to synchronise the reality with the ERP adopted.

In this context, the firm feels the necessity to find a solution fitted to its requirements. The solution chosen was the RFID technology.

This solution divides itself in three different areas: Edgeware, Integration and RetailID Solutions. The Edgeware is composed by the physical platform of RFID which includes the passive and active TAGs, manual readers, antennas and fixed readers, porticos and tunnels of reading. The integration aggregates the functionalities of the Edgeware and the solutions of the RetailID. The RFID is responsible by the management, of the information filtration that comes from the physical layer and by the combination of this one with the integration. The solution RetailID, was disposed by the Sybase in partnership with the Paxar and the CreativeSystems. The first partner, entrusts-itself with the supply and the impression of the labels RFID and the second one with the supply, support and integration of the hardware.

The firm advanced with the placement of TAGs RFID in some pieces of the winter collection, willing to extend the process to all the collection in the next year. In the warehouses, it is working already the process of orders control through RFID and his subsequent sending for the stores.

Throttleman started the first phase of the RFID pilot in March 2007. The garments are tagged with EPC Gen2 RFID tickets that are printed with variable data at Avery Dennison Service Bureau facilities (global network for printing variable data labels and tags). The garments with the RFID tags attached are packed in boxes and shipped from the manufacturer in India to the Throttleman distribution center (DC) in Portugal. At the distribution center the RFID tags inside the boxes are read and confirmed simultaneously in just a few seconds providing immediate information on quantity, style, size and colour.

With the new system, Throttleman's clothing manufacturer in India applies a RFID label to each item. The manufacturer programs and verifies tags at the site before shipping the goods, and sends the retailer an advance shipping notice listing which items are being shipped. When the boxed garments arrive at Throttleman's DC, they are placed on a conveyor and sent through the Tagsys 3-D tunnel interrogator. The interrogator captures the tag ID numbers with an accuracy of 99.9 percent, and sends that data through a wired LAN connection to the retailer's software system. The software then matches those numbers with the advance shipping notice, confirming that the correct items have been received. If it determines that ID numbers are incorrect or missing, the system illuminates a warning light on the warehouse floor alerting the employees to check the contents of the box.

Later, when items are repacked in boxes for shipment to stores, the tags are scanned in the same tunnel reader to compare the ID numbers against the pick list, before being loaded on trucks. Throttleman then sends an advance shipping notice to the stores.

Actually Throttleman is using the system only to verify the accuracy of the shipments its distribution center receives from India and sends to its stores. However, the clothing seller intends to equip its nearly 100 stores in Portugal and Spain with RFID readers at the receiving docks during the next two years. At that time, stores will also verify the receipt of each shipment as it arrives from the DC, before moving the items to the sales floor. Throttleman does not have yet plans to read the tags at the point of sale.

Advantages and Disadvantages associated with the implementation of the RFID

Were the inefficiencies and wastes identified widespread all over the firms' processes that motivate Throttleman to find a solution to overcome this situation and work on reach a better performance in terms of efficiency?

With the adoption of the RFID technology the firm enhances a lot of advantages. Since does not become necessary open all the boxes and verify piece by piece, the firm is reaching a good performance as regards the life cycle of products, any thing as four days of sales in store. On the other hand, the stock static decreased 60% contributing to a reduction on the warehouse space.

Moreover, the option of Throttleman by the RFID technology permits its integration with the logistic process of the brand being, at the same time, a quick project in terms of development and implementation. The Portuguese fashion retailer has reduced also the time items spend in the supply chain by seven to five days and a quickly identification of them as they arrive from the manufacturer in India ensuring that the right items are shipped to its stores throughout Portugal and Spain. After the implementation of this solution the reception lead time improved a lot. Before this the average of this indicator was 4,97 days and after RFID it reached an improvement to less than 24 hours. Furthermore, the stock levels in warehouse decreased 60%.

Beyond all the important advantages identified and according to the Throttleman' CEO, the investment in all the project RFID is low, not arriving even to the six digits. The big cost is associated with the TAGs, since it costs four times more than the traditional. Each tag costs 30 cents to the firm.

New Challenges Faced By Throtleman

After having successfully achieved the first objective of improving the supply chain process, Throttleman has now started a second phase that will involve tagging 60% of the current collections, 371,234 articles, with the RFID tickets.

Throttleman is considering the possibility of creating a new shopping experience in their retail stores by installing one of the most innovative solutions from Avery Dennison, the Magicmirror. Magicmirror is an interactive mirror that informs the user about the garments that they are trying on. Information about the garment is read from the tag and appears simply by putting the garment in front of the mirror. In addition a touch screen option offers the client the possibility of requesting a different size or colour from the shop assistant without having to leave the cubicle.

The installation of the smart labels in all the garment allows the firm to attain the following advantages: (i) complete online inventory in the warehouse and stores; (ii) decrease the error' levels in the system; (iii) improve thrust and accuracy of data; (iv) get better capabilities in terms of anti-theft and fraud (in the supply chain); (v) complete ITL (Item Level Tracking); (vi) complete supply chain traceability; (vii) smart Identification of the client needs; (viii) personalised contact and Direct Marketing; (ix) customer experience solution; and (x) cross selling.

Conclusions

In the business context the smart labels have reached many adepts by the huge potentials that it presents for firms considered individually or integrated in a supply chain. The drive toward adopting RFID is being further enhanced by mandates from large retailers such as Wal-Mart and Target, and the Department of Defense of many countries, who require all suppliers to implement this technology.

The RFID technology has received considerable attention from academics and practitioners because of its potentialities and diverse fields of utilisation in organisations such as: manufacturing, transportation, distribution, information systems, store operations, sales. The increase use of the RFID has been pointed out by several kinds of firms especially by retailers because of the advantages gathered with its use. Through the RFID we may assist a decrease on the stock levels, a better productivity, a decrease on stockouts, a more efficient cross-selling, a better visibility and rastreability along the supply chains, more efficient logistics activities. The adoption of this kind technology allows a quicker flow of information, an improvement in the quality of the information that crosses the different types of logistics activities and a better synchronisation of the information among the supply chain' members. To the retailers, the RFID permits to become easier and quicker the identification of the products.

However some disadvantages are also pointed out. The one that is most referred is its cost. Apart from this, questions of security, the complexity of it and a lack of know how are also identify.

In order to illustrate the application of the RFID technology in retailing a case study is presented about a Portuguese fashion' retailer named Throttleman. This firm is pioneer in the implementation of this technology in the fashion sector. Throttleman feels the necessity to implement a solution based on RFID technology because the increase on the number of pieces to be manually processed. This situation associated with the geographical scope of its supply chain (the manufacturer is located in India and the Distribution center is sited on Portugal) was provoking delays and inefficiencies in almost all the processes. Being so, the option was to implement the RFID in all the items that comes from India to the DC in Portugal. With it Throttleman could improved its performance in term of products' life cycle, stocks level, throughput time, reception lead time. However, besides the important advantages reached by this technology with the adoption of this technology a significant disadvantage is also identified by Throttleman, the costs associated, mainly with the smart labels.

This paper is a first attend to alert managers and academics to the benefits of RFID technology's adoption in general and in a fashion retailing context in particular. Future studies should therefore be developed in other realities and contexts.

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