Usage of RFID Technology in Supply Chain: Benefits and Challenges

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Abstract
In today’s supply chain, the technology of RFID is become significantly important. Many researches have been published several articles over RFID. In this research, we have examined the major challenges, which faces by companies during implementation phase as well we also discuss the fruitful benefits of this technology’s blessings. RFID is consider as a backbone for information sharing process in supply chain; because real-time information sharing plays a vital role in supply chain, and due to the latest information and real time information, companies can minimize their upcoming risks and maximize the profitability of supply chain end-to-end. Some risks including; bullwhip-effect, accurate scheduling and forecasting. As well there are remaining several benefits attached with RFID’s technology including; inventory reduction, fulfill to customer demand/ customer service and satisfaction etc.

Keywords: Inventory Reduction, RFID, bullwhip-effect, Information Sharing, Supply Chain.

Introduction
The application of RFID and EPC in the supply has big potential in term of improving efficiencies and effectiveness in solving problems of supply chains. EPC is the idea of storing identification over chips, then placing those chips over tags, and because of this tags; object can be identified easily. The technology of RFID is new and significantly using in supply chain for the purpose of calculating inventory accurately in real-time (reduced processing time and labor). The biggest benefits of RFID is visibility, higher visibility can be achieve by RFID from manufacturer’s to distributors and finally till retail stores. There is no doubt that’s, RFID can help a wide range of firms & individuals like hospitals, manufacturers, distributors and retailers in the whole supply chain to realize significant efficiencies and productivity gains. In this research article, we will answer to the following questions:

1. In the supply chain, which processes will be affected by usage of RFID and where RFID has the potential of generating the most business values?

2. What is the capabilities of RFID in giving privacy, security and integrity of processes, however facilitating information sharing with suppliers and customers, and gaining competitive benefits?

3. What are the major hurdles and suggestions in adopting and execution of RFID technology?

We examine the basic elements of RFID as parts of a broad strategy’s supply chain, which directly help and support the efficiencies and effectiveness of SCM. We will investigate suitable business processes in SC affected through RFID and will recognize processes, where RFID have a significant and critical role in creating the value for the business. In specifically, we will highlight the RFID’s benefits and as well hurdles and recommendations in adoption and execution of the RFID in the context of integrated & interdependencies of SC processes.

Related Work
According to the many researchers including; (Gunasekaran and Ngai, 1); (Karkkainen, 2); (Lee and Ozer, 3); (Singh, 4); (Khan, S.A.R, 5); (Khan, S.A.R et al., 6) the technology of RFID increase to the visibility and performance of supply chain. RFID technologies provide real time information and due to the real time information, management can take decision on the right time (Anckar and D’oncau, 7; Clarke, 8) In the light of Lee and Ozer 3, RFID is significantly has potential in other areas of operations including; after sales service, manufacturing and total product life cycle management. RFID is the modern and latest technology. Through this technology easily can be identify any object including; products, goods, people etc. the technology of RFID support a wide range of applications- everything from management of assets and tracking to manufactured items and customer services to access control and automated payments. For an enterprise, every RFID system has distinctive components so that it can support a specific business process. It’s depending over the application in an industry and the enterprise within an industry, a system of RFID can be complex and execution can be more complex.
According to the (Karygiannis et al., 9) system of RFID may be composed of three subsystems as illustrated in Figure: 1.

1. An RF Subsystem, its perform identification & related transactions using communication of wireless.
2. An enterprise subsystem, which covers computers running specialized software this can store, process and analyse data acquired by RF subsystem transactions to make the data useful to a supported process of business.
3. An inter-enterprise subsystem, which links subsystems of enterprise, when information required being shared across boundaries of firm.

Each system of RFID contains an RF subsystem, which is composed of readers and tags. In many systems of RFID, the subsystem is supported through a subsystem of enterprise; which is called middleware, networking services and analytic systems. However, in a supply chain application, A RFID tagged items and products can be tracked during whole life cycle; from the manufacturing till final purchase of finished goods.

The subsystems of the enterprise are the software and computer that utilizes information stored over tags of RFID. Its play a very vital role, depending on the industry context, but usually a front end component manages the antennas, readers and a middleware component routes this information towards servers, which run the backbone database applications. E.g. in the context of manufacturing, the software of enterprise will required to be made aware of RFID at many levels depending over how far downstream into producing and out into the supply chain RFID is executed. The technologies of middleware are categorized into three levels:

1. The software applications, which solve problems of connectivity as well monitoring in particular vertical industries.
2. Application managers, which connect disparate applications within an enterprise.
3. Device brothers, who connect applications with devices like shop floor machines as well readers of RFID (Rockwell Automation, 2004).

The auto ID center at MIT developed a software program “savant” to manage the enormous amount of data expected to be built through RFID readers (Asif & Mandviwalla, 10). In a complex scenario of manufacturing, e.g. readers will be picking up a continuous steam of tag data that might contain errors like phantom-reads and duplicate reads etc. the Savant job is to clean and filter data, after these processes, forward data in term to avoid overwhelming enterprise applications. The applications may vary in how they interact with RFID. Some treat RFID as bar code scans or keyed data. The RFID application ranges from production and distribution of goods like as automobiles and its various components to minting bank notes shipping, oil exploration, and port operations, among others (Angles, 11; Khan, S.A.R. and Dong, Q., 12). The technology of RFID is AIDC technology, which uses electric fields at radio frequencies for identification, location authentication as well automatic data acquisition and transmits and supports a wide range of applications. The technology of RFID has the capability to share information across the organizational boundaries like applications of supply chain.

In Japan, the technology of RFID chip has become a de facto standard in the last five years, and credit cards having RFID and this is use by Millions of people per day to make travel, purchases etc. in the year of 2004, the technology of RFID chip by Sony’s Felica, beginning getting integrated in cell phones and today owners of those mobiles phones can make credit card purchases in stores. Tokyo’s subway and bus operators are launching a common card of travel based on the Felica platform. The system of Pasmo will be interoperable with East japan railway’s company.

The card of Suica allowing the almost 35 million people, who live in the city of Tokyo the ability to travel on more than 100 railway lines as well hundreds of bus routes only with a card. The touch-and-go payments it helps and support work over a distance of a few centimeters and take 0.1 seconds for each to complete. In addition, the technology gives the base for the octopus subway card in the Hong Kong, which has also morphed into a payment of e-money system, and in the Singapore, the ez-link card of transport, Felica is also using in Shenzhen’s Transcard, but has yet to break importantly into the market of European or north America.

According to the (Mears, 13) the company Schiff Nutrition International is in the process of a deployment of the technology (RFID) in term to keep continue business with his customer (Wal-Mart). In the year of 2003, the Wal-Mart began setting a strict deadline for all suppliers to implement RFID technology. However it was argued that the tags were very expensive and its look, will not add any savings, which Wal-Mart was expecting. Because many suppliers was complaining about the higher cost of execution; but it was expected that, the project will help to established a stronger links in the supply chain and will minimize the whole systems cost and will improve efficiencies.

The international Data Corporation did estimate that the RFID market for related implementation, consulting and managed services was expected to grow 47% in the year of 2004 and will reach to 25billion dollar world-wide by the year of 2008. As per the McCathie and Michael, (McCathie and Michael, 14; Khan, S.A.R, and Dong, Q., Zhang, Y. 15) the progression
of barcode standards from proprietary to globally accepted open standards had played a pivotal role in world-wide technology’s acceptance. Consequently, in term to be effective there has to be regulations & standards in the case of RFID as well. E.g. several firms specifically maintaining, installing a system of RFID technology has been a major and often determining factor in the placement of RFID technology in the commercial sector.

**Methodology**

In exploring the efficiency and effectiveness of RFID’s technology, we consider the following 8 key processes (Cooper et al., 16); (Croxton et al., 17). That developed the process of supply chain management. These processes give a framework for various aspects of tactical and strategic problems shows in the supply chain management.

1. Customer Relationships Management (CRM): facilitate structure to customer relationships and how such relationships are maintained, managed and developed. Identifies targeted customer’s groups as part of the mission of business & established agreements with key accounts. The report of performance also calculates financial impact for major customers and profitability.

2. Customer Service Management (CSM): provides information of customers for example: product availability, real time info, and shipping daters between company and customer.

3. Demand Management (DM): the requirement of customers with the company’s supply capabilities. This would add forecasting of demand, managing the demand, and in all other outcomes of company.

4. Order fulfillment Management (OFM): provides the integration of company’s logistics, marketing, and manufacturing plans. That would need the management of partnerships sustained through the firm to fulfil the requirements of customer.

5. Manufacturing Flow Management (MFM): support and help to produce items and build the production flexibility needs to service target markets. Requires management of items’ flow as well maintain the flexibility created.

6. Supplier Relationship Management (SRM): how a firms communicate with their suppliers. Similar to CRM, partnership management is needs to establish key relationship with key suppliers potentially providing a competitive edge.

7. Product Development and Commercialization: provides the new products’ development through integrating suppliers and customers in minimizing reaching time to market. Timely developments of products are important for company’s success.

8. Returns Management: provides a critical component of maintained competitive edge for the company. Allows company to monitor improvement in productivity and identify the valuable projects related to products.

We have also selected & identified four more processes, which include order fulfillment, demand management, manufacturing flow management, & return management where the technology of RFID plays a significant role as well generate most value. According to the Keen and Mackintosh, (Keen and Mackintosh, 18), define first time, process freedom, as those processes with the ability to add value in whole supply chain through enabling the mobility of crucial factors. These crucial and critical factors are people, documents, business activities, communication and information that are required for a more effective process design of business. As per the Angels, [11] argues that, the technology of RFID’s hold the potential to gives important and critical freedom that will liberate considerable human labor from certain workflows, and also facilitate the possibility of making updated and latest information visible for all stakeholders throughout the value chain. We will focus over strategic and long term benefits of RFID’s technology and business values. Besides, this we will also elaborate the hurdles, which face during execution process and some recommendations for smooth implementation of RFID technology, specifically when a firm extends its supply chain to upstream level (suppliers) and also downstream level (customers). As their integration (external), needs to gain in capacity planning in efficiency.

**The Technology of RFID**

In the year of 1990, the company (IBM) establishes companywide organizations for logistics, procurement, manufacturing and fulfillment. (Field, 19) In the year of 2002, the company brought those all units under the umbrella of integrated supply chain. This division was credited with supporting to minimize cost and increase responsiveness within one year. The firm had to balance 2 ways of calculating performance of supply chain:

1. Effectiveness (responsiveness and flexibility)
2. Efficiency (minimization of cost)

In the research paper of (Field, 19), that the supply chain optimization effort forced IBM company to find opportunities to balance efficiency vs. effectiveness if all following dimensions:

1. Data collected on several points in the supply chain
2. The processes of business involved in the supply chain
3. The information system involved
4. The companies involved in carrying out the several business practices.

In term to calculate efficiency and effectiveness, companies required to have a clear picture of the key supply chain processes and a measure of performance in every one of the processes. Organizations in several industries, like FMCG, consumer electronics, manufacturing are in their infancy stages/ levels in the execution of latest technologies that use RFID and EPC. This new technology will extend their abilities of company to capture accurate info over the location as well status of physical objects across the supply chain boundaries. The execution step in Wal-Mart has been slower than the giant retailer and predicted due to insufficient infrastructure of SC for the technology of RFID and also the cost of execution of technology. In our research, we will discuss supply chain infrastructure and relate it with inter-
enterprise subsystems of systems of RFID technology. To in-depth and better understanding of RFID technology, opportunities and challenges which are associated with RFID.

RFID Technology in Enterprise Systems

The fundamental usage of technologies in supply chain area is to increase and make to the operational and transactional efficiencies in the area of manufacturing, sourcing and distribution activities within a company and across its chain of supply. As per the supply chain council, “the supply chain encompasses every effort involved in manufacturing and delivering finished products, from the supplier’s supplier to the customer’s customers / consumer. As well managing supply and demand, manufacturing and assembly, sourcing raw materials and components, inventory tracking, distribution across all channels and finally delivery to the customer on the right time

According to the Keen and Mackintosh, Keen and Mackintosh, (18) debate that, the technologies of RFID are part of the universal infrastructure, which will help and support mobile commerce. They also introduced “process freedom”, the ability to add value along the whole chain of supply, to relate logistical operations & business relationships through enabling the mobility of crucial factors that included business providing significant “freedoms” which will minimize considerable human labor from certain workflows and for facilitating the possibility of making info readily available to all stakeholders in the value chain. While, because of its wide scope, SCM must address difficult interdependencies and accordingly be open to reengineer its appropriate processes. Furthermore, these processes should establish an extended enterprise, which reaches far beyond the door of factory.

In effect, supplier of material, channel supply partners that include distributors, wholesales, customers and retailers, system developers, SCM consultants become key players in the processes of supply chain. For a supply chain stakeholder, major competencies and capabilities must enable them to generate value in the form of lower cost, higher flexibility, better information sharing, improvement in quality and service, higher visibility and velocity. In specifically, the business intelligence’s concept to data from systems of supply chain management, and SC technologies might be applied to give strategic information for decision-making purposes. In this way, data collected across the supply chain may be analyzed to give information for evaluation of the performance of supply chain and its reconfiguration, and also conduction of “what-if scenarios” to calculate the efficiency and effectiveness of whole supply chain.

Value of RFID in Enterprise Systems

What has been developed and shown as a supply chain within different firms has varied widely. In essence, no two firms’ supply chains look alike. There are many supply chain models, and these models only effectively deliver over their promise when aligned with the way in which the firms want to go into market. However, many firms do not only have one chain. As illustrated in the Figure 2, on the basis of business complexity and impact, Cavinato, (20) differentiate 16 types of supply chains with the respect to complexity, chains may range from a basic form to a sophisticated complex supply chain and based over business impact, they range from a very traditional to a supply chain with competitive edge. The technology of RFID can support to establish like an integrated model of demand and supply chain/ integrated value chain in that one use the technology to run profits, innovations and generate value not just to minimize cost, but also to gain competitive edge.

The main reason of installing RFID technology is authentication, identification, and ADA (automatic data acquisition). Applications of authentication often assume the tag-holder to be a person, who has smart cards for automatic payments such as cafeteria bills etc. rather than an object; whereas most application is ADA. In mostly applications of ADA, objects like pallets and products tracked automatically and the captured data is used to derive enterprise resource planning systems. Application that need ADA or identification like RFID embedded in athletes ‘shoes to keep accurate timings over major athletics events related to the domain of ubiquitous computing. The idea of envisages a world, where the technology of RFID tags are fixed to a multitude of products that automatically coordinate and communicate with other intelligent devices to accomplish objective that now need human intervention (Khan, S.A.R, and Dong, Q., 21; Asif & Mandviwalla, 10). The effectiveness of those applications will be largely dependent over the type of tag itself. However some tags offer longer range of read, other may hold huge data / easier to manufacturer later less costly.

As the technology’s prices as well the applications become cheaper, the technology of RFID becomes very valuable from a productivity perspective. One can see operational performance on traditional process, approaches as well technologies. The company of Ford uses a real-time system of logistics for higher visibility by triangulation. Similar to e-commerce, the RFID is evolving in application and its effect over effectiveness. Initially, e-commerce was only automating existing processes and work flows. One can send a PO (purchase order) through the internet / pay an invoice and thus substituting an old technology for a new one. While, the major value in the e-commerce is, when a firms establish collaboration with its upstream supply chain partners (suppliers). The company (Microsoft) found value in e-commerce, when they were using the internet for collaboration purpose to design the Xbox. Recently RFID technology can be seen for efficient tracking. There is no doubt, only technologies cannot make improvement in the organization. As Neubauer, et al., (22) if companies view RFID as a replacement for barcodes, and they do not change their processes or redesign their processes so ultimately the RFID’s all benefits cannot be achieve and return on investment will be suboptimal. The technology of RFID can generate a borderless supply chain when cargoes are equipped with tags presenting the contents, so that cargoes’ customs clearance can be through automatically. RFID can also give a security in supply chain. When RFID tags are used to electronically seals containers as well monitor to movement. The biggest advantages of RFID technology is information
sharing (real-time) with upstream and downstream. In simple words, the technology of RFID can establish an integrated demand and supply chain or an integrated chain of value, in which one uses the technology to run profits, innovation and build value not just to minimize the cost and increase advantages.

ISO also have a standard of RFID. ISO is a profit organization. EPCglobal will generate and set the information regarding a product in UPC term, as well firm and by tags of RFID. The stored data in those tags indicates the data form, style and format for encoding and reading data enterprise. The latest EPC version tag data standard specifies build value not just to minimize the cost and increase which one uses the technology to run profits, innovation and demand and supply chain or an integrated chain of value, in words, the technology of RFID can establish an integrated management. EPCglobal Incorporation, managed countries, on the behalf of one member of every country, with a network of the national standards institutes of more than 157 countries. One of the most crucial factors of RFID application in supply is standardization for encoding information over RFID tag similar to the current bar codes over UPC (Universal Product Code) system. When one firm ships material to other firms, these standards will support simplify the electronic transactions that occur among the companies’ ERP systems. These standards will examine how middleware handles data scanned through an RFID reader as goods punching a warehouse and will pass the data to an application of enterprise. The latest EPC version tag data standard specifies the data form, style and format for encoding and reading data by tags of RFID. The stored data in those tags indicates information regarding a product in UPC term, as well firm and products identifiers. ISO (international standards organizations) and EPCglobal have adopted radio frequency identification device in their standards. The most prominent sector standards of RFID are the EPCglobal specifications and standards for supply chain management. EPC global Incorporation, managed standardization for encoding info over tags of RFID. This is the same institution that manages UPC information in bar codes, sets the standards for how fundamental information of product is encoded in the radio frequency identification device chips. EPCglobal initiated in the year of 2003, it is the non-profit organization. EPCglobal will generate and set the standards over how information goes through RFID readers to several applications, and from one application to another application. ISO also have a standard of RFID. ISO is a network of the national standards institutes of more than 157 countries, on the behalf of one member of every country, with a central secretariat in the Switzerland, which coordinate the system. Between the public sectors and private sectors, ISO occupies a special position. That is because, one hand, several of its member institutes are part of the governmental structure of their countries. On the other side, remaining members have their roots uniquely in the private sector, having been set up through national partnerships of associations of industries. The ISO18000 series cover (both active and passive RFID technologies) the data content of RFID is included ISO 15962, ISO 15418, ISO 15434, ISO 24721, ISO 15459 and ISO 15961. The performance standards & conformance are protected in ISO 1806 & 18047 series for RFID (active and passive) technologies.

Data Synchronization in RFID
Synchronization of data, is one significantly critical and important factor of supply chain to be addressed through RFID technology, firms need detail information regarding their items and goods as well supply chain, and the ability to share those information with their supply chain stakeholder (upstream and downstream) in term to support multiple business transactions and the movement of goods. Two different information networks have been building: the GDSN (global data synchronization network) and the EPCglobal between partners for collaborative trading. The network of EPCglobal gives access to dynamic info about the movement of individual products as they pass by the supply chain. The network of EPCglobal and the GDSN each gives important advantages in their own right. Conservatively, for those companies, who’s striving to achieve a fully collaborative business model, the combination of the GDSN and EPCglobal network may provide a comprehensive, integrated method to electronic collaboration and, as a result; can be complementary in the effort to enhance and improve global trading relationships?

SCM Processes and RFID Applications
The technology of RFID may be used in order fulfillment, demand management, return management, and manufacturing flow management; we will discuss those four SCM processes in detail one by one.

Demand Management and RFID
In the demand planning, one of this major hurdles is a lack of reliable data as well adopting RFID would produce accurate information related to the inventory of WIP (work in process), finished products, as well in-transit levels with reliable due dates (Bose & Pal, 23). Data get by RFID may eliminate inaccuracies in data due to absence of data or human error. Low price consumer demand and good quality are the main driving forces for firms to make their supply chain more efficient and effective. Timely data at the item-level as well in aggregate about the market demand for any product would support, help to build more successful strategies in marketing, production and distribution. The forecast gives the in-put for matching demand with supply in the form of planning of aggregate. This aggregate planning may be increased through accurate data , info using RFID thereby avoiding costly...
inventory stocks, buffer, safety stocks, while demand planning.

**Order Fulfillment and RFID**

Order fulfillment, is a major process in fulfilling the customer requirements and make better the supply chain effectiveness (Kumar and Sharman, 24). RFID will make able process automation in shelving, picking, cross-docking, and execution consolidation operations as well minimize cost of logistics mistakes for example sending a product towards a wrong address, to track its journey by the supply chain, as well to make instantaneous routing decisions. For example, RFID portals, mounted in strategic points in the center of distribution, may be used to read tags as well update inventory automatically as tagged pallets and cases enter the center. The merchandise of incoming will be matched against the correct PO (purchase order) and discrepancies will be identified. The freedom process will be reached in freeing up labor-intensive manual labor included in the receiving processes and quantity check-in.

**Manufacturing Flow Management and RFID**

By using RFID, assembly line operation can get streamlined. This automation in the manufacturing line will significantly increase production output and minimize cycle time. With improvement in the process automation as well tracking capabilities enabled through RFID, in the supply chain visibility, velocity will be increase and variability will be decrease (Bose and Pal, 23). And this process will support manufacturers with JIT assembly lines. According to the one biggest company in the world (P&G) believes that, the technology of RFID may help to track each and every item; due to the RFID implementation, P&G saves almost $1 billion in their working capital as well $200 million in carrying costs of inventory. According to the Lee and Ozer (3) the bottom-up approach, e.g. beginning with the operating characteristics of the processes is a good way to assess the RFID’s value.

**Return Management and RFID**

In the reverse logistics, products return (defective products etc.) is usually in supply chain operations. The track also can be traced by RFID technology. By its smart ESM (electronic security maker) may also support and facilitate return management by helping retailers know if they sold the product by RFID technology) may also support and facilitate return management by helping retailers know if they sold the product. An Electronic security maker ties the management by helping retailers know if they sold the product etc.) is usually in supply chain operations. The track also can be traced by RFID technology. By its smart ESM (electronic security maker) may also support and facilitate return management by helping retailers know if they sold the product etc.) is usually in supply chain operations. The track also can be traced by RFID technology. By its smart ESM (electronic security maker) may also support and facilitate return management by helping retailers know if they sold the product etc.) is usually in supply chain operations. The track also can be traced by RFID technology. By its smart ESM (electronic security maker) may also support and facilitate return management by helping retailers know if they sold the product.

**Challenges and Recommendations**

According to the (Sabagh and Vaidyanathan, 27); (Yelie and Wong, 28) there are several issues related with future of RFID technology processes. And several issues are related with complexity of execution of RFID technology, as well security of processes. Furthermore research required to be conducted to figure out how to increase the range of signals (RFID technology) and figure out how to barcodes, new smart labels and RFID equipment can work with customers’ existing business practices (Sabagh and Vaidyanathan, 27). One of the challenging tasks facing by firms “implementing technology of RFID” is to properly integrate it with other IT systems in the supply chain networks. Such as given the capability of RFID technology in creating significant voluminous data compared to technology of barcode, it would needs new warehousing systems (data) to intelligently parse the usable data from the RFID data stream to ensure suitable data processing, as well effective mining of data at an economical storage cost. In specifically, a firm extends its chain of supply to upstream side (supplier) as well downstream side (customers) their external integrations required to increase in capacity planning and in efficiency. In the systems of RFID, privacy, security and integrity plays a very important role in the type of supply chain application. In specific, as a technology of wireless, RFID poses some potential security reasons to users when the communication among the tags and the reader is exposed to snooping and analysis of traffic. Due to the security reasons may arise about the compromise of data during storage of data, wireless transmission, as well as physical security of site’s storage. Applications of supply chain might be vulnerable to security risk, because a variety of external entities may have read access to the tags and related databases. For example, the world’s biggest seaport operators started to deploy automated tracking and collaborate. RFID technology for containers entering ports of US (Cuneo, 29). Theft prevention is another through RFID’s product. Qualification of such values has been researched (Lee and Whang, 30). While, this remote wireless access is crucial advantageous, it may also build security risks if appropriate controls are not in place. The technology of RFID vendors have addressed some of these issues related of security by encrypting data transfer, employing varying querying protocols, blocking data transmissions by jamming, as well technique of blocker tag. A several RFID privacy-protection schemes are classified depend over the new functionality they execute in the technology of RFID (Ohkubo et al., 31). They range through adding just memory to adding lightweight standard specifies that tags must be equipped with at least one nullification function, as way to address public opposition through function disability of the tag, after the product purchase by consumers. It includes a very high level of security privacy and protection; but error always possible by human. (Ohkubo et al., 31) There is privacy issue with RFID tag (Fusaro, 32),...
Remaining privacy protection schemes generally reflect 2 major approaches:

- Normal tag
- Smart tag

The approach of normal tag protects individual consumer’s privacy, without changing existing tag or cost the user company more money. Smart tags are equipped with additional parts, like memory (rewritable), hash function units, basic logic circuits as well common key encryption units (Ohkubo et al., 31).

Another big challenge in execution of RFID in the supply chain is various and multiple conflicting standards, which might hinder the development of technology as well, minimize its anticipated advantages. For instance, while EPCglobal has developed a series of RFID manages standardization and application specifications for information encoding over tags of RFID within the united states, the ISO has developed standards to address problems like the “Generic parameters for the Air interface for globally accepted frequencies” as well the “parameters for the Air interface communications” at distinctive operating frequencies (Department of Commerce, 33; Khan, S.A.R and Zhang, Y., 34). Firms with extended supply chain to the global market can pressure to choose among standards and develop applications that might work under one standard. If many countries accept and adopt divergent of RFID technologies, this would undermine interoperability of RFID and the software application in goods’ tracking by the supply chain. In specifically, in supply chain globally, this can motivate countries to mandate adoption of certain and specific standards to protect internal market as well to increase economic gains rather than for some technical reason. However, in order to enable the technology of RFID in global supply chain, international interoperability of tags as well readers and international spectrum allocation to support and facilitate international technology of operability required to be addressed. In this perspective, it is very crucial that (international) regulatory processes again non-discriminatory in supporting the technology of RFID standards to ensure that these standards are based over merit technical and support interoperability. This ensure that, the technology of RFID reach its potential economies of scale in the supply chain.

**Conclusion**

In this research, we have investigated the efficiency and effectiveness of SCM with using the technology of RFID. We have been examined that appropriate business processes affected through the technology of RFID. Using mainly 4 SC processes, we highlight economic opportunities as well hurdles when planning and execution the technology of RFID within an existing SC framework. The technology of RFID enables an firm to crucially change its business processes, not only improve its efficiency as a low cost, but also improve its effectiveness, e.g. improving mission performance, makes the executing firms more resilient as well better able to assign accountability. The technology of RFID gives significant strategic values for firms in developing an integrated supply and demand chain’s model to run innovations, revenues and to get competitive edge. Firms that execute the appropriate business processes to leverage the data collected through RFID technology and its conversion to intelligence and information will accelerate these advantages. As firms develop their strategies of RFID, they must see beyond mere compliance for ways to execute those creativities into their whole supply chain and harness the real values of business by technology, hastening incomes.

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