

Communication Technology Utilization in Operations Management: Industry 4.0 Perspective

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ABSTRACT: *Information technology is acting as a catalyst in supply chain. Information technology has made possible providing of information at right time to the right person accurately, which is further utilized for Decision making. According to recent research on supply chain, many supply chain members believe that it is vital to improve information sharing for firm's success (Trainor 2011;Hellstorm 2009). Also study Witkowski, K. (2017). suggests that organizations are investing forty percentage of their total expenditure on Information technology in developed countries to enhance inter departmental co-ordination and co-operation. This suggests that information enables relational exchange between supply chain partners to speed up supply chain performance.*

Further, sharing of information can support a firm to achieve more benefits from cross-functional and cross-organizational partnering. In an era of marketing and cut throat competition, every organization wants to capture new avenues for their business by expanding an organization globally. Information technology has become strategic necessity to achieve such objectives. Main purpose of this study is to analyze impact of traceability on supply chain performance and to understand whether Indian automotive sector is ready for Industry 4.0 revolution.

Key words: *Information technology, EDI, RFID, Industry 4.0, supply chain performance.*

1. INTRODUCTION

Information technology plays crucial role in firm success. According to recent supply chain research, many supply chain members believe that it is vital to improve information sharing for firm success. This suggests that information enables relational exchange between supply chain partner to increase both intensity and effectiveness. Further, sharing of information can support firm to achieve more benefits from cross-functional and cross-organizational partnering. The term Industry 4.0 was first used in 2011. It is expected that the realization of this vision may take 10-20 years. The "Fourth Revolution" will use digital product models, which will be formed to a large degree in compliance with the requirements of customers, and will be produced, in Smart factories (Mamic, I. 2017).

It is assumed that intelligent factories will largely have the ability to self-plan and self-adapt. The existence of a complete digital product model, together with the methods of its manufacture, model, intelligent factory with its real representation in networked Cyber Physical Systems are key conditions for the success of the "Fourth Revolution"

1.1 Information Technology: An agent to improve supply chain performance.

Information technology is divided into two - one is internal and other is external. Internal logistic information system (LIT) is utilized within firm, eg. - Database and applications, which supports financial and supply chain operations (Smith 2009). With business process changing prior to implementation of database or more advanced software like enterprise resource planning (ERP), there is need for improved internal information exchange (Witkowski, K.2017).

Organization needs to improve internal information exchange to react to an ever changing market place and increasing competition via quick response to the market and product changes. Thus internal LIT can support fast information, which gives support to managerial applications which in turn provide greater managerial control over organization as a system. (Closs 2000.)

External logistics information technology facilitates communication and information exchange between supply chain partners, which makes possible obtaining information from customer to facilitate desired changes in products or services.

The success of supply chain can be counted on the basis of four important parameters viz. *minimum cost, maximum quality, speed and flexibility*, and to achieve this integration between supply chains members should equally respond to changing business scenario by quickly accepting new communication technology. The big firm like Wall mart, IBM, and Motorola put extra pressure on suppliers to adopt new technologies. (Lee 2008)

In general IT produces following advantages:

- a. IT developments help to increase awareness in customers.
- b. Efficient computerization helps in reducing cost of moving goods through EDI, tracking systems etc.
- c. Speedy analysis.
- d. Lower operating cost.
- e. Improved reaction time.
- f. Gives better picture of market and customer

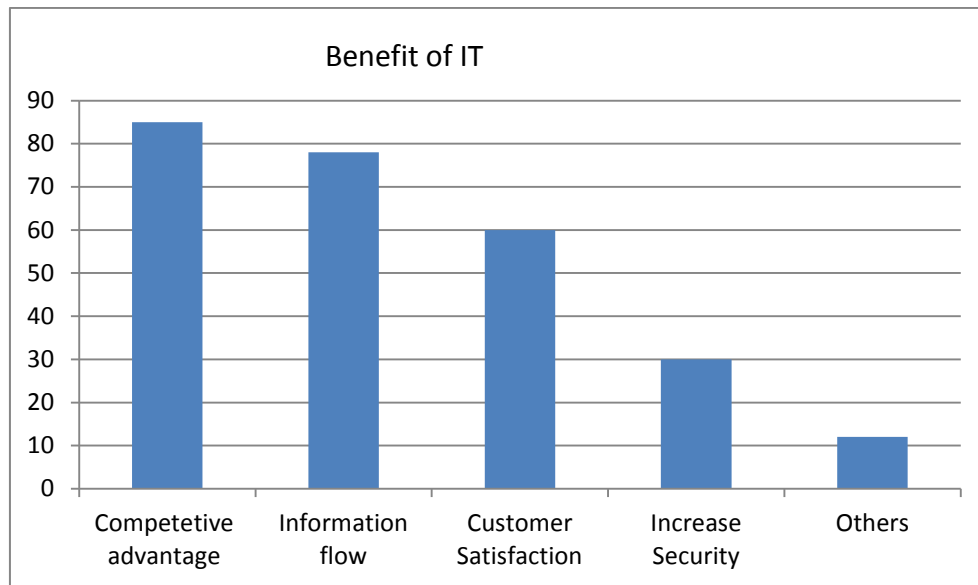


Fig 1: IT benefits (Source: Fan et al.2015)

The organization of the paper follows as Section 2 discusses objectives of same study. The details of the research methodology are presented in Section 3. Section 4 presents the researcher proposed model with respect to selected literature available on IT in SCM. A brief review of the literature is presented in Section 5. In Section 6, represent research gaps. Section 7 present conclusion and section 8, 9 present conclusion future direction, followed by Bibliography. From above discussion it can be concluded that EDI, RFID, bar-coding, web sources are an integral part of communication technology, this is represented by following diagram:

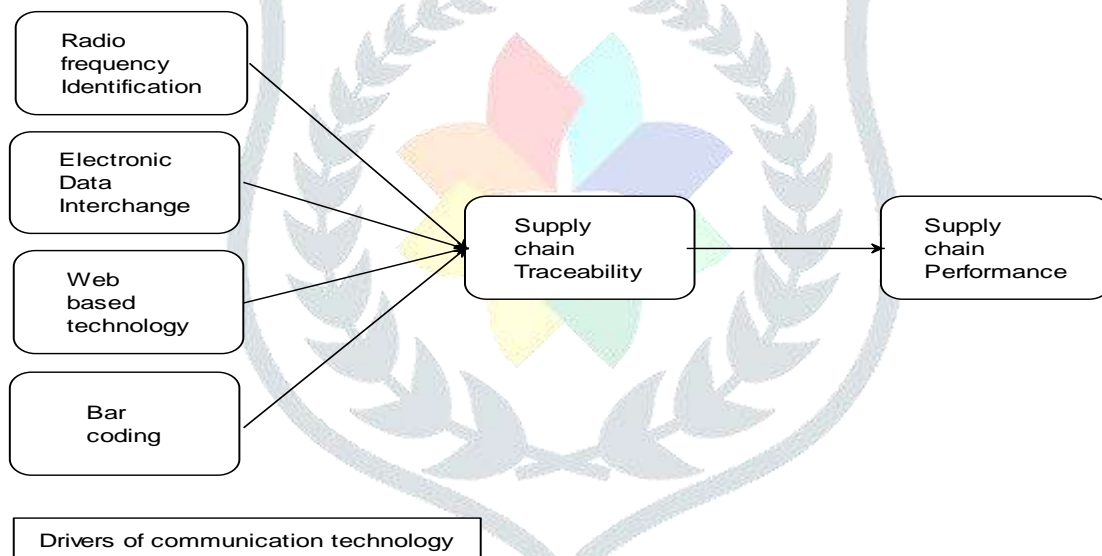


Fig: 2 Researcher conceptual model of impact of communication technologies on supply chain performance

1.2 Electronic Data Interchange:

For over two decades, electronic data interchange (EDI) has been one of the primary enabling technologies in conducting business-to-business (B2B) transactions. EDI-based transactions enabled more than \$2 trillion of trade among various firms in 2001, with as many as 55% of all North American large and mid-size companies reporting use of an EDI network. While the economics associated with EDI has long been a concern for many companies, the advent of the Internet has made the technology feasible even for small firms. International Data Corporation (IDC) estimates the total value of EDI—traditional and Internet—grew from \$10.99 trillion in 2003 to \$ 20.68 trillion in 2010, with 45.9% of EDI commerce revenue attributable to Internet EDI (IDC, 2010). Far from becoming a legacy technology, EDI continues to be a preferred platform for sharing business documents in many supply chain based transactions.

1.3 Moving towards RFID via Bar-coding:

The globalization and digitization of supply chains have triggered innovative applications of connective technologies to improve the efficiency in product and service deliveries and to provide deeper market and consumer intelligence for future development (Subramanian, N., & Gunasekaran, A. 2015). Specific connective technology widely applied for supply chain management is tagging, when integrated with databases, software for pattern matching, wireless protocols, global positioning system (GPS), or other location identification technologies, tagging provides a way to quickly make connections between objects and events in time and space. Tagging technology is important in today's economy, enabling exact tracking and matching of products or assets. Use of labels to describe or identify an object using tagging technology connects the digital and physical worlds. As such, it is the ultimate broker across media, tasks, locations, accounts, etc., even across a crowded room.(Lee 2008)(Trainor 2011.)

The ancestor of (and the most popular) tagging technology is the Universal Product Code (UPC) or barcode. Bar-coding is still widely adopted in part and product tracking in a supply chain. Owing to its effectiveness and lower cost, bar-coding will continue to be adopted by manufacturing and service enterprises.

However, intelligent bar-coding has emerged in the form of RFID, which is increasingly applied for supply chain management.

A fully RFID-enabled supply chain is yet to be realized. Tag costs are still high; readers cannot always read all the cases on a pallet; one frequency and one tag design does not fit all; standards are in a state of flux; end users lack real RFID knowledge; and radio interference can upset the best-laid plans, early adopters of RFID technology have to go through many steps like evaluation of current system, deliberate and well planned project.(Kim 2011).

There is no doubt that RFID and other connectivity technologies present massive potential for creating competitive advantages, Enterprises will find that incorporating these technologies into their information infrastructure and integrating them into their business processes will provide substantial business benefit. However, to realize maximum return on investment, they need to leverage their information architecture strategically. Issues like cost of technology, implementation cost are always the point of concern for the management, more focus is required to analyze return on capital employed.

A fundamental issue with RFID technology is that its range and high-frequency (13-56 MHz), applications get hindered by the limited maximum read distance, at best a couple of feet, which is not suited for tracking applications in distribution centers and warehouses. However, ultra-high-frequency (UHF) RFID applications have read ranges of up to 3 to 4 m, and results from the latest field trials and pilots with UHF have demonstrated performance that is well suited for applications in the supply chain.

It is clear that RFID is here to stay, and enterprises can achieve significant business value by embracing it. Because of the high cost of investment in RFID, each enterprise needs to evaluate its own business processes for determining where, and if, RFID can be used without making any confusion, and then only it can be applied to improve operational and process efficiencies to positively affect the bottom line. If that evaluation suggests that the technology can benefit the business, the next step is to develop a roadmap for RFID implementation .For suppliers who need to achieve customer-mandated deadlines given by main manufacturing organization to match their speed, it is important for the supplier to adopt and implement communication tools like RFID in his organization. It is important to find out impact of this situation on supplier.

1.4 Web (Internet) based technologies:

Logistics just might turn out to be the crucial element that separates a successful Internet retailer from all the others. Companies today need to move beyond plan, source, make, and move to take a holistic view of the supply chain if they want to score a market hit, or indeed to survive .The key to supply chain excellence will be the ability to extend the business into *customers* and *trading partners*(Dowine 2010).

That's why this technology is attracting maximum focus nowadays. Those companies that are highly successful with supply chain management will compete on their ability to work rapidly with customers and trading partners to create new and unique products and solutions, the speed at which they can integrate the community together is something they compete on. The impact that IT has on managing the integration of the supply chain community is profound. However, it has to be realized that integrating systems is more than just linking computers. Integrating systems is integrating business processes, data, and then systems .(Azevedo 2008; Zhang 2005).

Companies will have to work harder than ever at constructing and managing complex supply chains that will take shape during the twenty-first century. Supply chains will become more complex as organizations start selling through more diverse channels like over the internet or in other parts of the world . The enterprises operating these supply chains will face enormous challenge in form of co-coordinating many activities simultaneously; although this task appears daunting, the leading companies today have shown that it is possible if they give attention to detail(Subramanian, N., & Gunasekaran, A. 2015).

Many challenges exist in setting up market on internet also known as e-marketplace. Primary among these challenges is identifying the tools necessary to use the market, providing a secure environment, pricing, payment, and fulfillment.

For an orderly marketplace, Internet protocols must be selected. Security and privacy must be adequate to ensure confidential transactions. Authentication and authorization of users from many organizations must be possible. Private communication must be assured. The cost of the technology to access and engage in the market must not be prohibitive.(Trainor 2011;Keebler 2009).

As with any new technology, there is a fear and risk of the unknown. Although Internet technology has been in existence for decades its application to a large-scale manufacturing supply chain is relatively new. The pros and cons are not yet fully understood. It is probable that early adopters stand to gain a competitive supply chain advantage, as the technology will eventually become a basic business requirement. On the other hand, it is sometimes safer to wait until others have worked out the "bugs" in a new technology before spending time and resources. So it is important to determine risks and rewards of early adoption.

1.5 Big Data – the digital revolution in logistics

In the modern world, through the rapid development of Internet, such a big amount of information is produced and collected on a regular basis that their processing and analysis is beyond the capabilities of traditional settings. However, there is a technology by which we can conduct analysis and that is Big Data. This allows us to quickly and efficiently manage and use this constantly growing (thanks to reaping information from many different sources) database. The discussed technology allows analysis and separation of the important from the less important – helping to draw conclusions and support effective transfer of knowledge to carry out business objectives (Ahson, S. A., & Ilyas, M. 2017).

According to Forrester's definition, Big Data consists of four dimensions (i.e. 4V): Volume (amount of data) ,Variety (variety of data) ,Velocity (the speed of generation of new data and analysis) ,Value (value data) the general aim is to segregate the whole mass of information to what is most useful for us this is why it is so important that the results reflect the actual conditions and led to the most favorable business activities.Big Data makes it possible to analyze the data at a more advanced level than traditional tools allowed. With this technology, even data which has been collected in various mutually incompatible systems, databases and websites is processed and combined to give a clear picture of the situation in which there is a specific company or person.

Krzysztof Witkowski (2017) has nicely explained an interesting example of the use of Big Data technologies in the area of logistics is DHL, which implemented the so-called. "Resilience360" – an instrument designed to manage risk in the supply chain. The company can provide customers with information on potential interference of their respective supply chains. It is through the collection and evaluation of data that

it is possible not only to protect, but also to improve the efficiency of the supply chain. Hence, there is no interruption in operations and it is possible to permanently achieve customer satisfaction. DHL demonstrates that the use of Big Data analytics increases operational efficiency, while providing the opportunity to explore new business models. “DHL Resilience360” contains two elements that are associated with the risk assessment analysis, as well as tools to monitor the supply chain that work in almost real-time. The strength of the chain and associated revenue losses depend on whether a break occurs in the production, and this should be less prone to failures. DHL is in the pilot phase on the model of “The forecast number of packages DHL”, which has also been taken in connection with the analysis of Big Data. This model simplifies the planning volume of parcels for transport – this is done by “taking into account correlated data factors”. Big Data enables service providers to optimize logistics processes, improve customer service, and presents “a promising starting point for developing new business models”.

Big Data suggests some instruments operating in the field of geo marketing for small and medium-sized enterprises. Another model “DHL Geovista” allows a detailed analysis and evaluation of very complex geographic data to be obtained, which greatly facilitates the logistics service providers to anticipate the multiplicity of sales, which generate small and medium-sized enterprises.

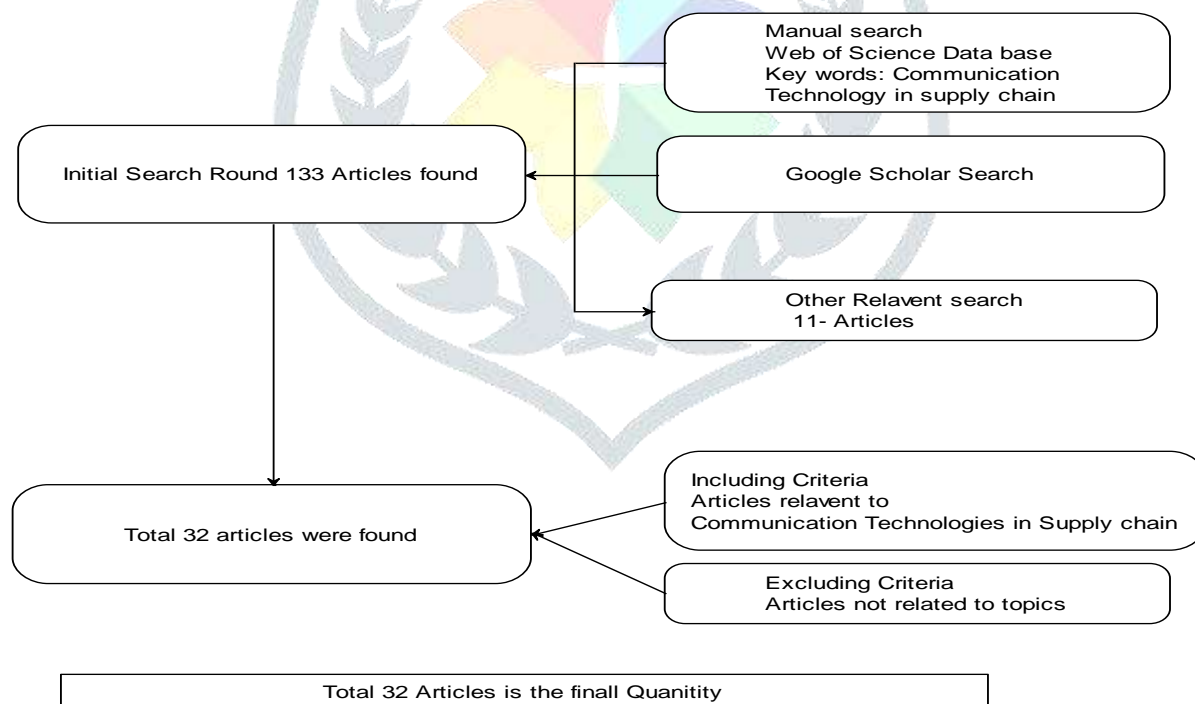
Among the sources from the supply system is information from retailers, transport, invoices and more. Data from customer profiles, social networking profiles, orders, market forecasts and geographical schemes also plays a role. Using customer data to analyze information from the delivery system, retailers can meet the expectations of customers by anticipating their behavior.

2. OBJECTIVES OF REVIEW OF LITERATURE.

1. To investigate potential benefits or impact of electronic data interchange (EDI) on improving relationships, resolving conflict and co-operations among supply chain partners.
2. Evaluate current business practices to identify the best opportunities for RFID and identify whether enhanced information and visibility from RFID would provide faster rate information exchange & resulted in terms of time, accuracy
3. To analyze impact of Internet technology on supply chain performance and find out if integration of customers will always be beneficial for a firm to understand market fluctuation and also if the internet is acting as a connective tool for the same.
4. To examine current process to determine whether communication technologies would improve or curb current operations. It is also interesting to find out if technology implementation in supply chain can lessen pain and confusion of the manufacturer and retailer?
5. To understand process of implementation of communication technologies and its impact on supply chain performance.

3. RESEARCH METHODOLOGY:

In order to evaluate communication technologies and their impact on supply chain system. Studies that were published in scientific journals between the years 2000 to 2017 were examined, a search for articles was conducted in international journal database (Ebsco, Emerald, and Science Direct) and 133 articles were found, based on the criteria of communication technology finally 32 articles found relevant.



Since the present review concentrate solely on communication technologies in supply chain, study is not related to communication technologies; technology is kept aside.

Artificial laboratory experiments, reviews of theoretical articles, studies among students were excluded, additionally only few empirical studies focusing on communication technologies were left for deeper analysis. Only the research context, level of analysis, theoretical approach, conceptualization, operations and measurement issues are reviewed here. Only communication technology accessed through EDI, RFID & Web based technologies are considered.

4. IMPARTING TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT.

4.1. Impact of EDI on logistic management

There are two most important dimensions along with EDI benefits which are as follows (Walton and Gupta 2000):

- A scope of business process affected by EDI transaction set.
- The nature of impact of EDI transaction set on business process.

The scope for business process being EDI transactions set it is internal or inter organization. Internal processes are those which are wholly contained within an organization with lesser contact made outside e.g. Internal supply chain process includes production planning, inventory management and purchase order generation, one could claim that inventory management is considered to be cross-organizational boundaries, since they may depend on co-ordination of external supplier, however this contact can be generated through purchasing department which acts as boundary spanning unit.

In modern supply chain management the programs like JIT have become 'alter agent' for redefining relationship between buyers and suppliers which has resulted in suppliers becoming more co-operative. This puts the manager of inter-organizational process in position of carrying out real change in his own company by affecting changes in trading, particularly by using systems like EDI. Combining two dimensions of process focus i.e. High Span of Control vs. Low Span of Control and transaction set impact i.e. direct influence vs. indirect influence represented in the figure. This represents benefits achieved through use of EDI for implementation of the transaction set. (Brah & Lim 2008)(Cho 2009).

Table represents examples of companies that have achieved the types of benefits described in each cell depicted in table

Table: 1 Phases in technological adoption.

Cell No.	Transformation Stage	Example changes and benefits
I	Phase - I Automation	Automated purchase order generation and transmission system. <i>Reduced purchase order execution cost</i> <i>Reduced critical error</i> <i>Reclaimed floor space, reduced paper generation.</i>
II	Transmission between phase one to phase two automation enhancement	Automated purchase order generation and transmission system linked to inventory reduction efforts <i>Reduced inventory levels from 3 weeks to 2 days of supply.</i>
III	Transmission between phase II to phase III enhancement & redefinition	Automated purchase order generation and transmission system linked to inventory reduction efforts and supplier process improvement <i>Supplier able to freeze master schedule</i> <i>Safety stock reduction by supplier</i> <i>Reduced times</i>
IV	Phase III radiation	Automated purchase order generation & transmission related to inventory reduction efforts, and supplier process improvements, system available for partners <i>Small supplier can win contract because of EDI capability.</i> <i>Buyer able to leverage, more in new PLC</i>

From above it can be concluded that if company seeks to achieve strategic gains through EDI, then framework represented should help companies to align their expectations for improvement through EDI. The framework suggested that simply installing EDI into the electronic phase of purchase order will not be sufficient. Further, framework lacks to suggest availability of inter-organizational information; these issues must be considered, since achieving benefits in cell IV will require achieving a collaborative information coupling. It also states that business process of two organizations must be redesigned to achieve coupled work environment with more parallel physical coupling.

4.2 Impact of RFID on various functions of supply chain

In the 'logistic operation' we observed potential for very low cost automatic identification for both improving supply chain operations (playing the current game better) and providing new services to all kind of customers, facilitating new games and enabling new services to customer of all kind. Thus understanding the impact of Auto-ID has become very essential. Various researchers studied the impact of this on both logistic operation and supply chain management. A review of various studies (Mamic, I. 2017; Wyld 2006; Spier 2009)(Voronaeu 2009) has produced following result:-

Table: 2 process flow

Process	Function of supply chain	Variability in supply chain function.
1.Shipping Process	Including shipment, consolidation, contact compliance, Routine optimization, tendering and other transport, management, and function associated with getting shipment out door.	Late orders, emergency shipment, lack of transportation capacity, lack of out inventory visibility, misplaced or mis picked items.
2.Transporta-tion process	Including all process and activities performed by eager logistic companies or whomever in connection with transportation process.	Delays, misrouted packages, inter meant operations, dynamic trucking operations wrong, drop off and pick up operation, pilferage during transit.
3. Receiving	Including verification, acknowledgement , pairing and put away activities, associated with receiving shipment at buyer location	Item shortage, wrong items. Wrong quantities, deliveries to wrong location, put away in wrong locations, wrong data entry.
4.Internal process	Including all process take place with buyer's facility such as information in factory, storage in warehouse, display in store and all the process around these activities.	Errors in determining product state during processing, quality problems, raw material stock outs, inventory mismatch, and unknown location of product within facility

A) Shipping: Shipping involves various process facility until it gets on the conveyance to destination, this include decision on which modes of transportation to use how economically consolidate and load shipment and when and how to exchange information with carrier and consignee. It is divided into two parts 1. Shipment consolidation and conveyance loading.

1. **Shipper consolidation:** A shipper may typically look at shipments “on hand” i.e. on loading dock and ready to ship. More the shipments taken into account, better the consolidation opportunities. With an Auto-ID system in place, shipper has been able to greatly extend its visibility; hence it is possible to access the status of shipments that are in still in production or picking process when making the decision.
2. **Conveyance loading:** The advantage of RFID in this process is efficiency of loading process – shipment can be scanned while driven out of in found trailer and into outbound trailer through the loading doors, elucidating the manual task of each shipment or pallet, here RFID produces great advantage as compared to bar-coding for maintaining great accuracy and to save time.

B) Transportation: A shipment moves from terminal to terminal through a carrier network or as it changes hands while moving from one mode to the next. Shipment moves through number of S/R pairs with receiving in terminal operations and shipping. The benefits of Auto-ID during transportation process itself involve tracking of carrier conveyance and shipment.

C) Conveyance Tracking: Many applications described here do not involve RFID tags but rather expensive GPS, satellite receivers, it is important to realize that many of these applications are getting on real time data were developed or enhanced by data stream available in real time. (Ahson, S. A., & Ilyas, M. 2017)

- a. **Automatic dispatching:** Main function in this process is to assign each truck a right load RFID solve this problem by knowing, Which truck to assign where, depends on current and future activity of the rest of feet.
- b. **Local Operation:** 2003 JB Hunt (USA) large truck carrier claim reduction in 10% of empty miles driven, and 20% in driver turnover as a result of using such optimization model coupled with the satellite system.
- c. **Fuel Optimization:** A truck movement is tracked throughout the country, a sophisticated algorithm checks the fuel price in real time and future of truck, fuel represent 20-25% of trucking company cost. Such algorithm reduces company overall cost by 1% to 2%.

C) Sub-conveyance tracking: Sub-conveyance includes trailers, containers, pallets and racks; these can be automatically tracked through RFID based system. Being able to automatically and accurately track individual pallets would enable material handling companies to 1) Reduce number of pallets in circulation, 2) Charge customer for their use an individual pallet bases and similarly maintain pallet at better condition, Similarly this is also applicable for returnable pallets. (Fan et al. 2015).

Mark and Spencer (UK) a retailer uses RFID to track food trays rolling cages which cuts down time required to read and identify this sub-conveyance by factor of five.

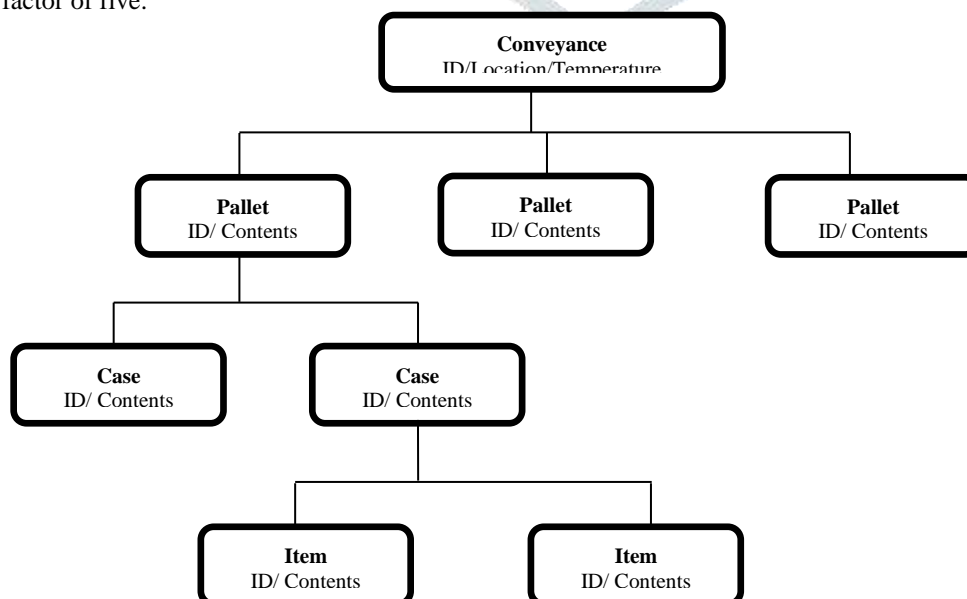


Fig no: 3 hierarchies of identified objects.

D) Shipment and tracking:

Above fig. shows different data type illustrated in fig. 6. Hence a shipper with access to carrier location information and RFID scanned items information is able to provide customer with location information and/or temperature of specific items with their route and delivery (Fan et al. 2015).

Unit and in-house warehousing: Manufacturing units RFID helps manufacturer to track item throughout the plant which results in administrative process running smoothly and speedily.

In USA electronic plants, there are several customized items that are placed into one body and then are put into trolleys and racks. The trolley moves from one location where the pallet is built to line where it is connected to main vehicle. Throughout this process worker has to read trolleys barcode, rack barcode and item barcode this happens for every item manufactured by the plant both when trolleys are loaded and when they are position next to the production line. Auto-ID system minimizes difficulties by increasing accuracy and efficiency.

E) Warehouse: Following benefits could be possible by using RFID in a warehousing application.

- a. Efficiency: RFID leads to constant tracking of inventory levels in real time which in-turn leads to most accurate picking and packing operation.
- b. Reach: Virtual inventory network provides 'anywhere' accessibility.
- c. Productivity: A worker can concentrate on core functions and reduced wastage of time.

F) Receiving: This activity includes verification and storage: (Ahson, S. A., & Ilyas, M. 2017)

1) Verification: Receiving process is time consuming as it includes verification of the delivery. "One touch" approach is becoming very powerful/popular verification process. It is a source of continuing tension and waste effort on the part of customer and supplier. Many retailers have schedule of deduction when they receive merchandise, late delivery, shortage, wrong shipment involves fine to the supplier. These deductions are sources of contention between parties and can be eliminated carefully by tracing what was delivered and when to deliver it.

2) Storage: Material parts, semi finished goods, finished goods come into the facility, and for recognizing their presence and provide carrier with a proof of delivery computer based acknowledgement is required; this process can be simplified by installing RFID reader at uploading docks. Identifying presence of material as it flows through the receiving docks, results in more accuracy and less expense.

G) Internal logistic process: Auto ID system can be utilized for internal logistic system in two phases (1) Manufacturing, (2) Accuracy. FID system insures that correct shipment gets routed from inbound to outbound facilities, performing necessary checks regarding shipment content, automatically and consistently.

4.3 WEB BASED TECNOLOGY:

The year 1990 gave advent to enterprise resource planning (ERP) software packages. In same transition organizations moved from department to enterprise wise information system, which is the next logical step. Many pioneering organizations linked themselves with customers and supplies. This improved reliability and security of web based new opportunities for all organizations. At starting of a new millennium, it is observes that organizations are moving towards the internet to conduct their business transactions, connecting themselves with supplies and customers. Various similar studies have been done to understand the role of web based supply chain organizations, resulting in following benefits 1) Reduction of process cost, 2) Improved operational efficiency, 3) Improved customer satisfaction, 4) Improved co-ordination and co-operations, 5) Commitment between EDI partners.

In this study by (Dowine 2010) researcher tries to compare the process performance benefits of all three groups 1) Companies not using electronic supply chain integration 2) Companies using a solution other than web based supply chains integration and 3) Companies using a web based supply chain integration. Study reveals following characteristics:

- a. Moving electronic supply chain integration over to the web can decrease cost.
- b. Operational efficiency was shown to be best for web based electronic supply chain integration.
- c. Customer satisfaction may take time to be realize, potential web-based partners should be cautioned at outset that extra waiting is to be required to analyze situation.
- d. It is safe to expect overall business performance will increase after implementation of either web based or non web based electronic supply chain integration.
- e.

4.3.2 Web based technologies for supply chain:

Focusing on process rather than the departments is widely gained business trend. Recent shifts in corporate structure point to the starting of group process companies are moving from vertical to horizontal, process oriented group that links cross functional teams focused on same set of business task.

The main difficulty is interaction between different departments, functions and even countries; the internet is ideal vehicle for empowering process based cooperative communities.

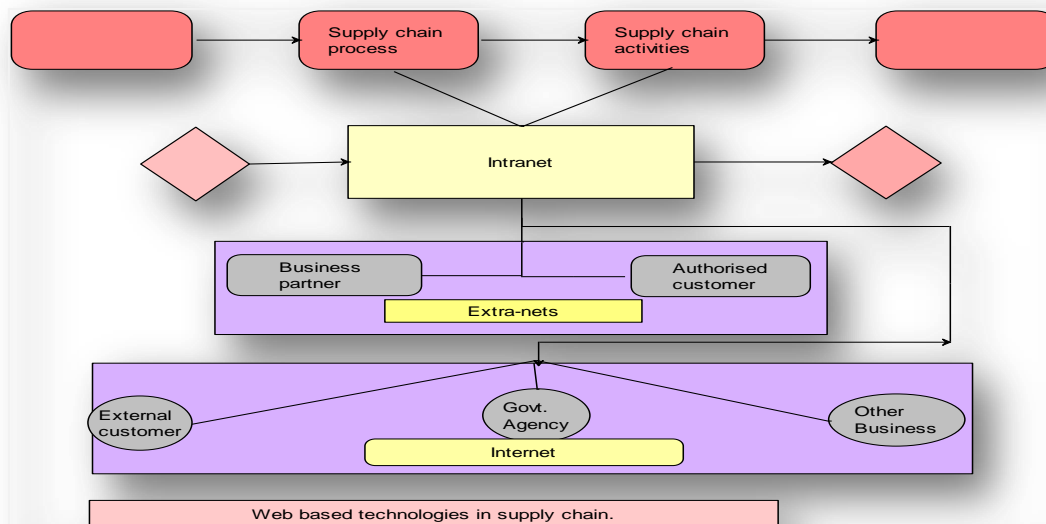


Fig: 4 Web based technology for supply chain (Dowine 2010).

Many organizations are allowing people and organization itself to have a limited access to their intranets. For example an authorized client could dial into portion of organization intranet from public internet to catch different information like product cost etc.

1. Intranets that are accessible to selected user are called extranets; organization can use firewall to ensure that access to internal data is limited & remain secure. These extranets are useful for linking organizations with customers or business partner for providing data availability.
2. For extended organizations engaged in supply chain management, XML tags could be placed on common messages as for purchase orders or advance shipment notice.
3. A web browser is capable of decoding XML, and then it can ascertain instantly the nature of message from supply chain partner. Furthermore it can be possible for a member's computer system to respond automatically to information request from another member's system. XML thus can provide an alternative to electronic data in the requisite computer services and hardware. Many see XML as new age EDI.
4. Fig shows 2 outline holistic view of a typical organizations supply chain process, its support activities and business partners and also how they are linked via internet, intranet, extranet.

1.4 INNOVATION IN PRODUCTION LOGISTICS – INDUSTRY 4.0

The consequence of developing the Internet of Things and Big Data is the conception of Industry 4.0. The third industrial revolution, based on the computerization of business processes and information technology supporting manufacturing, has moved into a fourth wave, which has begun to be dominated by intelligent (smart) products, 3D printers or autonomous vehicles. The term "Industry 4.0" refers to the fourth industrial revolution. The first was related to the mechanization of production through steam engines, the second – with the introduction of mass production due to electricity, the third – with the use of IT and electronic controllers for further automation. The term Industry 4.0 was first used in 2011. It is expected that the realization of this vision may take 10-20 years. The "Fourth Revolution" will use digital product models, which will be formed to a large degree in compliance with the requirements of customers, and will be produced, in Smart factories (Mamic, I. 2017).

It is assumed that intelligent factories will largely have the ability to self-plan and self-adapt. The existence of a complete digital product model, together with the methods of its manufacture, model, intelligent factory with its real representation in networked Cyber Physical Systems are key conditions for the success of the "Fourth Revolution".

5. RESEARCH GAPS

1. Cost of new technology seems to be too high at entry level, and becomes less in latter phase. RFID technology is not exception to this. Big organization has strong financial support to overcome this issue. Few studies have focused same issues. More detailed focus is required to find out if the cost factor is biggest hurdle for adoption of new technology for small & medium scale organization.
2. Supplier is important element of supply chain. Though main manufacturing unit is ready to accept new communication technology, it is important to focus on supplier compatibility towards acceptance new technology.
3. Implementing new technologies resulted in deployment of operations. This will result in decreased labor cost. Successful implementation can be possible with co-ordination and communication. Few studies have done research on this line (Fabbe-coster 2009). A study should require carrying out employee response in implementation of new technology.
4. Adopting and implementation of communication technologies involved greater risk, problems, uncertainty. Indian organizations are moving towards accepting new technologies for supply chain. More focus is required on security issue to prepare for future problems.

6. CONCLUSION

This review focuses on impact of communication technologies on supply chain performance. The competition of an organization has extended up to communication technologies. This integration results in better supply chain performance by providing information in real time for decision making. Organizations like Wall mart, IBM are using this as competitive tool to remain on top of the market.

In spite of some advantages this communication technology carries some serious issues like supplier infrastructure, security issues, early adoption difficulties and investment. If an organization focuses on these issues, it will result in smoother and faster implementation of communication technology.

From above discussion it can be concluded that to achieve collaborative information it is required to redefine business information exchange process. This can be only possible with integration of supplier and customer. This could result in readiness for the fourth revolution of Industry.

7. LIMITATIONS:

First limitation of this review is lies in small sample size. (i.e. 33) of research papers. More focus is required to study similar kind research papers with special focus on empirical analysis. This can be further utilized to produce generalized and acceptable solutions. All research papers studied over here are from context of developed countries like USA, European countries; perceived result may get change when studied in context of developing countries like India.

8. FUTURE SCOPE:

This study proposes good relationship between communication technology and supply chain performance. Though the cost factor is important issue for the management, accurate & speedy information can help for decision making and to tackle the *bull-whip effect*. Further analysis should be done to find out supplier compatibility and customer interest in adoption & implementation of communication technology. Role of management & employee is important to make successful implementation of communication technology more elaborative focus should make on same.

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