

## Role of ICT in Supply Chain Management

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### ABSTRACT

Supply Chain Management has played a vital role in improving organizational efficiency at all possible levels. It has also pulled the attention of several researchers & educators over the last two decades. The literature review reveals a significant spout in research in theory and practice of Supply Chains and Supply Chain Management (SCM). In the era of covid-19 pandemic, all physical supply chains have been broken however soft supply chains (such as data, software, and financial supply chain) are at the top. It shows that how the ICT is important in general. Connecting and sharing the real time information across the Supply Chains and their respective stakeholders is essential but this is a big challenge. Information and communication technology (ICT) play an awesome role to integrate and streamline the supply chains and supply chain management as a whole. This paper tries to put forward the role of ICT in supply chain management.

The limitation of this study is to rely on prior researches from journals, books and reports, newspapers, magazines and some other electronic & digital mediums.

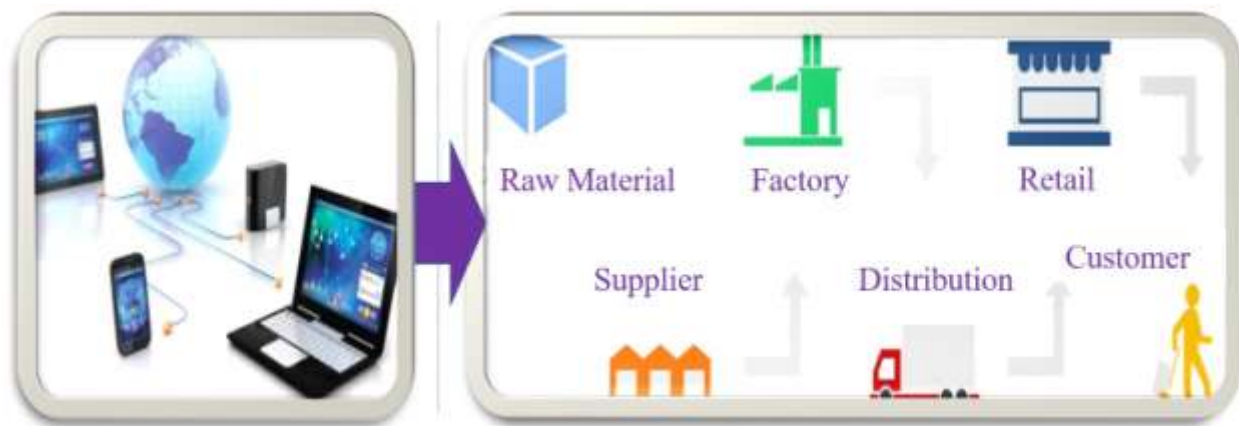
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**Keywords:** Supply Chain, Supply Chains, Supply Chain Management, SCM, Information & Communication Technology, ICT

**Paper Type:** Review Paper

## 1. INTRODUCTION

Information and Communication Technology (ICT) industry is one of the largest creators of jobs globally. Continuous increasing consumer's expectations in terms of added features & demand in products, the supply chains have becoming more complex than ever. The business demand today is to practice unconventional and innovative ways to achieve competitiveness and efficiency in day to day supply chain operations which could be achieved by a proper management of supply chains (D. Elmuti, 2008). Efficient & effective supply chain management ensures that the right data is in place, for right forecast, at right resources, to produce right product, in the right quantity, in the right condition, are delivered to the right place, at the right time, and the right cost. In supply chain management, these rights can be called the nine rights (9Rs)(Jagdeep Singh, 2019).



Now days, mostly organisations have become part of at least few or many supply chains and these firms have to perform equally well in order to achieve superior performance. In general, a supply chain consists of supplier's supplier, supplier, manufacture, wholesaler, retailer and end consumer.

Normally, the automobile industry has been acknowledged as a key driver of growth of a nation's economy and is a significant contributor to the global economy. The automobile has been described as 'both a form and function' based product involving high level of engineering as well as being positioned as a fashion product. The industry has appropriately been called as the industry of industries as it uses outputs of nearly all manufacturing industries mining, steel etc. till after market, insurance, finance, etc.

The aim of the paper is to comprehend the “Role of Information & Communication Technology in Supply Chain Management”.

## 2. REVIEW OF LITERATURE

(Bhandari, 2013) informed that IT arrests the analysis and provides information as per need whereas SCM defines the network of the organisations integrated to each other in some or other means of information & communication technologies. ICT applications in SCM offers transparency along with supply chain activities towards customer.

(Imran, 2012) investigation shows that investment in information system is contributing towards increase market share, reducing operating cost, improved customer services and assisting the banks in introducing new products and services. (M. Fasanghari, 2008) evaluated direct impact of ICT on SCM and revealed that the ICT has a big impact on supply chain management in terms of better communication within and outside organizations what we call stakeholders. It was also stated that ICT helps to reduce overall cycle time (Radjou, 2003), process time and develops a cooperative network for inclusive growth. ICT does not only improve the teamwork & customer relationship management (CRM) activities but also it helps to expand the markets across the globe. (Radjou, U.S. Manufacturers' Supply Chain Mandate, 2003) suggested that it is very much essential and necessary to use information & communication technology to have a better and effective control on complex supply chains. (Radjou, 2003) also told that information & communication technology helps to reduce cycle time, improves supply chain agility and efficiency, and ensures online delivery of the products as desired (M.J. Tippins, 2003). (Z. Yu, Benefits of Informationsharing with supply chain partnerships, 2001) advised that the collaboration & integration of ICT to supply chain management underlines the long-lasting advantages to all stakeholders throughout the supply chain through cooperation and information sharing and hence this implies the reputation and necessity of ICT in supply chain management.

(D. Simchi-levi, 2003) proposed the objectives of the IT in SCM as below:

- Info. availability and visibility
- SPOC for data
- Decisions based on supply chain info.
- Collaborations

(Bharadwaj, 2000) established the notion of Information Technology as the firm's capability and the results shows that the firms which are equipped with more IT capabilities are performing better than others. (S. Walton, 1999) proposed that IT development worked as catalyst or enabler in designing and management of supply chains. (A Bayo-Moriones, 2013) told that the organisations with innovative processes/procedures & modern work practices with high level of information & communication technology have a positive impact on several dimensions with improved organizational performance. Logistics is an area where ICT has been successfully applied for many decades in managing the flow of goods between end points to reduce theft, pinpoint route tampering, provide equipment tracking, reduce delays in production and increase the security of products (A report by Price Waterhouse Coopers on Transport and Logistics, Volume 1, 2013). The ICT helps to explore the business development, revenue generation, minimization of cost and reaching the customers (Bethapudi A. , 2013). (K.L. Choy, 2014) suggested that the proper ICT implementation improves the service quality which helps to create competitiveness among the peers. (Z. Yu, Benefits of Information Sharing with Supply Chain Partnerships, 2001) told that SCM and partnerships provides long term advantages to all stakeholders whether these are internal or external throughout the supply chain pipeline through information sharing, desired product delivery on time, customer service and all possible cooperation and hence the importance of ICT in SCM. In a study, conducted by "Forrester Research" specifies that U.S. manufacturers are progressively reliant on the advantages of ICT which helps to improve supply chain agility, reduce cycle time, and deliver products to customers in a timely manner as desired. According to (Nadim Ahmad, 2004), information & communication technology has become the fundamental and integral part of every industry & company of almost each type of economies whether it is under developed, developing or developed. This is because as ICT helps to reduce all types of transaction costs and therefore it improves productivity at all levels in the organization. It offers instant connectivity whether it is voice or visual, enhances the efficiency, brings the transparency and accuracy throughout the system. (Nadim Ahmad, 2004); (Leonard Waverman, 2005) studies have exposed the optimistic and noteworthy impact on gross domestic products by the investment in mobile & telecommunications and information technology and this optimistic impact is not limited to only developed countries but also to developing countries. (R.S. Safari, 2014) studies the technical competency levels of Iranian banks and it was found that publicly-owned banks obtained average

technical efficiencies lower than the private banks and hence the experimental results specified that the effective use of ICT improves efficiency and hence operational performance. According to (M. Khalil, 2008), “the world bank’s survey reveals that the use of ICT shows the faster sales growth, higher productivity and faster employment growth” According to (Dherange, 2013), ICT offers the ability of essentially altering the lives of the global population. ICT affects many ways like in terms of business processes, Government organisations and government itself including the daily life of an individual human. “New technologies, particularly information and communication technologies have had a great impact on all aspects of life and as a result global society and economy is undergoing a fundamental transformation towards what is popularly known as ‘knowledge society’”. According to (Dherange, 2013), “ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. ICT connectivity is very common in businesses. It is classified into two categories which are traditional and contemporary. Traditional ICTs are PC based technologies using computer at home, at work whereas contemporary is more recent one use of digital communication technologies which transmits information digitally. Supply chain related examples could be ERP, CRM, SRM, SCM, and mobile computers used in warehouses etc. There are gaps in agreement level and adoption level of ICTs in many manufacturing companies including automobile companies however they are willing to adopt in near future. Many business software’s could improve information sharing, business processes management efficiently and overall improved organizational performance. According to (Kevin, 2003), the top benefit of ICT is information availability to N-number of people and reduced production cost due to increased efficiency. (D. Rooney) described that the knowledge is created, shared, and widely accessible and anyone could participate, share information across the borders. It brings transparency and lowers prices.

## **2. WHAT IS SUPPLY CHAIN AND SUPPLY CHAIN MANAGEMENT?**

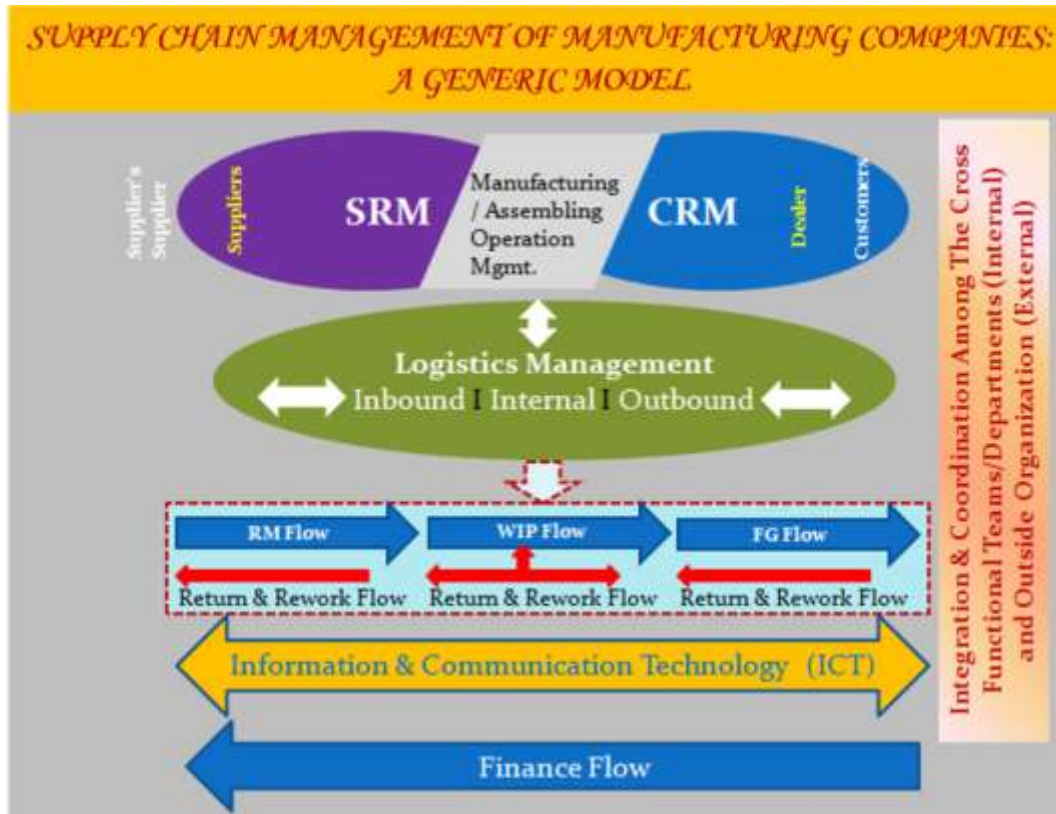
### **2.1 What is Supply Chain?**

(Christopher, 1998) defined the supply chain as network of the firms which are involved through upstream and downstream relationships in the diverse actions and processes. This yields worth in the form of services and products for the final customers. In the valedictory of supply chain management process, the stake holder firms allow meditation & economies of scale due to crucial issues and problems which must be fixed to achieve SCM operation.

Supply chain could also be defined as the network of all partners & stakeholders who helps to design, create a prototype and produce the product, through procurement & sourcing, information sharing, technology support, capacity building, logistics handling whether it is transportation, distribution, storage and finally to deliver the desired product to the final customer to satisfy his/her needs efficiently & effectively.

## **2.2 What is Supply Chain Management?**

(Jagdeep Singh, 2019) defined the general model of supply chain management as below in figure-1. The model also states that there are two kinds of activities involved; first one is system supply chain flow while other one is physical supply chain flow. A system refers to virtual which does not have physical presence (but acts & helps as integral part of physical supply chain execution) such as information flow (e-documents such as invoice, packing list, any other documents), finance flow (payments), and any other information which are desired to execute seamless supply chain practices while other one physical supply chain refers to the actual movement of physical products, material or documents such as parts/components flow, invoice copy, airway bill/ bill of lading, packing list and many other documents required in the physical supply chain pipeline.



**Figure-1:** A Generic Model of Supply Chain Management of Manufacturing Companies  
(Source: IJMTE)

Supply chain management may be defined as the integration and coordination of various activities and functions across the flow of information, material and finance to design, produce and deliver the desired products to the end consumer in timely manner efficiently & effectively (Jagdeep Singh, 2019). Supply chain management is closely associated to integration (Mentzer, 2005) and also the whole concept of supply chain management is truly predicated on integration as described by (Pagell, 2004). According to (Lambert, 1998), SCM denotes and defined the industry's various processes and procedures integration from suppliers to end consumers through information sharing flow, material/goods flow, and finally the services which add value.

(H.L. Lee, 1995) stated the SCM has a lot of combination & integration among the supply network which procures raw material and convert it into intermediate and / or final products followed by the delivery to the final consumer through the distribution system. (Council of Supply Chain Management Professionals, n.d.) defined the SCM as “encompasses the planning



and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies". (Global Supply Chain Finance, n.d.) defines SCM as: "Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders".(J. Stock, 2009) proposed the definition of supply chain management as it involve in managing the associations of network of focal firm and the dependent firms and their respective business units which could be termed as purchasing, suppliers, manufacturing facilities, marketing, logistics and any other related systems that enable two way (forward & reverse) flow of materials, finance, information and services from origin to end consumer. During this entire supply chain process, SCM helps to add value to the products or services, improves profitability through enhanced efficiency with achieving customer satisfaction. (J. Stock, 2009) also told that the "objective of SCM is to attain maximum profitability by adding value and creating efficiencies, thereby increasing customer satisfaction".

### **3. INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) AND ITS ADVANTAGES AND DISADVANTAGES IN GENERAL**

#### **3.1 Information & Communication Technology (ICT)**

According to Oxford dictionary, Information technology is defined as the study or use of systems (especially computers and telecommunications) for storing, retrieving, and sending information. The ICT is a stretched term of IT. That is, it strains the role of combined communications and the integration of 'tele-communications' like telephone lines etc. and processers- "computers" plus compulsory software's, middleware's, data storage devices like hard disks and 'audio-visual systems', which enables handlers to 'retain & store', 'access', 'transmit' and 'manipulate info'. It refers to all the techs. which knobs 'transmission media', 'tele-communications', intellectual factory/house supervision systems, audiovisual dispensation & 'broadcast systems' including 'network-based' monitoring & control

The life cycle consists of the following six phases as Process Strategy, Process Documentation, Process Implementation, Process Optimization, Process Execution, and Process.(Kowal, June, 2016)suggested that the information and communication technology

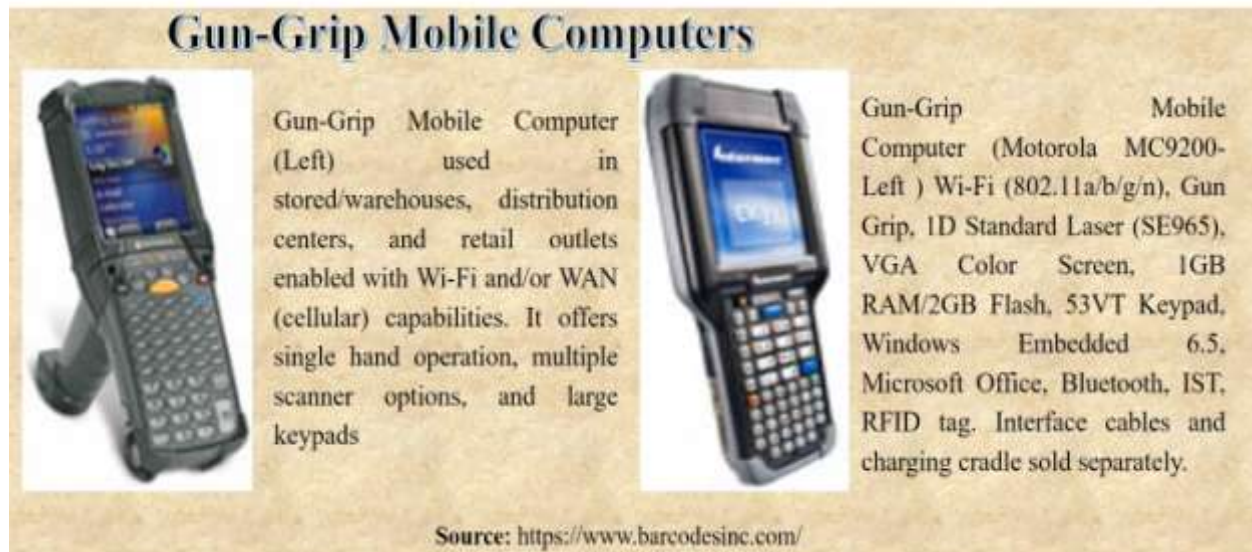


always expect the continual trainings, upgradation of professional educations, managing aptitudes and innovativeness in information systems that leads to human capital and economic growth development.

### 3.2 Examples of ICT

‘Telephone, radio apparatus and switches used for voice communication, Software, hardware, storage devices, web services, Apps, computers, laptop, mobile’ and so on.

Ultra-modern technologies like gun-grip and hand-held mobile computers are widely used in supply chain management. Figure-2 below is showing the examples with their applications.



**Figure-2:** Gun-Grip Mobile Computers and Their Applications

### 3.3 Important Business Objectives of Information & Communication Technology (ICT)

ICT played a vital role to develop and integrate global economies and to develop global products to buy and sell in international markets. Organizations rely on ICT for fast communications, data processing and market intelligence. ICT also played an integral role in every industry, helping organizations improving business processes, accomplish cost efficiencies, drive profit growth and sustain a competitive advantage in the national & international markets.

- Information & Communication Technology in Stakeholder Integration
- Information & Communication Technology in Process Improvement
- Information & Communication Technology in Product Development
- Information & Communication Technology and Cost Efficiencies
- Information & Communication Technology in Globalization
- Cost Savings and Competitive Advantage

### 3.4 Functions of Information & Communication Technology (ICT)

Functions of ICT are provided in figure-3 as below. There are many more functions of ICT such as in education, governance, various types of communications, SCM, agriculture and medical, and developing new processes and technologies etc. however it is not limited to it as there is much more to define.



**Figure-3:** Graphical Representation of Functions of ICT

### 3.5 Advantages and Disadvantages of Information & Communication Technology (ICT)

ICT is integral part of any business organization today because of its instant & direct rewards. There are more benefits to ICT than what individual could see at the surface level. The advantages of ICT are numerous and revolutionary in nature especially when it comes to business and organization growth however there are disadvantages as well. The medicine which is very useful for a disease but at the same time it might have certain disadvantages as well. Let's see the advantages and disadvantages of ICTs as below:

### 3.5.1 Advantages

There are n-number of advantages of the ICTs however fewer of them are discussed below:

- **Expands Communication:** Speed/time and money can be saved because it is much quicker to send/share information around. Communication is more efficient to contact either business partners or friends and family members all over the world. ICT expands availability for communications. Social network sites and Social media such as Skype allows making video-conference calls with immediate response. Messages can be sent to numerous people/companies across distances. Lives have been affected by ICT in most positive way's bringing families together across the world.
- **Cost effectiveness:** Numerous offers from telecommunication companies and smart phones therefore making far cheaper than in the past. For business ICT saves incredible amount of money on business flights and accommodations. Only few years ago there was no way to send free message through to the phone, but now people use social network for free communication e.g. Viber, Skype, Facebook. Saving time and money for petrol as people can go shopping from home through online shopping.
- **Greater availability:** Websites are open for communication in every minute of the year. This means that a business can be open anytime anywhere giving a customer the capability to make purchase from different sites and different countries.
- **Bridging the cultural gap:** Greater access to the ICT has helped to build the bridges between different cultures giving them opportunity to exchange views and ideas. Also, educate both sides of communication bridge thereby increasing awareness and reducing prejudice.
- **Creation of jobs:** The best advantage of ICT has been a creation of new and interesting jobs in IT sectors. Computer programmers, web designers etc. have great employment opportunities created through the advancement of technology.

- **Education:** There is new opportunity for further education to improve qualification in so many economic sectors. A degree can be completed online from person's home. It is possible to hold a job and still do degree.

### 3.5.2 Disadvantages

- Risk of Cyber threats and attacks
- It attracts health related problems such as vision problem, heart related problems
- Data and personal information related privacy issues
- Misuse of ICT by teenagers and student
- Eating unnecessary time now a days (Wastage of time)
- It is not accessible everywhere
- Destroying Relationships among friends, family and relatives

## 4. ROLES OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

The roles of ICT are divided in two categories as below:

- ✓ General Roles of ICT
- ✓ Role of ICT in Supply Chains & Its Management

### 4.1 General Roles of ICT

Information and Communication Technology is an extensional term for Information Technology. Since ICT uses the telephone lines, broadbands or wireless signals and hence its importance increases the capacity & efficiency of hardware and software that stresses the role of necessary middleware, software, storage, and audiovisual systems that enable users to access, transmit, store, and manipulate information. ICT has contributed enormously to economic, social and educational improvements, such as higher employment and productivity, increasing access to a higher quality of life, and the online classes and national & international webinars/conferences at all levels. ICT incorporates electronic technologies and techniques used to manage information and knowledge, including information-handling tools used to produce, store, process, distribute and exchange information. The concept of ICT covers any product that will store, retrieve, manipulate, transmit, or receive information electronically in a digital form (e.g., personal computers, digital television, email, or robots)

### 4.2 Role of ICT in Supply Chain Management

The chief goals of the ICT in supply chain is to exchange the information and/or managing supply chain related data and activities among all the stake holders at functional and

organizational levels. Supply chains connect the key players of the transport and logistics business, and ICT represents the means for their cooperation and the glue that binds them together. The Information Technology impacts positively on Supply Chain Performance (A Bayo-Moriones, 2013). Implementation of ICT improves supply chain visibility, reduce theft, improves the delivery and reduces the delays in the supply chain pipeline. It also improves security of the materials and products at all levels. The ICT helps to explore the business development, revenue generation, minimization of cost and reaching the customers (Bethapudi A. , 2013). (K.L. Choy, 2014) suggested that the implementation of ICT -Directly augments the service quality' of the 'logistics as well as SCM' companies Improves 'service quality' which brings competitiveness.

(Z. Yu, Benefits of Information Sharing with Supply Chain Partnerships, 2001) advised that 'SCM' highlights the 'long-term' advantages to all stakeholders across chains through 'collaboration and info.' sharing. It stands to be understood as the position of ICT in "supply chain management and logistics". (Radjou, U.S. Manufacturers' Supply Chain Mandate, 2003) suggested that the application of ICT is well-thought-out as a precondition of operative governor for "modern but very complex supply chains". A research conducted by the research firm called "Forrester Research" in the US. The study was conducted for manufacturing firms which acknowledged the benefits such as enhancement in the supply chain agility, decreased cycle time, improved efficiency, and enhanced goods/material delivery at the place of need. (X. Zhang, 2011) also found a positive impact (role) of ICT on Supply Chain and its management & performance.

## **5. CONCLUSION**

The study has explored many literatures and tried to consolidate the gist of the study. Study has explored and explained the supply chain and supply chain management through a generic model of supply chain management of manufacturing companies, various information & communication technologies and examples, business objectives and various functions of ICTs, advantages and disadvantages of ICT in general, the roles of ICT in general and finally the roles of ICT in supply chain management. ICT helps to integrate all possible functions within and outside organizations and organizations itself which results a better exchange of information and/or supply chain related data and activities between and among all the stake holders. Supply chains connect the key players of the transport and logistics business, and information &

communication technology represents the means for their cooperation and the glue that binds them together. The study has explained the roles of ICT in SCM. (X. Zhang, 2011) also found that there is a positive impact of ICT to Supply Chain and its performance. The objective of this study is clearly defeated by the clear explanation and understanding on the roles of information & communication technology in Supply Chain management.

The crux of the study is that the role of information & communication technology is vital in today's complex supply chains and hence it cannot be ignored as it is an integral part of modern supply chain management. Avoiding the application of ICT means the firm is out of business as it cannot compete in the market even if its products are world class. Therefore, study recommends to use ICT wherever possible and collate maximum benefits out of it to streamline the business processes and manage your supply chain efficiently & effectively.

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