Supply Chain Management Concepts and Challenges: Literature Review

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ABSTRACT: Supply Chain Management has been at the nucleus of the manufacturing industry and has gained immense importance by the academicians and researchers. Supply Chain Management has been defined as a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. In the past two decades Information Technology is being integrated with Supply Chain Management. The manufacturing industry is trying to align all the domains with IT. While there is a considerable body of literature on Supply Chain Management and Information Technology there are unanswered questions and leave a lot of scope for further research. The researchers have reviewed thirty plus papers pertaining to Supply Chain Management and its various factors. This paper is an attempt to present the review of these papers and identify some issues for further research.

KEYWORDS: Supply Chain Management, IT systems.

I. INTRODUCTION

Supply Chain Management has been at the nucleus of the manufacturing industry and has gained immense importance by the academicians and researchers. The continuous quest for improving the Supply chain outcomes there is a need for ceaseless improvement in Supply Chain process. Supply chain is challenged by the global dynamic market and meeting customer demand. The advent of manufacturing industry has completely transformed from the function based unit to process based unit and further to an integrated Supply Chain based industry.

Supply Chain has many facets and has been the focus of research globally. Indian manufacturing industry is not an exception . With the changing dynamics of the market , global competition, cost control pressure, persistent efforts are being made to design, implement and execute world class Supply chain Management system by the Indian manufacturers and the service sector as well.

Technology has emerged as a powerful tool to strengthen the basic functions and processes in supply chain. Extensive research has been carried out in this arena and its related facets. The researchers have reviewed twenty eight papers pertaining to Supply Chain Management and its various factors. This paper is an attempt to present the review of these papers and identify some issues for further research.

II. SCM PROCESSES

In their research paper I.M Ambe et al have tried to develop   a Strategic Supply Chain framework for the automotive industry [1]. Their work is based on the case study of BMW Roslyn plant located in Pretoria. The authors have observed that Supply chain management focuses on the processes that are needed to synchronize supply to customer demands allows the optimization of inventory held and reduces waste. The automotive industry requires flexibility and responsiveness in their supply chains. In order to maintain and improve levels of efficiency , quality and cost effectiveness , automotive component suppliers will have to look at different area across the board to streamline their operations. The generic supply chain strategies are lean and agile supply chains. According to the authors leanness is

most appropriate to be used in a stable environment , agility can achieve more benefits in a volatile environment. Taking their observations further they quote that BMW possesses features of both lean and agile supply chain strategies.

Keely L. Croxton, et. al have taken the base of the eight Supply Chain Management processes identified by the forum members of The Global Supply Chain Forum [2]. The eight key processes that make up the core of Supply Chain are Customer Relationship, Customer Service Management, Demand Management, Order Fulfillment, Manufacturing Flow Management, Procurement, Product Development and Commercialization and Returns. They have explained each process and activities pertaining to that process in detail.

Carter, Joseph R et. al have noted that from the historical manufacturing philosophy of one supply chain, one plant and one product the industry has traveled to an era of several supply chains, with a variety of multi-national suppliers, partners and joint ventures[3]. There are numerous customer channels and increasing customer needs (demands).They also stated that Supply Chain has structures, processes, technology and relationships. Due to the directional shifts of companies the above features of supply chain will go through a dramatic change. For example, Make-to-order strategy will place different requirements on a supplier. Adoption of new processes supported by IT; by one company will affect the technologies that its trading partners are using. Responding to the increasing level of complexity there will be shift from control to collaboration; collaboration among internal stakeholder and with external suppliers, partners and customer.

The key findings of the study by Fawcett include : Each organization is a part of SCM, Channel power remains an incredibly important weapon [4].Inadequate information systems are prevailing in most of the organizations , There are no concrete measures for evaluating performance, Non aligned and conflicting objectives are existing in the organizations , Standard form of SCM in any organization is missing, Each functional area / team considers itself important for SCM and ignored other members / teams in SCM , SCM maps are not followed systematically by the organizations, Organizations do not go beyond first tier suppliers to make any integrations , Supplier's suppliers and customer's customers are ignored , Customer side receives (downstream) more significance and is more clearly in focus than supplier side, Companies need to take a holistic approach to SCM.

Achie Lockamy stated that Business Process Orientation is critical in reducing conflict and encouraging connectedness within an organization while improving business performance[5]. In addition to this the authors have also found other BPO elements like process management and measurement (measures that include aspects of the process such as output quality, cycle time etc.) , process jobs (jobs that focus on process as compared to functions) and process views (the cross functional , horizontal picture of a business involving elements of structure, focus, measurement, ownership and customers.). The authors have developed a SCM maturity model based on capability and maturity model developed by the Software Engineering Institute. The researchers empirically tested the model and stated that the SCM maturity measurement instrument can be used for perspective purposes in SCM improvement efforts by indicating which maturity measurement are deficient , therefore focusing continual improvement efforts. The study by Larry C et. al covers a decade of academic research in the Supply Chain Management field, offering an in depth analytical review focused on existing trends and gaps in the Supply Chain literature[6]. This paper was reviewed keeping in focus the futuristic path for SCM research.

The study by Larry C et. al spans a decade of academic research in the field of Supply Chain Management and presents an in-depth analytical review focused on existing trends and gaps in the supply chain literature. The research was carried out by doing categorization of subjects related to supply chain. A content analysis was carried out on the articles based on levels of supply chains , sample populations and types of industries. The researcher has pointed out that more research is required to understand the multiple links in SCM chains and networks. The categories selected in this paper are SCM strategies , SCM frameworks , trends and challenges , Alliances , relationships, E-commerce , Time based strategies, Information Technology, Quality. The researcher also studied the categories like Supplier Development , Environmental social Responsibility, Outsourcing , HR Management, Buyer Behavior and Globalization of supply chain. This study emphasizes on future research by identifying the gaps in the body of the literature. The areas pointed out by the study are : Small sample sizes The researcher suggest that trade associations

should be involved to elevate the access to more companies and their further multi layered supply chains , One tier Investigation : Researcher argues that the research is focused generally on OEMs and first tier suppliers . The studies should be expanded beyond first tier suppliers and at multiple layers.   , Limited methodological analysis : Articles have limited their methodology to correlation analysis as compared to that other methods would have provided a more in-depth analysis , Lack of longitudinal studies and limited global supply chain analysis. The researcher expects a more comprehensive and refined analysis from further studies. The momentary study should be extended to long period of time to effectively study organizational processes and bring in the required modifications in the processes. The long time frames will also facilitate study of multi layered supply chain. Global supply chains are crucial to the industry and have limited published papers in the body of literature. The researchers have put forth the need for continuous studies on SCM filed as manufacturing will be an ever changing industry.

Milind Kularni in his research attempts to study the present developments, complexities and challenges faced by Indian Automobile sector [7]. The researcher has also explored the trends like visibility and innovations. A framework has been proposed to overcome the issues faced by the industry. This research seems to indicate that the Indian Industry is yet to match the supply chain standards of developed countries.

There exists immense scope for the Indian automobile industry to integrate their supply chains. The researcher also suggested that there is a requirement to bring radical changes in the supply chain practices to acquire the global standards and achieve the competitive advantage. The industry also needs to emphasis on development of green technologies such as hybrid vehicles, low emission and fuel efficient vehicles to meet futuristic norms and attain the cost control. Government can enhance the industry by providing state of the art infrastructure and revised policies and regulations. An integrated effort by OEMs, suppliers, external agencies and Government bodies is required to improved supply chain practices to sustain in the competitive world economy. Academicians can contribute to this industry by carrying out in-depth and empirical research according to their requirements. Attempt has been made by the Aziz Muysinaliyev to review 29 papers based on Supply Chain Management. The research has tended to show there is a considerable effort made by the industry and academicians to review Supply chain concepts [8] . The Supply chain management and distribution management have combined together. This integration has resulted in the concept of extended enterprise. Supply Chain is emerging as the collaborative Supply Chain spanning the inter company horizons and is maximizing the value of the entire supply Chain. The researchers have identified areas for further research. They emphasis on carrying out empirical research on the impact of internet on several e-SCM processes. Further they suggest to conduct research on application of decision models and technologies on Internet. The value of these decision models will increase due to availability of high quality and real time information. These decision models will impact the members of Supply Chain and therefore need further in-depth investigation. The researchers have insisted upon generating body of literature that considers Supply Chain as a multi layered network.

III. THE ROLE AND SIGNIFICANCE OF IT IN SCM

Rayati Shavazi et. al in their study have identified the goals of SCM as to decrease inventory costs, to decrease production costs and to improve customer satisfaction[9]. Driving forces of SCM are 1) Global sourcing and 2) Time and quality based competition. The tasks of information technology as stated by the study are 1) Providing information availability and visibility 2) Enabling a single point of contact ,3) Allowing decisions based on total supply chain information and 4) Enabling collaboration with supply chain partners. The researchers also examined the role of Information Technology as to carry out the functions and not actually dong the functions, e.g. to extend support to pass / share the information. However, information has to be created by the supply chain players and can be used decision making tool. The researchers also perceived that e-Business / e-Commerce has a significant impact on level of analysis issues in management research. The authors also observed that e-Business has an impact on supply chain structures, supply chain coordination and supply chain relationships. Extranet facilitates the selection and negotiation activities in the procurement process. The authors observed that ICT has a very important effect on SCM (i.e. on the coordination and integration aspects.) ICT can be employed to improve the management of supply chain systems. e.g. Internet has presented supply chains with many significant opportunities for cost reduction and service improvements. There is a need for the organizations to design a supply chain with the help of ICT to ensure responsiveness and efficiency.Amy

z. Zeng have reviewed the concept of supply chain integration and evolution of e-Hubs[10]. They have examined the case studies classified by supply chain processes namely procurement and transportation. They also have carried out value-gap-analysis. Coming to the conclusion that gaps and limitations do exist in e-Hubs they present a framework for integrating existing e-Hubs into other advanced technologies (IT) such as ERP, CRM.

The researchers have undertaken two case studies for reviewing the procurement process. The two e-Hubs are MRO.com and E2Open.com. The researchers have observed that both the e-Hubs have help in reducing transaction costs and search time. There is an easy access to both suppliers and buyers to enter into the market.
However, these e-Hubs are coupled with some limitations: They are not successful in reducing the risk of online transactions. Suppliers and buyers are not reviewed seriously / thoroughly at the time when they join procurement hubs and their performance is not actively evaluated. Dependency on technical infrastructure and language related issues may arise for suppliers and buyers on global level.

On the similar note the researchers have taken up two case studies for procurement hubs. First is transportation.com and second is freightquote.com. The researchers have identified that freightquote.com offers wide range of options for carriers; more services are offered to the shippers. The e-Hub provides criteria based functions, which saves the time associated with process of biding. They overcome the time consuming orthodox process of tenders and contracts. These transactions and communications substantially reduce the time of processing and managing transportation needs. Depending upon goods and trusts participants can engage in both systematic and spot deals.

However these e-Hubs able to take the responsibility of any claims and leave it to the participants. Due to entry of loose shippers it is difficult to establish immediate trust between participants and online transaction might be perceived risky. Freightquote.com provides information about import & export, however, transportation.com does not provide such instructions related to import & export. e-Hubs are not capable of providing warehousing facilities ,simplifying import & export related issues required by the small players in the SCM. These e-Hubs consider transportation as a standalone process and thus fail to provide an integrated supply chain management solution. The researchers also stated that major players have their own intranet and extranet facilities and have integrated their business processes. They have not opted for transportation e-Hubs yet. To deal with the existing problems / issues related to e-Hubs the researchers have proposed capability to connect all trading partners. This can be achieved by using supporting technologies like CRM, ERP and SCM. ERP systems help the enterprises in automating and integrating corporate cross-functions.

Jaana Aurama et. al provided empirical evidence of benefits from IT in SCM[11]. The researchers have undertaken exploratory study .The case study method was selected to explore the benefits of IT in SCM. This study throws light on various queries like befits of IT in SCM, significance of IT in SCM, It solutions implemented by the companies and more. The results of this study indicates that operational use of IT has developed in the last five years. Internet technology and third party transaction integration services have provided OEM to network with supply chain partners. In most cases IT solutions were individualistic as they were built from the perspective of OEM. The study also found out that IT is implemented mainly for operational purpose. A broader view of IT has yet to come. Along with IT infrastructure, it was observed that to achieve real competitive advantage it is important to focus on improving the processes that are critical for customer service. The study observed that benefits of IT are manifold. Also it states that business process re-engineering skills are vital to benefitting from IT strategically in SCM.

Without any process changes, IT benefits will have a limited scope.
 Shutao Dong et. al have presented a conceptual Model having key resources for the digitally enabled supply chain as the independent variables[12]. The researchers has drawn the inferences :Information Technology can create value in supply chain contexts. The value is generated through developing digitally enabled integration capability and manifested at the process level. Value is generated through effective use of the technology to improve upstream, downstream and inter operations. This supports the RBV theory that common technologies can be converted into valuable resources through deployment in specific processes. Managerial skills and partner support are significant value drivers in supply chains suggesting that IT value comes from fitting the pieces together. Successful SCM requires a firm to possess not only technological capability but also managerial skills and external resources. The data

has proved that managerial skills play the strongest role among the 3 key resources. Competition shapes IT value creation. In the supply chain context, backend integration and managerial skills become more valuable in highly competitive environment. The authors emphasized that it is essential for the managers that they take into consideration the technological, managerial and external resources when there is a transition from physical supply chains to digitally enabled SCM and information flow. Managerial innovations are complementary to technological innovations. Managers should understand that it is important for them to establish information linked strategic alliances with business partners is critical. Gunasekaran A. ; Ngai E.W.T. (2004) . Information systems in supply chain integration and management. European Journal of Operational Research. pp 265-295. Gunasekaran et. al have presented a literature review paper[13]. In this paper the literature available on IT in SCM has been classified using criteria (strategic planning for IT in SCM, VE & SCM, e-Commerce and SCM, Infrastructure for IT in SCM, knowledge and IT Management in SCM, implementation of IT in SCM) and then critically reviewed to develop a framework for studying the applications of IT in SCM. The researchers seem to indicate that the strategic information systems should include the strategic objectives of SCM. Information systems architecture needs to be designed for SCM that could be different from that of traditional organizations. Successful strategic information systems are not easy to implement in SCM. They require major changes in how a business operates internally and with external partner. Commercial enterprise information systems required flexibility in order to accommodate individual organizational characteristics. Performance measures and metrics need to be established for measuring the performance and suitability of IT in SCM. There is a need for developing standards and legal framework for the applications of IT in SCM.In order to determine to what extent Indian companies are using internet in the operations and management of their supply chains a survey of firms was conducted by Zillur Rahaman [14]. These firms appeared in the list of 1000 companies published by Business Standard. (2002).In light of those firms who do use the internet for SCM, the most popular application was management of their transportation system. Internet was least used in the area of production scheduling. There the usage of internet was checked in various departments like purchasing, inventory management, transportation, order processing, customer service, vendor relationships and production scheduling. Intranet usage and extranet usage was also studied by the researcher. It was found that 70.4% of the firms used intranet for communication .Interestingly it was found that smaller firms use internet more to communicate with vendors more on finished goods inventory levels; to communicate with customers on out-of-stocks, to check the credit status of vendors and customers and to provide technical service. Conversely large firms use the internet more to purchase items from vendor online catalogues and supply lists and to provide vendors with ratings for on-time performance of their carriers.

IV. THE COMPLEXITIES /BARRIERS IN IT ENABLED SUPPLY CHAIN MANAGEMENT.

Archer Norm et. al. have found that the suppliers have perceptions about what IT(e-commerce , e-business) can or cannot do for their organizations [15] .According to the researchers Supply Chain partners play a significant role in the adoption of innovative e-business solutions. These companies require training and education to make better/ appropriate adoption decisions.

Shaw(2000) has noted that security and access privileges are the two most important barriers in IT implementation [16]. Warren and Hutchinson(2000) have noted cyber attacks against SCM as the barrier for IT implementation. They also identified that IT implementation is time-consuming, expensive and risk oriented [17]. Lee and Whang reported that there is a disagreement amongst the supply chain partners on the adoption and specifications of the technical system to be implemented [18]. (Bender 2000, Kilpatrick and Factor 2000) have investigated poor IT infrastructure and lack of funds as barriers to IT implementation [19]. Further in one more research(Lee, Whang 2000) stated that the supply chain partners are reluctant to share information and this acts as a barrier to effective SCM [20].

According to (Neuman and Christopher 1996) mutual trust for long term relationship and the confidentiality of information are the important issues in the IT-enabled SCM [21]. Lack of awareness and commitment of top management about usage of IT tools is yet another barrier in IT enablement of SCM .Kadambi (2000) has stated weak infrastructure outside the organization and small size of the trading partners as the inhibitors of IT implementation of the supply chains [22]. Further (Sohal et. al. 2001) and Kwan revealed that financial factors and lack of compatibility of partners as the barriers to the IT – implementation of Supply Chains [23].

Sanjay Jharkaria and Ravi Shankar in their research have identified 11 barriers for IT-enablement of SCM. Disparity in trading partner's capability and Resistance to change to IT enabled SCM are the highest ranking barriers as per their survey [24]. The other barriers noted by them are (Low level of Supply Chain integration, Threats to information security, lack of trust in Supply Chain linkage, Fear of information, System breakdown, low priority by the management, fear of Supply chain breakdown, lack of funds). Poor IT infrastructure facilities and lack of awareness about use of IT in Supply Chain have the lowest ranking as the barrier.

Vachara Peansupap et. Al(2006). have categorized the barriers at three levels : Organisational, Group and Individual[25]. They found that at the Organisational level there exists constraints like basic level computer experience, time availability for training and the identification of clear benefits of ICT use, lack of technology awareness, lack of confidence in senior as well as top management .

Constraints at the group level include time available to share information, quality of personal contact and geographical distance. Constraints at the individual level are: Training support, time constraint to learn and use new systems , lack of time by Team Leaders. C. Ranganathan , Thomson S.H. Toe , Jasbir Dhaliwal (2011)have reported supply chain infrastructure and complexity of SCM processes as barriers to IT enablement[26]. They have also noted other barriers which include (lack of integration which leads to failure deliver the B2B benefits), greater perceived cost and lack of systematic planning for IT installation. They have also observed that Domain experts lack IT knowledge and vice versa. SCM re-engineering involving multiple supply chains is very challenging.

Mickey Howard(2005) has stated that there is lack of industry consensus to recognize one platform for purchasing , supply and design which uses standard software, formats and protocols [27]. He also observed that replacing multiple legacy systems was a big challenge for the suppliers. Suppliers having multiple locations were also facing issues to connect firms with different people culture and locations. He also investigated that insecurity about the support extended for ICT , partial functional e-hubs , expensive and time consuming training, complex perception of the IT systems were few more barriers to ICT implementation. The other barriers observed by him adoption of ICT by Tier 2 and Tier 3 suppliers is delayed due to cost , up gradation of the systems and lack of best suitable system. Charles C. Poireier and Michale Bauer (book) have written that very few executives have technological grounding in what is necessary to construct ICT model for SCM [28]. They also observed that the passive role of the CIO is another barrier in ICT implementation.

V. FUTURE RESEARCH

Further Research : Research is required to find out any other processes are existing other than the identified by the Global Forum in the current era. Each process can be redefined according to the current requirements. Research is also required to find out if the organizations have well defined Supply Chain processes and the activities spanned by each process. We also need to find out how well the team members across the organization are aware about these activities. Research can be carried out to find whether these processes are optimally implemented in the organization. (Technology applications will broaden to network based, flexible solutions that will support the collaborative world. The research is vocal about the futuristic trends in SCM. Multiple supply networks has been the core of this study which opens the avenues for further research. The researchers have clearly stated that it is necessary to study tier2, tier3 suppliers for bringing innovations in supply chains. The study also talks about future research in industry restructuring, technology advances, challenges of globalization and new business risks. The study has thrown some light on multiple and complex supply chain which is the base of our research. Further research is required to find out the role of technology to bring more collaborations and integration in supply chains. Research / study of technological tools is awaited which will allow engineering and supply management to work more closely.)

The paper leaves behind many elements for further research. The authors have mentioned that true integration beyond first tier suppliers and customers is very rare. This integration is possible with Information Technology and can be embedded in our research. There are other elements like second tier purchasing which also need to addressed by the academicians. Supply Chain complexity is a major problem in SCM. Managers in the organisations are till

experimenting to build world class supply chain. Researcher should focus to build a SCM framework and define the SCM maps to build a world class supply chain.

Materials mangers are extremely resistant to change the processes to make them more effective and prefer to follow the known practices. Academicians can research and experiment on the SCM processes and help the industry to initiate new/upgraded processes. As mentioned earlier companies are not taking a holistic approach to SCM. Researchers through their longitudinal and extensive research can develop a holistic approach to SCM and help the companies to implement more effective SCM. Our research can further study the SCM processes in depth. A study can be conducted to find out the relationship between SCM maturity and overall business performance. A case study can be developed for such study. The limitation of this study is that processes are broadly defined.

From the research it is revealed that academicians should take up further research in the following areas: SCM Strategy. The articles reviewed only investigated alignment between the firm and one key supplier instead of the complete supply chain.(multi tier suppliers). Also the idea of Supply Chain organization has been put forth yet not systematically investigated. The authors stated that voluminous work was done in for SCM frameworks, Trends and challenges. However the academicians shifted their focus to other areas and there is a decrease in the articles related to this area. The authors believe that studies in this area should be continued to find and document the latest and current developments in SCM. The authors also clearly state the need to examine the supplier- buyer relations with second, third tier suppliers beyond the first tier chain. Similarly the authors found lack of research in the following categories: a) Large Sample sizes b) One Tier investigation c) Longitudinal Studies and d) Global Supply Chain Analysis.

Supply chain and Supply chain management have significantly made progress in itself and this needs to researched and recorded. The state of the literature needs to be upgraded with the development of new theories and concepts in SCM. Contemporary research will increase the utility of the literature for the business professionals and reduce the gap between academics and industry.SCM has set new trends in the last decade and is fast upgrading itself with new paradigms.

Extensive research has been carried out in American , Canadian and European Countries. So research is required to be carried out in Indian Context. Substantial research has been conducted on pre-implementation issues IT systems. The barriers confronted by the suppliers during the implementation and post implementation have not come under the lens of the academicians. The researcher feels that an integrated study in 3 stages for challenges is required to be carried out. (pre-implementation, implementation and post implementation stages.) Pre implementation stage will include the challenges like selection of (suitable) IT system, agreement of the supply chain partners for this decision, financial resources, support of Top management for the implementation of IT systems, support of the employees, (organizational support), implementation stage challenges : training period and cost, employee readiness to accept the system, period for the system to go live, transformation of the manual data to the digital formats, transformation of the legacy systems in to new systems, . Challenges of post implementation (maintenance of the system, up gradation,) integration with the OEMs and tier 2, tier 3 suppliers, Co-ordiantion with multiple OEMs also is a critical challenge for the tier 1 suppliers. Policy formation by the OEMs to implement IT becomes mandatory for the suppliers. This is a big challenge for the suppliers to integrate with the IT systems of the OEMs. Specifically if they are dealing with multiple suppliers.

The following challenges are documented however need in-depth research. Factors like Systems interoperability, Identification of suitable systems (solutions), Complex SCM processes, SCM re-engineering involving multiple supply chains. Research needs to be focused on the Location of the suppliers (local and global) also requires further research. Formal methodologies to redesign SCM and implementing IT requires focused research.

Issues pertaining to tier2 and tier3 supply chain partners are the least explored areas and represent area for future research. Researchers have focused on OEMs and Tier 1 suppliers as the matter of the research. Tier 2 and beyond SCM needs a structured and focused research. Identification of suitable systems, Financial resources, up gradation of IT systems, compatible IT systems with the next node in the network are the major challenges for the Tier 2 and further suppliers. Research is also lacking in study of types of IT systems implemented at the suppliers' end.

Methodical and précised study of the suitable systems will help the suppliers to identify most suited IT systems for them. IT implementation in Supply Chain has also to be analyzed from the view of Supply Chain partners and the Whole of Supply Chain. Study on collective decision and integrated approach by OEMs and suppliers will give a focused direction and systematic approach to implement IT at both the ends.

VI. CONCLUSIONS

To conclude we can say that the SCM field is redefining itself. SCM has set new trends in the last decade and is fast upgrading with new paradigms. SCM processes, activities, network maps, multi tier Supply Chains, needs the attention of the academicians and the industry people as well. The researcher can extensively and systematically contribute in this area of research for the current developments

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