International Journal on Emerging Technologies (Special Issue NCETST-2017) **8**(1): 486-494(2017)
(Published by Research Trend, Website: www.researchtrend.net*)*

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

Study about the Supply Chain, Flexibility and bullwhip effect on SCM in small-scale Industry

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ABSTRACT: The purpose of this work is to study, bullwhip effect on supply chain management and discuss the develop a conceptual model on the potential barriers in the implementation of supply chain flexibility in small-scale industries. The model suggests that supply chain flexibility can be researched using a three-tier approach: identification of risks, identification of potential barriers emerging from these risks, identification of bridges to these barriers. The proposed is based on the view of problems of small-scale industries as well as the limited research on supply chain flexibility. The studies indicated that the three main barriers to flexibility in supply chains are improper integration between systems, Supply Chain Function cost and quickening pace of product innovation. Some ways to overcome these barriers and act as bridges are also summarized. The field of study of supply chain flexibility presents numerous options for fresh research work.

Keywords: Supply chain management, Flexibility, Potential Barriers and Bridges, Bullwhip Effect, Push and pull view of SCM.

I. INTRODUCTION

The supply chain management is used to describe the management of material suppliers, Production facilities, distribution service and customers link together through the forward flow of information and backward flow of materials. Supply chain management (SCM) is the management of the flow of goods and services. SCM is a global network used to delivered product and services from raw material to customers. Supply chain management are consists of supplier, Raw material, Producer or manufacturer, distributor, retailer and customers. Key benefits of supply chain management (SCM) are given in the below:

1. Lower inventories
2. Higher productivity
3. Shorter lead-time
4. Improve the responsiveness
5. Create the customer loyalty
6. Improve the service level
7. Customer expectation increase day-by-day

A. Types of Flow in Supply Chain Management

In the supply chain, there are four types of flow from the supplier to the end customer in the chain

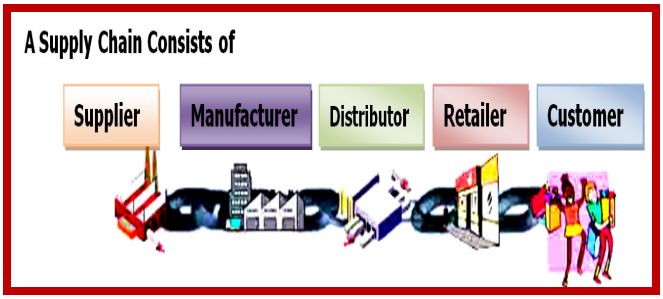

Fig. 1. Supply chain management.

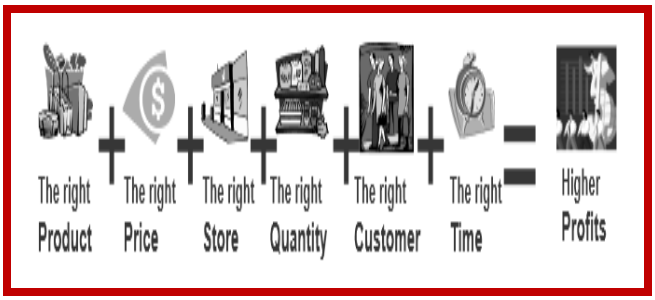

Fig. 2. Goal of Supply chain Management.

1. **Primary product or Material flow:** The flow of material (products and services) from the source of materials forward (or upstream) to the final consumer in the external chain. It should be noted that there is also a backward (or downstream) flow of materials. It is consists of raw material, semi-finished goods, finished goods.
2. **Primary cash flow:** The financial flow consists of credit terms, payment schedule, and consignment and title ownership arrangements.
3. **Information flow:** it is the consist of Invoice, receipt, order, product records, sales, forecasting decisions, Stock deployment, Manufacturing decisions, Physical procurement decisions, new product intro decisions, capacity, promotion plan, delivery schedule.
4. **Reverse product flow:** Reverse product flow consists of Return for repair, replacement, recycling and disposals.

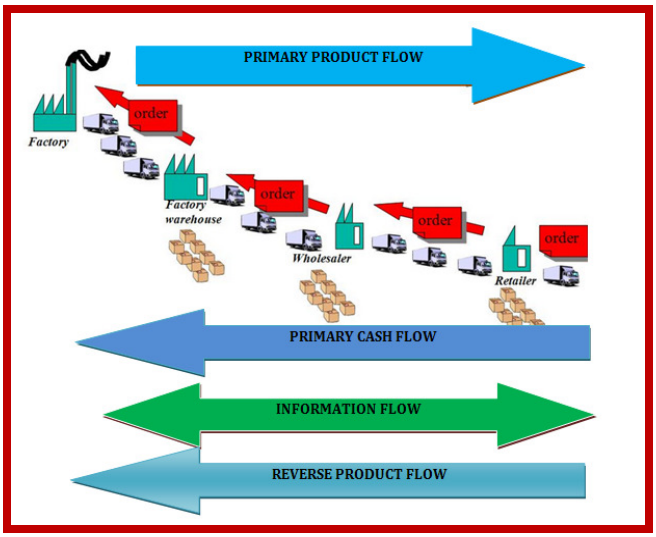

Fig. 3. Type of flow in SCM.

B. Cycle View of a Supply Chain Management

Supply Chain is a sequence of processes and flows that take place within and between different stages and combine to fill a customer need for a product. The processes in a Supply Chain are divided into series of cycles, each performed at the interface between two successive stages of a Supply Chain. Cycle view of Supply Chain is useful in making operational decisions as role of each member of Supply Chain is clearly defined.

1. **Order cycle (customer-retailer) -** The Customer Order Cycle sits at the interface between the customer and retailer and includes all processes for receiving and filling of customer orders: customer arrival, order entry, fulfillment, and receipt.
2. **Replenishment cycle (retailer-distributor)-** The Customer Order Cycle sits at the interface between the customer and retailer and includes all processes for receiving and filling of customer orders: customer arrival, order entry, fulfillment, and receipt
3. **Manufacturing cycle (distributor-manufacturer) -** The Manufacturing Cycle is found between a manufacturer or repair activity and the next downstream (toward the customer) member of the supply chain. This next downstream member may be a wholesaler, a retailer, or the customer. The cycle begins when a customer, retail activity, or wholesaler places a replenishment order, or when a manufacturer forecasts customer demand. Processes in this cycle include production and maintenance scheduling, and product repair, shipping, and receiving.
4. **Procurement cycle (manufacturer-supplier)-**The Procurement Cycle occurs between the manufacturer and supplier. It includes all processes to ensure the availability of materials and components at the time and place required in the production and maintenance schedule. These processes include supplier production scheduling and component manufacturing, shipping, and receiving. The cycle is triggered by requirements of the manufacturer's production schedule, the maintenance activity's repair schedule, or the restocking policy. This cycle may repeat several times between several tiers of suppliers

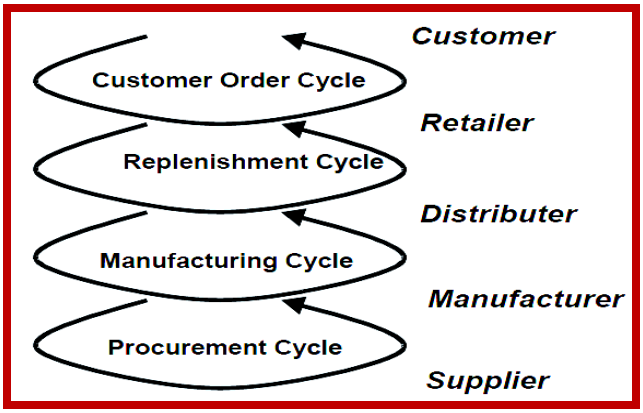

Fig. 4. Cycle view of Supply Chain management.

C. Push and pull View of SCM Process

a. Push View of SCM

A push-based SCM takes longer to react to the changing market place in a push-based supply chain, production decisions are usually based on long-term forecasts in push-based strategies, and SCM experience increased transportation costs, high inventory levels and high manufacturing costs. Key point for Push view of SCM:

- Mass production on the base of long range forecast
- Large inventory safety stock

- No direct contact with customer
- Focus only resources allocation
- Increased lead time
- High dynamic and effective distribution network.
- Huge warehousing and distribution cost
- High wastage & product rejection
- Slow information flow mechanism
- Objective is to minimize the cost
- Ex. Auto industry

b. Pull View of SCM

In a pull-based supply chain, manufacturing is demand driven so that it is coordinated with actual external customer demand rather than a forecast. Lead-time reduction occurs as the variability are better monitored in pull-based SCM, Pull-based systems are often difficult to implement when lead times are so long that it is impractical to react to demand information. Key point for Pull view of SCM:

- Production on the base of customer demand
- Very little or zero inventory level
- Good Coordinated with true customer demand
- Focus on the service level
- Decreased lead time
- Less dynamic and effective distribution network
- Less warehousing and Inventory carrying cost.
- Minimum wastage and high quality
- Fast information flow mechanism
- Objective is to maximize the service
- Ex. Dell and Amazon

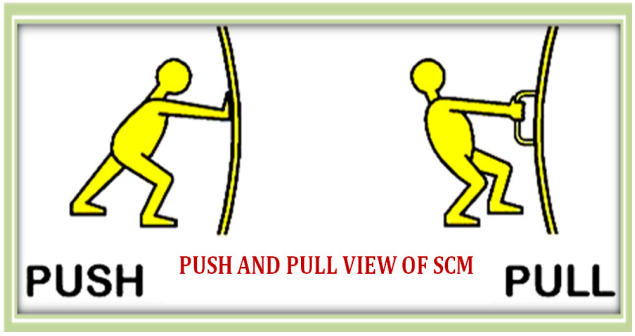

Fig. 5. Push and Pull View of SCM

II. BULLWHIP EFFECT ON SCM

According to Lee et al. (1997), there is a phenomenon that the variance of orders may be larger than that of sales, and the distortion tends to increase as one move upstream, which is called bullwhip effect. It is a distortion in the sharing of information from downstream to upstream in the whole supply chain system; the effects can propagates the enterprise's marketing, logistic and manufacture. Despite There are lots of factors which could affect the efficiency of supply chain, like organization structure, channel of information, geographical distribution, industry characteristics etc., the bullwhip effect is still one of the most deep-rooted influence factor for the whole system. You cannot find another such kind of element like the bullwhip effect, which could affect all parts of the whole supply chain system. No matter what kind of industry the firm are, what place does the firm in or how hard does the firm try by its own, the processes inside of the firm from producing plan to all kind of inventory must be all influenced by the bullwhip effect and hard to avoid.

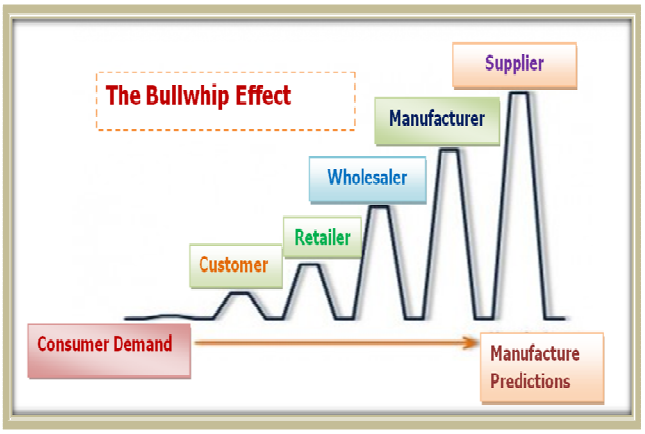

Fig. 6. Bullwhip Effect on SCM.

A. Impact of the bullwhip effect in SCM

1. Excess inventories investment
2. Reduced productivity
3. Increased raw material costs
4. Overtime expenses
5. Increased shipping costs
6. Lead-time increased
7. More difficult decision making
8. lost sales & customer service

B. Reasons of the bullwhip effects in SCM

1. Un-forecasted sales promotions
2. Low utilization of the distribution channel
3. Price fluctuations
4. Free return policies
5. Batch ordering (large orders result in more variance)
6. Sales incentives
7. No communication & no coordination up and down the supply chain
8. Poor customer service due to stock-outs
9. Delay times for material and information flow
10. Customer turning back sales orders
11. Forecast errors

C. How to Avoid the Bullwhip Effect in SCM

1. Share information about the each stage of the supply chain

2. Minimize the cycle time in receiving projected and actual demand information
3. Implement an everyday-low-price policy
4. Establish long-term contract with supplier
5. Improve operational efficiency
6. Understand product demand patterns at each stage of the supply chain
7. Minimize or eliminate information queues that produce information flow delays
8. Centralize information of supply chain
9. Eliminate the cause of customer order reductions or cancellations

III. FLEXIBILITY IN SUPPLY CHAIN MANAGEMENT

Flexibility is the organization's ability to meet an increasing variety of customer expectations without excessive costs, time, organizational disruptions, or performance losses. Flexibility may be defined as the ability to change or react with little penalty in time, effort, cost or performance .Flexibility can improve the company's competitiveness, particularly for the decision-making process of implementing technologies .But managers do not have a comprehensive view of flexibility because they focus more on machine flexibility than on total system flexibility. Flexibility in supply chains may well represent a potential source to improve the company's efficiency and may be a significant measure of supply chain performance. Supply chain flexibility is defined to encompass those flexibility dimensions that directly impact a firm's customers and are the shared responsibility of two or more functions along the supply chain, whether internal (marketing, manufacturing) or external (suppliers, channel members) to the firm.

A. Components of flexibility

1. **Operations system flexibility (both manufacturing and service)** – ability to configure assets and operations to react to emerging customer trends (product changes, volume, mix) at each node of the supply chain.
2. **Market flexibility –** ability to mass customize and build close relationships with customers, including designing and modifying new and existing products. A critical need in today's competitive environment is the ability to design and introduce new products as customers' needs, materials, and technologies change.
3. **Logistics flexibility** – ability to cost effectively receives and deliver product as sources of supply and customers change (customer location changes, globalization, and postponement).
4. **Supply flexibility –** ability to reconfigure the supply chain, altering the supply of product in line with customer demand. The flexibility of supply includes flexibility in establishing the relationships with partners. Companies may choose to solicit short-term bids, enter into long-term contracts and strategic supplier relationships, form joint ventures, form consortiums, create problem-solving councils or vertically integrate.
5. **Organizational flexibility** – the ability to align labor force skills to the needs of the supply chain to meet customer service/demand requirements.
6. **Information systems flexibility –** the ability to align information system architectures and systems with the changing information needs of the organization asset responds to changing customer demand.

B. Aspects of Flexibility

In the following paragraphs, flexibility is described in more detail, related to three aspects:

1. Buyer-supplier relationship
2. Demand driven and the role of marketing
3. Production/manufacturing

a. Buyer-Supplier Relationship

The roles of external and internal drivers are important for increasing supply chain flexibility in a business. External drivers relate to demand volatility and seasonality whereas internal drivers can be described as low commonality between products and product schedule uncertainty. However, these changing circumstances also emphasize the importance of the dyadic relationships between the focal company and its clients in the buyer-supplier relationships. This relationship can be described as 'sourcing' and 'supply'. The former one refers to the ability of the focal company to choose and change among suppliers based on supplier performance. Characteristics of buyer-supplier relationship listed in the below:

1. Social supporting
2. Trustworthy
3. Interdependence
4. strong Commitment
5. More Satisfaction
6. Innovation and development
7. Quality maintain
8. Exchange Information between buyer and supplier
9. Cost reduction

b. Demand Driven and the Role of Marketing

The fundamental goal of supply chain management is to create customer value. The role of marketing plays an important role in this. Without appropriate marketing activities, supply chain efficiency does not find out what the customer values. It is stated that manufactures must be able to respond to 'dynamic trade', which is defined as the ability to satisfy current demand with customized response. Traditionally, marketing was a function that was more externally oriented whereas supply chain management is merely internally oriented. Accordingly, it

can be inferred that marketing and supply chain management is hence between those that define demand with those who fulfill it. Although we consider a customer-oriented approach as an important characteristic of a 'flexible' supply chain, it does not necessarily create superior value for the customer. In order to create superior value, a supply chain must have the ability to support this with its supply chain processes. The term Demand Chain Management can be used for the same as it combines the strengths of marketing and SCM by shifting the focus to the customer. Next to this, the competitive environment of a company also indicates the role of manufacturing in the supply chain.

c. Production/Manufacturing

Flexibility in manufacturing is not prior limited to machine flexibility since manufacturing (system) consists of several interconnected subsystems. Because of this, it requires more changes in the firm's activities. It is stated that highly innovative products in uncertain, constantly changing environments need a supply chain production system that is focused on strategic flexibility and speed to market. Based on the competitive environment of a company, generally several forms of flexibility aspects are stated in manufacturing:

1. **Mix flexibility:** Ability of a system to simultaneously produce a number of different products in a given period (broad product line and caters to different market segments.
2. **Volume flexibility:** Ability of a system to change significantly the production level and the composition of the product mix in a short time span (volatile markets).
3. **New Product Flexibility:** Ability of a system to add or substitute new products to the product mix in a short time span (technology intensive markets).
4. **Delivery time flexibility:** ability of a company to adapt lead times to the customer requirements. An example of high delivery flexibility is just in time, when supplier delivers the product to the customer at the right place and right time.

C-Model Development

Several papers have already emphasized the need for flexibility although little attention is paid to how operational activities incorporate flexibility in their supply chain practices. In this paper, emphasis is put on the analysis of the major barriers faced in the implementation of supply chain flexibility. This aspect of supply chain flexibility is illustrated with the case study of small-scale industries, which help to generalize the main category of risks, associated, and, the barriers they lead to produce. The small and medium enterprises face various risks usually. Major risks can be listed as finance, problem of skilled manpower, irregular supply of raw material, inadequate credit assurance, lack of machinery and equipments, absence of adequate infrastructure, absence of organized marketing and, global level stiff competition. In a broader view, the first six risks listed can be attributed to the category 'financing issues', and, the last two risks can be attributed to the risk category 'unorganized structure' which bogs them down in the global competition. Now, by ample studying, searching and researching, we found so many barriers to supply chain flexibility. However, narrowing down, we have pinpointed three potential barriers, which is improper integration between systems, the supply chain cost function, and, the quickening pace of product innovation. The supply chain partners cannot integrate well because of technological and lack of good relationship type barrier. The supply chain maintenance cost also demonstivates the managers to implement supply chain flexibility, in face of less literature and knowledge related to the topic. Both these barriers, lack of proper integration, and, supply chain cost squeeze, seem to arise from the root risk that is improper financing.

D- Bridges as remedies to the Barriers

When all of the barriers are surveyed in a single glance, the absolute magnitude of the challenge of supply chain integration can be practically overwhelming. This fact may indeed represent one of the greatest threats to the long-term sustainability of SCM. However, certain remedies, although difficult to apply, do exist which can act as bridges to the identified barriers. Changing mindsets and creating a new organizational infrastructure cannot happen overnight. It is also encouraging to note that the central theme running through most of the barriers that is, getting people all on the same page is going to be a launching point for survival and success in the not too distant future. In fact, the majority of the identified bridges are the mirror image of the most prevalent barriers (e.g., poorly aligned metrics is the barrier; carefully aligned metrics is the bridge). This reality indicates that managers are cognizant of the barriers and are taking a somewhat targeted and systematic approach to mitigating them. It also suggests that patience and persistence are two critical ingredients to long-term success. Three additional, relatively unique core bridges stand out and merit individual discussion:

1. The need for expanding supply chain education and training,
2. The need to establish credibility and momentum early in the integration process, and
3. The value of formalized coordination and feedback councils.

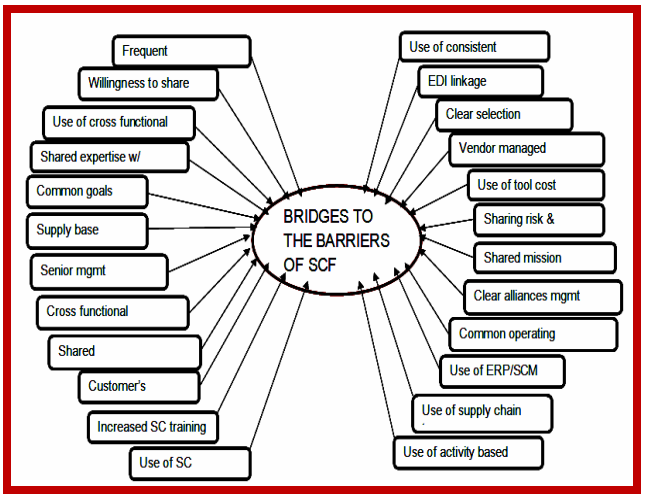

Fig. 7. Bridges to the barriers of SCF.

a.Education and training as a bridge

Managers across the supply chain point to education and training as vital. Almost half of the managers identified training as one of the singular requirements for long-term SCM implementation success. The need for training extends throughout the company and reaches up and downstream. Senior managers require education on the benefits and potential competitive impact of SCM. The goal of the education effort at this level is to generate support for SCM proposals and provide the context from which senior management will establish priorities and allocate resources. Middle management is also targeted for education regarding SCM with the goal of diminishing the reticence (and hostility) that is frequently directed toward integrative efforts. Managers need to broaden their horizons through increased participation on cross-functional teams and other activities that provide exposure to the value-added activities that take place outside their own domain. The manager, who possesses strong expertise in a chosen field, Yet speaks the language of colleagues in other functional areas and recognizes their roles and challenges, is in many respects the ideal middle manager. Because they are rare, leading companies increasingly value such cross-experienced managers. The often-stated goal for entry-level managers is to bring them into a rotation program designed to help them assimilate the skills and mindset of the cross-experienced manager. It is hoped that entry via a rotation program will help acculturate young managers in a way that will help them tear down functional silos. The desire is to develop a cross-functional or process mindset while maintaining strong functional expertise. Additional training targeting negotiation, team building, process mapping, and total costing is also deemed as useful in helping managers cope with the demands of a supply chain environment. Several participant companies have established in-house universities to both provide educational opportunities and inculcate a culture of lifelong education. Some companies are even augmenting their in-house universities through alliances with accredited state and private universities. Helping people adopt mindsets and build skills for success is viewed as a critical step in achieving supply chain leadership. The need for education and training extends both up and downstream. For several years, leading companies have been providing some training to valued suppliers, especially in the areas of quality and just-in-time practices. The emphasis on helping selected suppliers build key skills has increased at participant companies. Greater resources are now dedicated to supplier development efforts. The objective is to teach suppliers how to re-engineer processes through a pilot project and then motivate the supplier to utilize the improvement process in other areas of the organization. Suppliers are often inspired to work in a similar fashion with their own suppliers. Such hands-on training is increasingly being supported through formal classroom training. These training efforts create new skills while fostering better relationships and are an example of win-win thinking. Customer education is somewhat rarer and typically much less formal than process re-engineering or classroom education. Nonetheless, some leading companies have discovered that they have resources and knowledge their customer's lack. By sharing their expertise, they not only promote friendlier relationships but also help their customers achieve higher levels of competitiveness. At times, such customer education creates switching costs and locks in loyalty. Developing successful and loyal customers is a solid payback for customer education initiatives. True supply chain leaders realize that sometimes they can best use their own resources to help other members of the supply chain team build the skills needed to prosper in today's fast-paced world.

b. Pilot projects and success stories as a bridge

Enough organizational inertia exists to require intensive marketing of good supply chain ideas. Targeted pilot programs that can be used to document the value of SCM must then follow the marketing effort. Effective SCM champions recognize the value of using pilot projects to achieve early successes that can be documented and communicated throughout the organization. These success stories are needed to generate momentum and to justify further investment in supply chain efforts. Managers charged with making a pilot project work therefore select pilot projects carefully and do everything they can to assure project success. Assuring success in a supply chain pilot program requires that one or two receptive and trustworthy supply chain "partners" be identified. Strong historical working relationships can make all the difference to the success of a pilot program. When using pilot programs to establish credibility, it is imperative to

document baseline performance so that the value added can be validated. In today's market, a very strong "show me the numbers" mentality exists. Credibility is founded on documented performance. When used appropriately, pilot projects and success stories do two things invaluable to the success of most supply chain initiatives. First, they yield positive results that can be used to change mindsets, garner broad-based support, and establish momentum. Second, they help establish parameters for what can and should be done. Indeed, well-designed pilot programs are like a laboratory in that they provide valuable insight into new opportunities while revealing likely pitfalls that should be avoided in the future. The combination of success stories and the lessons learned makes judiciously crafted pilot programs a vital bridge to supply chain accomplishment.

c. Formal Advisory Councils as a Bridge

One practice increasingly used to mitigate resistance and facilitate collaboration is the adoption of advisory councils. Leading companies establish senior-level supply chain steering committees to increase cross-functional interaction and establish buy-in for specific initiatives within their own company. At one participant Company, the steering committee meets weekly to fulfill the following roles:

- Serve as champion and mentor
- Establish rules of engagement
- Acquire resources
- Provide encouragement and motivation
- Perpetuate rewards and recognition
- Facilitate communication
- Facilitate goal alignment
- Inculcate a customer satisfaction mindset

E-Mirror-Image Bridges

1. **Enhanced performance measurement** was the most commonly cited bridge to effective SCM. Because measurement provides understanding and drives behavior, it is critical to utilize appropriate metrics. Managers' greatest desires in this area are to have metrics that are aligned with corporate and supply chain objectives. They want metrics that are easily understood by everyone and that are both process and supply-chain oriented (e.g., perfect orders, supply chain inventory day's supply, churn factors, cash-to-cash cycle times, etc.).
2. **Alignment Mechanisms** are also on the most-wanted list of many supply chain managers. A common supply chain vision that is clearly and forcefully articulated is the starting point. Clearly defined and common objectives that support the vision are likewise called for. Managers also desire standardized policies and consistent operating procedures. With the vision, objectives, policies, and procedures all aligned within the company and to a lesser degree across organizational boundaries, greater consensus would emerge that would facilitate harmonious and synergistic action.
3. **Organizational Redesign** is also seen as a prerequisite to creating high-impact supply chains. Many managers favor the creation of an overarching "Integrated Supply Chain Department" or "Order Management Organization" to eliminate the cultural and structural distances that separate the inbound and outbound sides of the organization. Several of the managers have accepted that the organization structure must reflect the need for cross-functional collaboration. An increased use of cross-functional teams to tackle a myriad of issues from commodity management to supplier selection and development to key account management was also recommended by multiple managers. In essence, managers would like to see the permanency of an end-to-end supply chain department supported by flexible and responsive cross-functional teams.
4. **Open Information Sharing and Real Communication** is another highly valued bridge to supply chain success. The managers rely heavily on modern information technologies and believe that more investment in information technology will ultimately enhance communication effectiveness, helping to close the gaps that exist in current supply chains. Among the most sought-after information tools are the intra- and extranets that facilitate rapid information exchange. Accurate forecasts and actual production schedules are among the types of information that managers desire most. Also, databases and data mining packages are in high demand to help design optimized networks. Even as more emphasis is placed on technology, several managers expressed a desire for more face-to-face communication. One on one interaction and personal relationships are viewed as essential to establishing trust and close working relationships. Strong relationships are often viewed as the foundation on which the willingness to share sensitive information is built. Joint problem solving, brainstorming, and other continuous improvement communication also depends greatly on people working in close proximity. Managers are working diligently to bring technology, willingness, and relationships together to make better decisions and solve tough problems.
5. **Process Documentation and Analysis** is needed to make cross-functional processes transparent. Most processes capable of delivering a unique competitive advantage involve many value-added activities that span multiple functions and even cross company boundaries. As a result, no single manager understands, let alone controls, the entire process. This lack of visibility often leads to sub-optimal process performance. The resolution to this problem is simple - make the process visible by mapping it out and documenting key performance requirements

and parameters. The information that comes from the mapping and documentation effort can then be used in rigorous process analysis and redesign. Interfaces and tradeoffs are better understood and can be managed proactively.

6. **Trust** must be established to achieve synergistic relationships and results. As already noted, definitions of trust vary dramatically, depending on which side of the "leverage/power" fence a manager is located. Based on the managers' comments, most companies pay lip service to the ideal of trust without backing up the talk with behavior. To most of the managers, trust consists of 1) open information sharing 2) treating the other party as a valued team member all the time, not just selectively, and 3) doing what you say you are going to do every time. Anything short of this is seen as pretense and eventually comes to be viewed as manipulation.
7. **Managerial Commitment** is another requirement for true SCM. Most of the managers believe that active and expressed support at the CEO level would make their jobs easier. Many believe that the establishment of an executive-level position with a supply chain title occupied by a credible supply chain champion is also essential to solidifying SCM as a viable competitive strategy. A receptive ear at the highest levels in the organization is viewed as necessary to overcome the many obstacles to more collaborative working relationships.
8. **Simplification** is the final SCM implementation bridge. Many managers are simply overwhelmed by the mountain that is SCM. Indeed, the average company faces a combinatorial nightmare as it tries to make sense out of its supply chain network.

IV. CASE STUDY OF SMALL SCALE INDUSTRY

A. Defining a Small Scale Industry

Defining small-scale industry is a difficult task because the definition of small-scale industry varies from country to country and from one time to another in the same country depending upon the pattern and stage of development, government policy and administrative set up of the particular country. Every country has set its own parameters in defining small-scale sector. Generally, small-scale sector is defined in terms of investment ceilings on the original value of the installed plant and machinery. But in the earlier times the definition was based on employment. The Fiscal Commission, Government of India, New Delhi, 1950, for the first time defined a small-scale industry as, one, which is operated mainly with hired labor usually 10 to 50 hands. Fixed capital investment in a unit has also been adopted as the other criteria to make a distinction between small-scale and large-scale industries. This limit is being continuously raised up wards by government. The Small Scale Industries Board in 1955 defined, "Small-scale industry as a unit employing less than 50 employees if using power and less than 100 employees if not using power and with a capital asset not exceeding Rs. 5 lakhs". In spite of having huge potentialities, small-scale industries in India could not progress satisfactorily due to various problems that they are confronted with while running enterprises. In figure no. 6, we show some of the disruptions such as finance, Problem of skilled manpower, Inadequate credit assistance, Irregular supply of raw material, Absence of organized marketing, Lack of machinery and equipment, Absence of adequate infrastructure, Competition from large-scale units and imported articles, and supply chain risk mitigation strategies.

B. Problems/ risks faced by small-scale industries

1. Financial problems
2. Standardization
3. Problem of Skilled Manpower
4. Inadequate Credit Assistance
5. Irregular Supply of Raw Material
6. Absence of Organized Marketing
7. Lack of Machinery and Equipment
8. Absence of Adequate Infrastructure
9. Competition from Large-Scale Units and Imported Articles

V. CONCLUSION

Supply chain flexibility can be an ultimate sought after development in the industrial strategies. The companies giving due importance to supply chain flexibility and management can respond well to swift market changes and altering conditions. However, it faces many barriers to be properly implemented. We have tried to focus on the study of potential barriers to the supply chain flexibility, which have originated from the general risks derived from the analysis of small-scale industries. Those barriers are namely, lack of proper integration between the elements of supply chain, supply chain cost function, and, quickening pace of product innovation. These barriers are very wide in domain and their impact on supply chain management implementation is considerable. This model on barriers and bridges to supply chain flexibility can be helpful to carry the study forward. It raises the need to incorporate flexibility in the supply chains of firms, and, the need to assess the impact of increased flexibility on business performance.

VI. SCOPE FOR FUTURE WORK

This research work shows the possibilities for more flexible supply chains. Further research has to provide evidence on the specific factors that determine flexibility, as given in our preliminary definition. It has also to be investigated how flexibility meets demand volatility and at the same time, deal with external market disruptions or the aspects of longer term and strategic perspective. This is

maybe a new challenge, taken from a supply chain development perspective. Further research should also overcome shortcomings of this research. Although this framework introduces for the first time the assignment of responsibility to the supply chain partners, additional examination is needed to investigate the level of responsibility for each partner within the supply chain system. An appropriate area to research would be the issue underlying supply chain flexibility as organizations try to improve supply chain performance. To begin the process for building a theory for supply chain flexibility, this paper describes a conceptual model of the barriers and bridges in its implementation. From this model, researchers can proceed through the iterative research cycle of explanatory frameworks tested against reality and refined as studies build upon one another. Several research questions can be raised to advance the understanding of supply chain flexibility and improve its practice.

ACKNOWLEDGEMENTS

The authors Sushil Kumar Choudhary and R.S. Jadoun acknowledges Dr. H.C Sharma, Dean of College of Technology, G.B Pant University of Agriculture & Technology, Pantnagar, Uttarakhand & Technical Education Quality Improvement Programme (TEQIP)-II of All India Council for Technical Education (AICTE), New Delhi, India for providing financial assistance for doing this research work.

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