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Review of Logistics Parameters for Achieving Resilience and Coordination in Indian Supply Chains

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***Abstract:** Supply chain management is one of the thrust areas for competitiveness and growth of industries. Supply chain management emphasizing logistics parameters yields well optimized delivery of goods, services and information from supplier to customer. An effective supply chain makes industries competitive and profitable. Small and medium enterprises (SMEs) in India face problems in coordinating their supply chain due to lack of proper identification and utilization of logistics parameters and infrastructure. Latest and the state of art technologies and management tools have to be used for improving the performance of supply chain and logistics management in India with proper identification and treatment of appropriate logistics parameters. In this paper a review of factors affecting or influencing resilient logistics and various mechanisms for coordination of supply chains in Indian scenario is done.*

I. INTRODUCTION

India is a developing country and most of its industries are small and medium enterprises (SME). As per the government statistics almost 90% of industries are SME's and their contribution to the total export is 40%.Indian organizations have started collaboration with supply chain partners to cope up with the increasing uncertainty of supply networks, globalization of business proliferation of product variety and shortening of product life cycles. It has been observed that SMEs in general are not able to implement supply chain management (SCM) to its full extent, mainly because they are managed at arm's length by larger customers and have to follow the norms stipulated by the buyer (Arend and Wisner, 2005). Studies reveal the lack of performance among SMEs after the introduction of SCM, as compared with larger companies is because SMEs and large enterprises implement SCM differently, and apparently this difference in implementation is significantly associated with SMEs performance (Arend and Wisner, 2005).

Industries having high potential impact on business performance face high supply chain risks due to its complexity. On analysis it is found that almost 85% of global supply chains had experienced minimum one significant disruption in a year. A number of internal and external forces contributing the hike in supply chain risks. Studies conducted to locate and find out the risks showed that the operational risks are major contributors. Nobody can predict the possibilities of disruption in supply chains because of its structural complexity. Achieving resiliency in supply chain is considered as a best way to reduce the severity and likelihood of supply chain disruption.

A better option is to build sufficient resilience on possible major supply chain driver like logistics by closely identifying the connected parameters. A resilient supply chain can help an industry to overcome the various risks and to return suddenly from avoidable risks. Identifying connected parameters of major supply chain drivers like logistics are very much essential for the supply chain coordination also.

II. ISSUES FACED BY INDIAN SUPPLY CHAIN FOR ACHIEVING RESILIENCE AND COORDINATION

Generally Supply Chain (SC) consists of different functional drivers like logistics, inventory, purchasing, procurement, production, planning, and intra and inter-organizational relationships. To improve the overall performance of SC the members of SC may behave as a part of a unified system and coordinate with each other. Some Indian companies are moving towards making their supply chain and logistics system efficient but most of them have perform very little or nothing. The logistic cost as percentage of the Gross Domestic Product (GDP) stood at 13% in India in 2004 (Confederation of Indian Industries(CII) results), in comparison to 11% in Europe and 9% in the U.S. often total logistic cost, transportation represents 39% while warehousing, packing and inventory accounts for 24% of the total costs. Higher logistic costs are mainly due to poor infrastructural facilities or ineffective utilization in the country. The higher logistic costs represent high product and service costs in the international market.

Transportation related challenges are as follows. In India road has become the predominant mode of transportation of freight cargo. Estimate of the modal movement of cargo highlights that In India nearly 61% of the cargo is moved by road, 30% by rail and rest by airway, pipelines and inland waterways. This is as compared to a 37% share of road in the USA and 22% in China. It is recognized that movement of long haul bulk traffic by road is less efficient than by rail.

Infrastructure is one of the biggest challenges faced by the Indian logistics sector and has been a major deterrent to its growth. Infrastructural problems like bad road conditions, poor connectivity, inadequate air and sea port capacities and lack of development of modes of transports like railways and alternates like inland water transport and domestic aviation have been constant irritants.

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Due to the infrastructural bottlenecks costs per transaction in Indian logistics sector is very much high compared to those in the developed markets.

Transport of freight by road forms an important component of freight movements within India, with a large chunk of goods, over 65 percent, being moved by road. The poor infrastructure has severely crippled the smooth functioning of logistics operations. With narrow and congested highways, poor surface quality of roads and 40 percent of villages not having access to all-weather roads, the efficiency of the transport system is severely affected. (Venketaremana et.al 2013).

Pathetic road conditions combined with the fact that India is perhaps one of the least connected regions in the world constitute a major impediment. Poor connectivity via roads and railways to ports, warehouses and logistics hubs is major infrastructural bottleneck. Movement of goods within the country is fraught with delays and risks. The bulk of Indian trade is carried by sea routes and the existing port infrastructure is insufficient to handle trade flows effectively. The current capacity at major ports is overstretched and their infrastructural upgrades are being made at very slowly pace. While Shanghai's ports can turnaround a container ship in 8 hours, the same ship in Mumbai takes 3 days. Air cargo handling facilities at mini metros and towns are negligible as to be non-existent. The failure in augmenting the freight carrying capacity and efficiency of the railways has denied the logistics sector cheaper and efficient mode of transport. Comprehensive inland waterway systems, which India has in plenty and can act as auxiliary mode of transport, has been neglected. There is a huge requirement for air cargo centers due to growth in air cargo as well as up gradation of infrastructure at various airports.

III. FACTORS FOR DISRUPTIONS

To build resilience four capabilities are necessary. They are visibility, control, flexibility and collaboration. Visibility is the capacity to track and monitor and even foresee the supply chain events and patterns. This helps an organization to address the issues in supply chain before becoming a problem. Flexibility is the capability to response quickly to problems without much hike in operational cost. This minimizes the impact of a sudden shift or disruption. Collaboration with others helps to build trust based relationship. Control helps to ensure proper procedures and process which are following in the company by implementing robust policies, control mechanisms. There are so many issues which make disruptions in supply chain particularly in logistics. These are categorized as macro and micro parameters.(Business Continuity Institute Nov 2011)

The main types of modes are road, rail, air water and pipeline/cable. The equipments use for the above modes are trucks, train, aero plane and ship. Among the above modes for medium scale industries roadways are commonly used. Different types of trucks used are mini trucks (small commercial vehicle gross vehicle weight less than 3.5 tones), light commercial vehicles (gross vehicle weight up to 7.5 tones), medium commercial vehicles (gross vehicle up to 7.5 to 16.2 tones), and heavy commercial vehicles (gross vehicle weight more than 16.2 tones). All the above vehicles are not having GPS. The major advantages of roadways are cost effective, fast delivery and are ideal for short distances in national level, ideal for transporting perishables, easy to monitor and locating goods, easy to communicate with driver and ideal for sending couriers. These may also face disruption due to many reasons. The different macro level parameters are transport subjected to traffic delays, subjected to breakdown of vehicle, goods susceptible to damage through careless driving, bad weather, driving regulations, administrative delay, driving habits, geographical pattern, political situation, lack of warehouses, lack of trust with operators and improper control mechanism. (Falasca et.al 2008)

On analysis of macro level parameters at micro level the following observations are made: The first ones is subject to traffic delays. The reasons for traffic delays are traffic block in junctions due to lack of traffic control mechanism (signal/traffic police), narrow roads, bad condition of the road, improper maintenance of the road, paving of pipelines/cables on the side of the road, breakdown of vehicles on the road, accident in roads, parking vehicles in prohibited areas, crossing of school children on roads in morning and evening, breakage of pipelines, closing of railways gates and deviation from main routes. The second is break down of vehicle. The causes for break down are engine failure, failure in transmission system, failure of Axles, puncture of tyres, breakage of suspension system, failure of brake system, failure of electrical system, failure in steering system, failure in chassis, over loading, shortage of fuel, lack of maintenance and accident to the vehicle. The third reason for disruption is due to goods susceptible to damage through careless driving. The different parameters for this are that the vehicles are carrying fragile items and being less careful and slow driving. Another cause for disruption is due to bad weather. The various factors affecting the logistics due to the above are heavy rain, landslides, earth quakes, storms, breakage of electric lines and high atmospheric temperature. Another macro level parameter for disruption are driving regulations and the various possible causes are speed restrictions, restriction during peak times in towns and restriction for night journey through forests. The next major cause is administrative delay. The reasons are clerical delay in office, failure of net working system, delay in check posts, working time of offices, communication delay and errors in the calculation of demand. Another one of the main parameter for disruption in logistics is driving habits. On analyzing, the following are the factors which affect the above parameter. Over speeds, sudden braking, riding on clutch, driving on unhealthy condition of the driver, consumption of alcohol and restless driving. Considering the factor of geographical pattern, it is found that the following are the causes for the delay. They are hills and valleys, passing through forests, lack of tarred roads and most of the villages are in remote areas, so the communication is very difficult. Another major parameter for disruption is political situation and this makes the following situation that will hinder the smooth functioning of the logistics system. These are harthals, bandhs, strikes called by political parties/employees, loading and unloading problem, policy matters of government, processions on roads by political parties, festivals and road block due to satyagraha on roads. It is also found that lack of warehouses is also affecting the logistics system. The factor which has major influence is that the vehicle has to run long distances and cannot meet the fluctuation in demand.

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The next parameter for disruption to logistics system is lack of trust with operators. The reason for this due to suspicion of pilferage by operators and suspicion of adulteration. Finally the last one on analysis is the Control mechanism. The factors which weaken control mechanism are that there are no robust policies, no monitoring and no control mechanism.

IV. COORDINATION MECHANISMS

In SCM, its members perform different functions or activities like logistics synchronization, inventory management, ordering, collaborative decision making, forecasting and product design, management of flow of goods, information and money (Singh and Rajesh, 2011).

There are different approaches for supply chain coordination mechanisms. It can be classified into price coordination, non price coordination and flow coordination mechanisms (Fugate et al.2006).In price coordination mechanism quantity discounts are offered to encourage the retailer to increase the replenishment quantity thereby eliminating system sub-optimization. Buy – back contracts that allows the retailer to return any portion of initial order at a pre-specified price can coordinate pricing and quantity decision for short shelf life and seasonal demand products (Sahin and Robinson 2002).Non – price coordination mechanisms include quantity flexible contracts, allocation rules, promotional allowances, cooperative advertising and exclusive dealings (Fugate et al.,2006).Quantity flexible contracts allow the buyer to obtain different quantity than previous estimate (Lariviere1999). Flow coordination mechanisms are designed to manage product and information flows in supply chain (Sahin and Robinson 2002).Some of the methods used in product and information flows are Vendor Managed Inventory (VMI), Quick Response (QR), Collaborative Planning, Forecasting and Replenishment (CPFR), Efficient Customer Response (ECR).

According to Fugate et al.2006 a coordination mechanism is a specific tool designed to address a particular coordination problem and can be applied under any of the general organizational approaches.

A further research on supply chain coordination mechanism has revealed that the coordination mechanism can be applied based on two categories:

(Xiuhui Li et al., 2007)

(i) Centralized supply chain systems
(ii) De centralized supply chain systems

In a centralized system the supply chain is considered as a single entity and aims to optimize the system performance. In this approach the system is considered as deterministic and stochastic. In deterministic approach the aim is to develop an inventory policy to minimize system cost. Two conditions are taken in this approach, one with time coordination and the other without time coordination. In stochastic model the demand is considered to be stochastic with independent and exogenously determined demand, correlated demand.

The decentralized system also has two approaches- deterministic and stochastic. In deterministic approach two cases are considered, one being a single retailer and supplier and the other with heterogeneous retailers. The stochastic approach for decentralized supply chain is the most applicable since almost all real supply chains fall in this category.

Latest research in coordination mechanisms has lead to the following categorization of mechanisms:

(i) Supply chain contract
(ii) Information Technology
(iii) Information sharing
(iv) Joint decision making

(Arshinder et al., 2008)

V. ACHIEVING RESILIENCE AND COORDINATION

In the corporate world, resilience refers to the ability of a company to bounce back from a large disruption—this includes, for instance, the speed with which it returns to normal performance levels (production, services, and fill rate). Companies can develop resilience in three main ways increasing redundancy, building flexibility, and changing the corporate culture. The first has limited utility; the others are essential. Theoretically, a resilient enterprise can be built by creating redundancies throughout the supply chain. The organization could hold extra inventory, maintain low capacity utilization, have many suppliers. Yet although redundancy can provide some breathing room to continue operating after a disruption, typically it is a temporary and very expensive measure. A company must pay for the redundant stock, capacity, and workers; moreover, such excesses are likely to lead to sloppy operations, reduced quality, and significant cost increases. A focus on redundancy actually inhibits an organization's ability to achieve such efficiency. (Harvard Business Review, October 2005, Volume-1: No. 8)

To achieve built-in flexibility, a company should take the following actions:

Adopt standardized processes. Master the ability to move production among plants by using interchange- able and generic parts in many products, relying on similar and even identical plant designs and processes across the company, and cross-training employees. Interchangeable parts, production facilities, and people allow a company to respond quickly to a disruption by re allocating resources where the need is greatest.

Use concurrent instead of sequential processes.

Employing simultaneous rather than sequential processes in such key areas as product development and production/distribution speeds up the recovery phase after a disruption and provides collateral benefits in improved market responses. Lucent Technologies achieves concurrency through a centralized supply chain organization that spans various company functions, including engineering and sales. By aligning these activities with the supply chain, the company can view each operational area simultaneously and quickly assess the status of the activity in each if an emergency arises.

Plan to postpone.

Design products and processes for maximum postponement of as many operations and decisions as possible in the supply chain. Keeping products in semi finished form affords flexibility to move products from surplus to deficit areas. It also increases fill rates and improves customer service without increasing inventory carrying costs, because the products can be completed when more accurate information about what the customer wants becomes available.

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Align procurement strategy with supplier relationships.
If a company relies on a small group of key suppliers, it must maintain a deep relationship with each. Such suppliers are so vital to an enterprise that the failure of any among them can have a catastrophic effect on that enterprise. By knowing each trading partner intimately, a company can better monitor the group to detect potential problems and rely on them for help to deal in unforeseen circumstances. On the other hand, if a company is not closely allied with a small group of suppliers, its supplier network had better be extensive if it is to be resilient and responsive to the market. A company with shallow relationships is less knowledgeable about its trading partners and therefore less likely to be forewarned about supply problems. Therefore, maintaining a
large network of arm's-length suppliers would distribute the risk should a failure occur. Neither strategy is necessarily correct; the issue is to choose the approach that aligns a company's supplier relationships with its procurement strategy.

VI. CONCLUSION

Resilience and coordination in supply chain management (SCM) can be effectively used to improve the performance of a procurement – production – distribution system by reducing the disruptions and unifying functions of one or more of relevant supply chain drivers. This paper has chosen logistics as the key performance driver and identified a handful of most relevant and manageable parameters from the available secondary sources suitable for Indian scenario. This is effectively done by first identifying the factors of disruptions relevant to Indian supply chain and logistics and coordinating inter dependent functional activities between SC members. These interdependent activities are to be evaluated as independent decision variables. Further a model can be developed to build a resilient supply chain through coordination by considering the disruption factors in Indian logistics scenario as decision variables.

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