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A HYBRID FRAMEWORK MODEL FOR INDIAN SUPPLY CHAIN COORDINATION MECHANISM USING FUZZY LOGIC

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ABSTRACT

Supply Chains are generally complex with different activities within itself or spread over other organizations. It is ultimately necessary to coordinate the supply chain system so as to bring together multiple organizations and functions effectively for achieving the performance. In this paper a review of coordination mechanisms applicable to Indian industries is made and an attempt is done to develop a framework of coordination mechanisms suitable for Indian supply chains with an intention to use fuzzy logic.

Keywords: Supply chain coordination, Fuzzy logic, Supply chain coordination index, coordination mechanisms

1.INTRODUCTION

Supply chain coordination aims at achieving global optimization within a defined supply chain network. From an operational perspective, SCM is to effectively integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide cost while satisfying service requirements (Simchi-Levi et al., 2000). Thus a supply chain coordination mechanism is an operational plan to coordinate the operations of individual supply chain members and improve system profit. When supply chain members are separate and independent economic entities, this action plan has to include an incentive scheme to allocate the benefits from coordination among them so as to entice their cooperation (Xiuhui Li et al.,2007)

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).

2.ISSUES FACED BY SCM IN INDIAN INDUSTRIES

Generally SC consists of different functions: logistics, inventory, purchasing, and procurement, production, planning, intra-and inter-organizational relationships and performance measures. 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 efficient, most of them have done 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 mainly due to poor infrastructural facilities in the country. The higher logistic costs represent high products /service costs in the international market.

Technology usage is very low in India, which restricts the scope of increasing productivity and efficiency (365businessdays.com). Though India is a leading exporter of IT products, Indian companies are unfortunately least inclined to use them. Hence, the IT penetration in India is low. The lack of coordination results in poor performance of supply chain.

3. 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)

Supply chain contracts are used for better management of supplier-buyer relationship. The contract specifies the parameters within which a buyer places orders and a supplier fulfills them.

Information technology helps to link production with the point of delivery or purchase. It allows planning, tracking and estimating the lead times based on real time data. The supply chain members coordinate by sharing information regarding demand, orders, inventory etc. Information sharing results in inventory reductions and cost savings. A joint decision making helps in resolving conflicts among supply chain members and handling exceptions in case of future uncertainty.

4. IMPORTANCE OF FUZZY LOGIC IN SCM

The importance given to certain coordination mechanism may vary depending on the type of industry, the objective of supply chain and the interface or process of supply chain. The complexity in taking all these categories is that these are lying in different domains and some of the categories are supported by subjective judgments like behavioral aspects (trust, commitments, and cooperation) in coordination initiatives. These judgments may be vague in nature and difficult to quantify (Arshinder et al., 2007). Fuzzy logic is flexible enough to take imprecise and vague data and can be used to quantify these data. The multiple attribute decision making property of fuzzy logic has motivated to propose a framework for coordination mechanism in Indian SCC.

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6. PROPOSED FRAMEWORK FOR INDIAN SCM

Studies reveals that in Indian SC the most deciding factor in addition to the coordination mechanisms such as SC contracts, Information Technology, Information sharing and joint decision making, there can be two more coordination mechanisms namely logistics and time. The new framework thus has two more variables in addition to the above mentioned four mechanisms. Thus the proposed framework considers the following coordination mechanisms

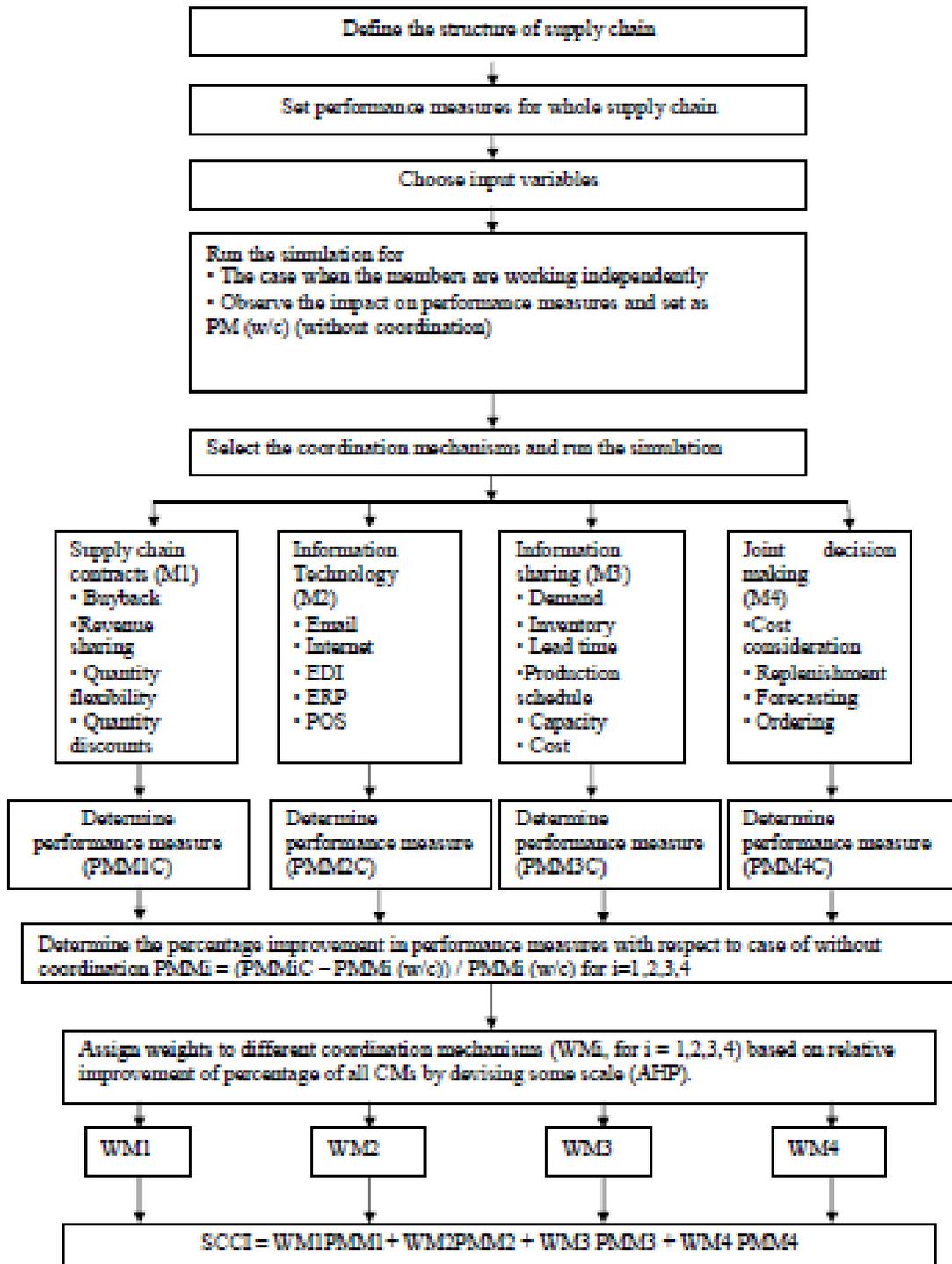
- SC contracts (M1)
- Information technology (M2)
- Information sharing (M3)
- Joint decision making (M4)
- Logistics (M5)
- Time (M6)

The coordination index SCCI for these six mechanisms can be represented as

$$SCCI = f (M1, M2, M3, M4, M5, M6)$$

In this framework logistic sharing and time coordination is also considered as decision variables and these are to be quantified using fuzzy logic.

Existing framework for SC Coordination by Arshinder et al., 2008



6. CONCLUSION

SCC can be used to improve the performance of the system by means of coordination mechanism. SCC can be achieved by coordinating different SC members that have more weight age in the chain. This can be effectively done by first identifying the interdependent activities between SC members. These interdependent activities are to be evaluated as independent decision variables. Next the simulation can be done with and without CM and the two scenarios can be compared. However different models in SCC are also available such as ISM-based models etc. The proposed framework is more flexible and can be used for evaluating coordination index using suitable fuzzy logic.

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