Integrated Supply Chain Management

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Abstract-The field of Integrated Supply Chain Management (SCM) has developed in the last few years for bridging the gap between demand and supply efficiency and cost trade-offs. The SCM now not only involves the “management of logistic function”, as was done in the past but, includes the management and co-ordination of activities: both upstream and downstream linkage(s) in the supply chain. The last two decade has seen the rise of a plethora of acronyms always used in conjunction with production, operational management and control. To name a few JIT (Just-In-Time); TQM (Total-Quality-Management); ZI (Zero-Inventory); ECR (Efficient Consumer Response); VMI (Vendor Managed Inventory). All these have now been integrated within the domain of Supply Chain Management Process.

The present paper explores the following issues:

- The need for supply chain management.
- Supply Demand Nexus
- Framework of the supply chain management model(s).
- Quantitative methods and supply chain management (SCM).

I. The need for Supply Chain Management

Supply Chain Management (SCM) can be best described as the natural extension of the downsizing and re-engineering performed by the organization(s) in the past. These operations involved the optimization of business units over which the organizations had full control. These strategies did lead to increased productivity and profitability of the organizations but as the benefits of these levelled off, it was realized that the approach to the way organizations work needed to be changed. Strategic alliances with other organizations were required for the growth of these organizations. A common basis that is required for the formation of these alliances is supplied by the participation of the organizations in the demand supply chain.

II. Supply-Demand Nexus

To have an effective supply chain management framework, organizations must have a clear understanding of the supply - demand nexus and its implications for strategy and implementation. There is an interdependent relationship between supply and demand; organizations need to understand customer demand so that they can manage it, create future demand and meet the level of desired customer satisfaction. The wide gap between the supply and demand sides of an organization can only be bridged by developing a holistic strategic framework that integrates demand effectiveness with supply efficiency. Such a framework provides a strategic anchor to prevent the supply and demand components of a business from drifting apart.

The basis of such a holistic strategy framework is the integrated supply and demand model. The model is designed around two key principles. First, in the present scenario where vertically integrated supply chains (VISC) are a rarity, organizations must bring a multi-enterprise view to their supply chains. They must be capable of working co-operatively with other organizations in the chain rather than seeking to outdo them. Secondly, they must recognize the distinct supply and demand processes that must be integrated in order to gain the greatest value.

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A. Three Key Elements

1) The core process of the supply and demand chains: To gain the maximum benefits, organizations need to identify the core processes across the demand and supply chain, as well as exploring the impact of each of these processes on the different functions.

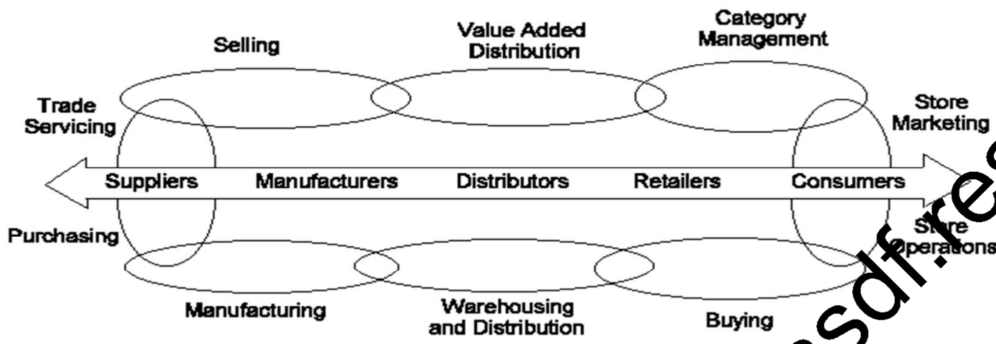

Fig -1: The Integrated Demand-Supply Model

2) The integrating processes that create the links between the supply and demand chains: This implies that the planning processes and service processes must be integrated. This integration must be done across the boundaries of the enterprises. If each participating organization in the chain formulates its own plans on the basis of its own private information, then there is no way to integrate the supply and demand chain processes that they share.

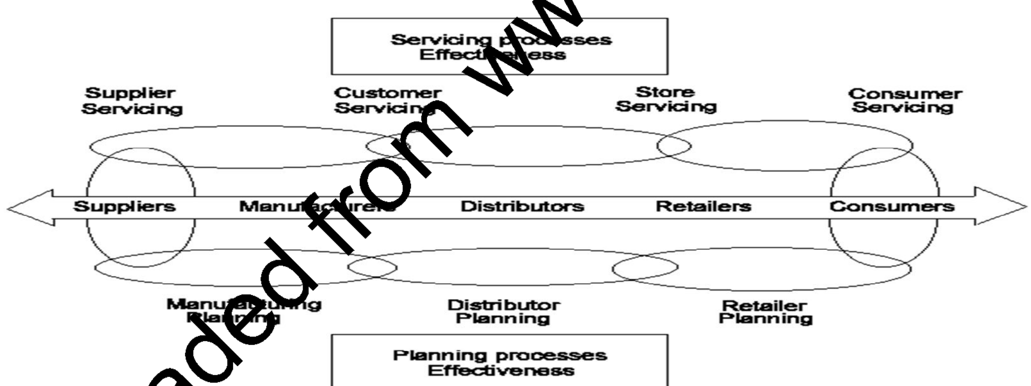

Fig -2: Integrating processes in the supply and demand chains

Source: This model is based on the work done by Jeff Beech [1]

3) The supporting information technology (IT) infrastructure that makes such integration possible: Information technology provides an integrating tools that makes it possible to convert data into meaningful pictures of business processes, markets and consumers that are needed to feed company strategies in order to develop competitive advantage.

III. SCM Framework

A. Four Levels of the Pyramid

A framework to understand the various issues involved in SCM is provided by the pyramid structure for the SCM paradigm (fig. 3) the pyramid allows issues to be analyzed on four levels:

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1) Strategic: The strategic level is customer oriented and deals entirely with customer service and satisfaction.
2) Structural: After the strategic issues are dealt with, the next level handles the different channels/modes of marketing and designs the network required for the same.
3) Functional: This is the level where operational details such as optimal operating practices for transportation management, warehouse operations, and materials management are designated.
4) Implementation: Without successful implementation, the development of SCM strategies and plans is meaningless. Of particular importance are the organizational and information systems issues.

It is important to note that the decisions made within the SCM strategy pyramid are interdependent.

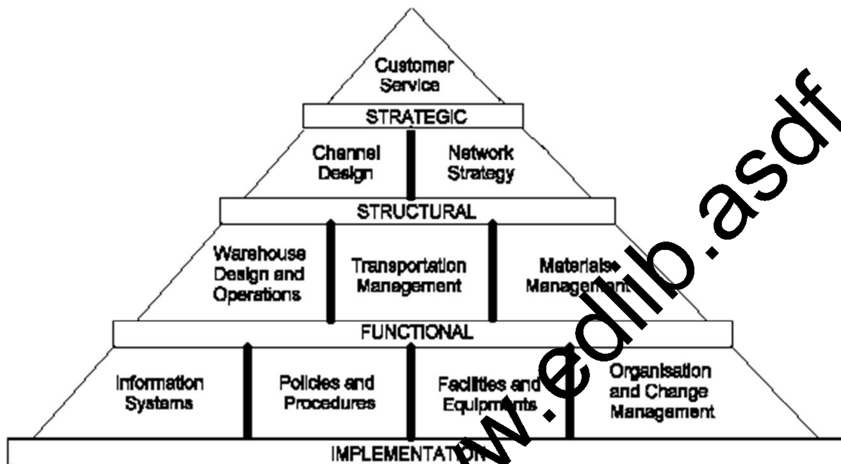

Fig -3: SCM Framework Pyramid

Source: Based on work done by William C. Copacino[2]

B. Factors that Influence Type and Structure of Supply Chain

1) Geographical: If the supply chain is stretched across the globe then it can lead to uncertain transportation schedules, unpredictable lead time and may need larger inventory carriage.
2) Cultural: The difference in the “culture” of the participants in the chain (the difference can be due to geographical factors or corporate practices) can lead to friction and distrust.
3) Government Legislation: The laws of the country may prohibit the sharing of information about some facet of the supply chain and thus, may lead to a restrictive participation by one or more participant in the supply chain.
4) Time: The first phase in any relationship is manifest as confrontation and the last phase is exemplified by total trust and working together of organizations. In between the two phases lies a continuum of phases.

IV. Quantitative Methods and SCM

‘SCM’ requires extensive decision support tools for the effective monitoring, control and management of the supply chain (that is tools for channel design, transportation and distribution planning, inventory control etc.) Various analytical and quantitative methods form the core of these decision support system(s). The quantitative models used in SCM are in general large linear programming models. By default all real life problems are Multiple Criteria Decision Making (MCDM) problems.

The MCDM solution methodologies address the multiple objective programming problems, viz

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$$\max \{ f_i((\mathbf{x}) = z_i \},\ 1 \le i \le k \qquad (1)$$
$$\text{such that } \mathbf{x} \in S.$$

Where k (> 1) the number of criterion to be optimized, z's are the criterion functions and S is the constraint set. Without the knowledge of the decision maker's utility function, the methods search the "space of trade-offs" among the criterion to arrive at a Pareto optimal solution to the problem using only the implicit information present [3,4,5,6,7]. MCDM has two distinct halves. One half is multiple-attribute decision analysis and the other half is multiple-objective mathematical programming. Multiple-attribute decision analysis is most often applicable to problems with a small number of alternatives in an environment of uncertainty. Multiple-objective mathematical programming is most often applied to deterministic problems in which the number of feasible alternatives is large. Other techniques that can be used are : **a)** Neural network[8,9,10] based techniques for the evaluation of alternatives in conjunction with MCDM solution **b)** using neural networks for demand forecasting and **c)** the use of fuzzy-neural network or genetic algorithms based[11] methods to incorporate uncertainty in the decision making process. These models can be incorporated in the (standard two-layered) architecture [6] for the development of interactive decision support system(s). Where the database refers to a repository of relevant data for the solution of the problem and the modelbase refers to the database of relevant analytical, fuzzy, neural network or genetic algorithm based models parameters that the user can choose from to solve the problem. It's the opinion of many that interactive methodologies are the best for the solution of multiple criteria decision problems.

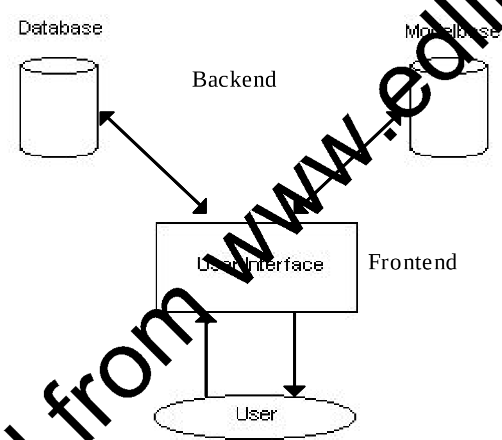

Fig-4: Architecture for a DSS

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