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A Review Material planning and control Purchasing Receiving Supply chain management System

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ABSTRACT: A supply channel is composed of three structures. At one end of the channel is the manufacturer. The manufacturer focuses on the development and production of products and originates the distribution process. The terminal point in the channel is the retailer who sells goods and services directly to the customer for their personal, non-business use. In between the two lies a process called distribution, which is more difficult to define. One involved in the distribution process is labeled a distributor. The describes a distributor as a business that does not manufacture its own products but purchases and resells these products. Such a business usually maintains a finished goods inventory the proliferation of alternative distribution forms, such as warehouse clubs, catalog sales, marketing channel specialists, and mail order, have blurred functional distinctions and increased the difficulty of defining both the distribution process and the term distributor. One ultimately could maintain that distributors include all enterprises that sell products to retailers and other merchants and to industrial, institutional, and commercial users but do not sell in significant amounts to the ultimate customer. According to this definition, most companies that are involved with the disbursement of raw materials and finished products belong, in one sense or another, to the distribution industry.

Keywords: Supply chain, Shipping, Transportation

INTRODUCTION

Supply chain the adopting this definition, distribution is expanded to cover nearly every form of materials management and physical distribution activity performed by channel constituents, [1] except for the processes of manufacturing and retailing. Distribution involves a number of activities centered around a physical flow of goods and information. At one time the term distribution applied only to the outbound side of supply chain management, but it now includes both inbound and outbound. Management of the inbound flow involves these elements:
Material planning and control- Purchasing, Receiving, Physical management of materials via warehousing and storage, Materials handling,
Management of the outbound flow involves these elements: Order processing, Warehousing and storage, Finished goods management, Material handling and packaging, Shipping, Transportation
Distribution channels are formed to solve three critical distribution problems: functional performance, reduced complexity, and specialization.
The central focus of distribution is to increase the efficiency of time, place, and delivery utility. When demand and product availability are immediate, [2] the producer can perform the exchange and delivery functions itself. However, as the number of producers grows and the geographical dispersion of the customer base expands, the need for both internal and external intermediaries who can facilitate the flow of products, services, and information via a distribution process increases. Distribution management also can decrease overall channel complexity through sorting and assistance in routinization.

Sorting is the group of activities associated with transforming products acquired from manufacturers into the assortments and quantities demanded in the marketplace. Routinization refers to the policies and procedures providing common goals, [3] channel arrangements, expectations, and mechanisms to facilitate efficient transactions. describes sorting as including four primary functions:

(i) Sorting is the function of physically separating a heterogeneous group of items into homogeneous subgroups. This includes grading and grouping individual items into an inventory lot by quality or eliminating defects from the lot.

(ii) Accumulating is the function of combining homogeneous stocks of products into larger groups of supply.

(iii) Allocation is the function of breaking down large lots of products into smaller salable units.

(iv) Assorting is the function of mixing similar or functionally related items into assortments to meet customer demand. For example, putting items into kit form.

As the supply chain grows more complex, costs and inefficiencies multiply in the channel. In response, [3] some channels add or contain partners that specialize in one or more of the elements of distribution, such as exchange or warehousing. Specialization then improves the channel by increasing the velocity of goods and value-added services and reducing costs associated with selling, transportation, carrying inventory, warehousing, order processing, and credit.

III. ROLE OF THE DISTRIBUTION FUNCTION

There are a number of critical functions performed by the channel distributor. Ross describes these functions as:

(i) **Product acquisition**. This means acquiring products in a finished or semi-finished state from either a manufacturer or through another distributor that is higher up in the supply channel. These functions can be performed by independent channel intermediaries or by the distribution facilities of manufacturing companies.

(ii) **Product movement.** This implies significant effort spent on product movement up or down the supply channel.

(iii) **Product transaction.** Distributors can be characterized as selling products in bulk quantities solely for the purpose of resale or business use. Downstream businesses will then sell these products to other distributors or retailers who will sell them directly to the end customer, or to manufacturers who will consume the material/components in their own production processes.

Following are the separate elements contained within the three critical functions of distribution:

(a) Selling and promoting. This function is very important to manufacturers. One strategy involves the use of distribution channels to carry out the responsibilities of product deployment. In addition to being marketing experts in their industry, distribution firms usually have direct-selling organizations and a detailed knowledge of their customers and their expectations. The manufacturer utilizing this distributor can then tap into these resources. Also, because of the scale of the distributing firm's operations and its specialized skill in channel management, it can significantly improve the time, place, and possession utilities by housing inventory closer to the market. [4] These advantages mean that the manufacturer can reach many small, distant customers at a relatively low cost, thus allowing the manufacturer to focus its expenditures on product development and its core production processes.

(b) Buying and building product assortments. This is an extremely important function for retailers. Most retailers prefer to deal with few suppliers providing a wide assortment of products that fit their merchandizing strategy rather than many with limited product lines. This, of course, saves on purchasing, transportation, and merchandizing costs. Distribution firms have the ability to bring together related products from multiple manufacturers and assemble the right combination of these products in quantities that meet the retailer's requirements in a cost-efficient manner.

(c) Bulk breaking. This is one of the fundamental functions of distribution. Manufacturers normally produce large quantities of a limited number of products. However, retailers normally require smaller quantities of multiple products. When the distribution function handles this requirement it keeps the manufacturer from having to break bulk and repackage its product to fit individual requirements. techniques are continuously seeking ways to reduce lot sizes, so this function enhances that goal.

(d) Value-added processing. [9] Postponement specifies that products should be kept at the highest possible level in the pipeline in large, generic quantities that can be customized into their final form as close as possible to the actual final sale. The distributor can facilitate this process by performing sorting, labeling, blending, kitting, packaging, and light final assembly at one or more points within the supply channel. This significantly reduces end-product obsolescence and minimizes the risk inherent with carrying finished goods inventory.

(e) Transportation. The movement of goods from the manufacturer to the retailer is a critical function of distribution. Delivery encompasses those activities that are necessary to ensure that the right product is available to the customer at the right time and right place. This frequently means that a structure of central, branch, and field warehouses, geographically situated in the appropriate locations, are needed to achieve optimum customer service. Transportation's goal is to ensure that goods are positioned properly in the channel in a quick, cost-effective, and consistent manner.

(f) Warehousing. Warehousing exists to provide access to sufficient stock in order to satisfy anticipated customer requirements, and to act as a buffer against supply and demand uncertainties. Since demand is often located far from the source (manufacturer), warehousing can provide a wide range of marketplaces that manufacturers, functioning independently, could not penetrate.

(g) Marketing information. The distribution channel also can provide information regarding product, marketplace issues, and competitors' activities in a relatively short time.

IV. SUPPLY CHAIN MODELING APPROACHES

Clearly, each of the above two levels of decisions require a different perspective. The strategic decisions are, for the most part, global or "all encompassing" in that they try to integrate various aspects of the supply chain. Consequently, the models that describe these decisions are huge, and require a considerable amount of data. Often due to the enormity of data requirements, [5] and the broad scope of decisions, these models provide approximate solutions to the decisions they describe. The operational decisions, meanwhile, address the day to day operation of the supply chain. Therefore the models that describe them are often very specific in nature. Due to their narrow perspective, these models often consider great detail and provide very good, if not optimal, solutions to the operational decisions. To facilitate a concise review of the literature, and at the same time attempting to accommodate the above polarity in modeling, we divide the modeling approaches into three areas Network Design, ``Rough Cut" methods, and simulation based methods. The network design methods, for the most part, provide normative models for the more strategic decisions. These models typically cover the four major decision areas described earlier, and focus more on the design aspect of the supply chain; the establishment of the network and the associated flows on them. "Rough cut" methods, on the other hand, give guiding policies for the operational decisions. These models typically assume a "single site" (i.e., ignore the network) and add supply chain characteristics to it, such as explicitly considering the site's relation to the others in the network. Simulation methods is a method by which a comprehensive supply chain model can be analyzed, [6] considering both strategic and operational elements. However, as with all simulation models, one can only evaluate the effectiveness of a pre-specified policy rather than develop new ones.

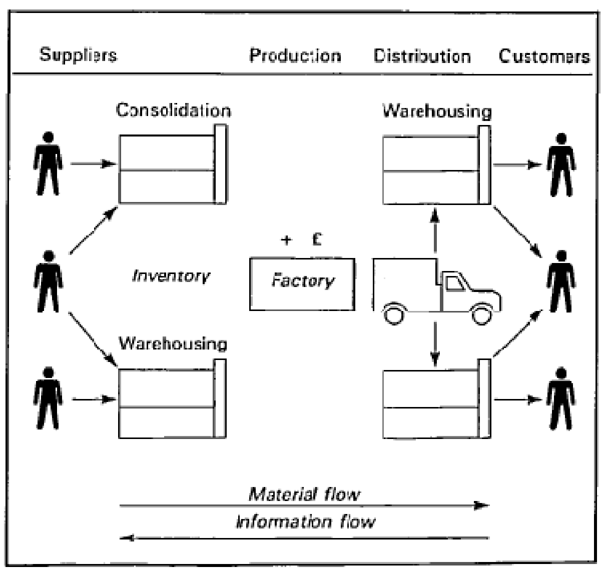

Fig. 1. Supply Chain Scope.

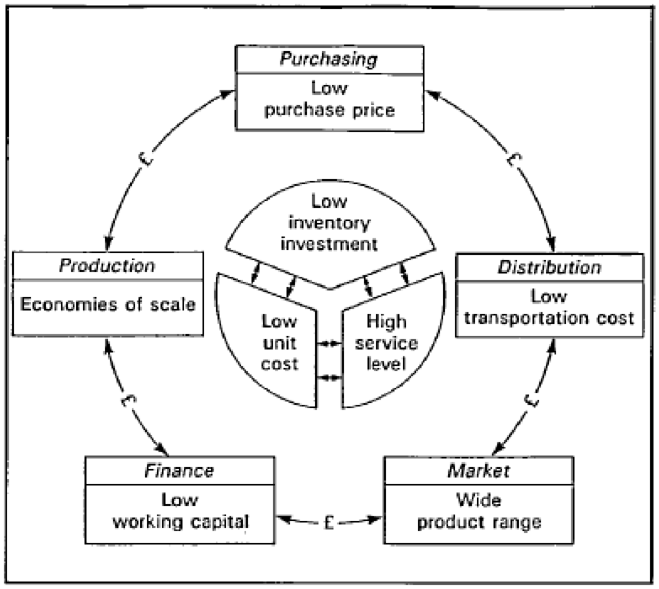

Fig. 2. Balanced Supply Chain.

V. NETWORK DESIGN METHODS

As the very name suggests, these methods determine the location of production, stocking, and sourcing facilities, and paths the product(s) take through them. Such methods tend to be large scale, and used generally at the inception of the supply chain. The earliest work in this area, although the term "supply chain" was not in vogue, was by Geoffrion and Graves [1974]. They introduce a multicommodity logistics network design model for optimizing annualized finished product flows from plants to the DC's to the final customers. Geoffrion and Powers [1993] later give a review of the evolution of distribution strategies over the past twenty years, describing how the descendants of the above model can accommodate more echelons and cross commodity detail.

Breitman and Lucas [1987] attempt to provide a framework for a comprehensive model of a production-distribution system, "PLANETS", that is used to decide what products to produce, where and how to produce it, which markets to pursue and what resources to use. Parts of this ambitious project were successfully implemented at General Motors. [7] Cohen and Lee [1985] develop a conceptual framework for manufacturing strategy analysis, where they describe a series of stochastic sub- models, that considers annualized product flows from raw material vendors via intermediate plants and distribution echelons to the final customers. They use heuristic methods to link and optimize these sub- models. They later give an integrated and readable exposition of their models and methods in Cohen and Lee [1988].

Cohen and Lee [1989] present a normative model for resource deployment in a global manufacturing and distribution network. Global after-tax profit (profit-local taxes) is maximized through the design of facility network and control of material flows within the network. The cost structure consists of variable and fixed costs for material procurement, production, distribution and transportation. They validate the model by applying it to analyze the global manufacturing strategies of a personal computer manufacturer. Finally, Arntzen, Brown, Harrison, and Trafton [1995] provide the most comprehensive deterministic model for supply chain management. The objective function minimizes a combination of cost and time elements. Examples of cost elements include purchasing, manufacturing, pipeline inventory, transportation costs between various sites, duties, and taxes. Time elements include manufacturing lead times and transit times. Unique to this model was the explicit consideration of duty and their recovery as the product flowed through different countries. Implementation of this model at the Digital Equipment Corporation has produced spectacular results savings in the order of $100 million dollars. Clearly, these network-design based methods add value to the firm in that they lay down the manufacturing and distribution strategies far into the future. It is imperative that firms at one time or another make such integrated decisions, encompassing production, location, inventory, and transportation, and such models are therefore indispensable.

Although the above review shows considerable potential for these models as strategic determinants in the future, they are not without their shortcomings. Their very nature forces these problems to be of a very large scale. They are often difficult to solve to optimality. Furthermore, most of the models in this category are largely deterministic and static in nature. Additionally, those that consider stochastic elements are very restrictive in nature. In sum, there does not seem to yet be a comprehensive model that is representative of the true nature of material flows in the supply chain.

VI. ROUGH CUT METHODS

These models form the bulk of the supply chain literature, and typically deal with the more operational or tactical decisions. Most of the integrative research (from a supply chain context) in the literature seem to take on an inventory management perspective. In fact, the term "Supply Chain" first appears in the literature as an inventory management approach. The thrust of the rough cut models is the development of inventory control policies, considering several levels or echelons together. These models have come to be known as "multi-level" or "multi-echelon" inventory control models. For a review the reader is directed to [8] Vollman *et al.* [1992]. Multi-echelon inventory theory has been very successfully used in industry. Cohen et al. [1990] describe "OPTIMIZER", one of the most complex models to date --- to manage IBM's spare parts inventory. They develop efficient algorithms and sophisticated data structures to achieve large scale systems integration. Although current research in multi-echelon based supply chain inventory problems shows considerable promise in reducing inventories with increased customer service, the studies have several notable limitations. First, these studies largely ignore the production side of the supply chain. Their starting point in most cases is a finished goods stockpile, and policies are given to manage these effectively. Since production is a natural part of the supply chain, there seems to be a need with models that include the production component in them. Second, even on the distribution side, almost all published research assumes an arborescence structure, i. e. each site receives re-supply from only one higher level site but can distribute to several lower levels. Third, researchers have largely focused on the inventory system only. In logistics-system theory, transportation and inventory are primary components of the order fulfillment process in terms of cost and service levels. Therefore, companies must consider important interrelationships among transportation, inventory and customer service in determining their policies. Fourth, most of the models under the "inventory theoretic" paradigm are very restrictive in nature, i.e., mostly they restrict themselves to certain well known forms of demand or lead time or both, often quite contrary to what is observed.

VI. CONCLUSION

It is known that decentralized planning results in loss of efficiency with respect to centralized planning. It is, however, difficult to quantify the difference between the two approaches within the context of production planning. We investigated this issue in the setting of a two plant series production system. In particular, we explored a “locally optimized” production planning procedure where the downstream plant optimizes its production plan and the upstream plant follows his requests (while optimizing its costs). Then we compared this locally optimized (and decentralized) approach with global optimization where a single decision maker plans the production quantities of the supply chain in order to minimize total costs. Using a combination of analytical and numerical results, we characterized system structures which lead to small (or large) efficiency loss. Future research could focus on development of efficient profit distribution in case of global optimization. Another interesting extension would be the analysis of an assembly system and the exploration of similarities with the model presented in this work. In this paper we have assumed that the demand as well as the processing times are deterministic. Although this assumption is true in many practical situations, it would be interesting to model systems with random processing times and random demand. This problem is subject of ongoing research.

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