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Manufacturing networks and supply chains: an operations strategy perspective

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Abstract

The purpose of this paper is to analyze manufacturing networks and supply chains from an operations strategy perspective. These two areas have traditionally been treated as separate research tracks, but with the ongoing globalization of markets and operations there is a need to integrate these complementary disciplines to study networks of facilities. In this paper we examine the two research areas based on two structural decision categories in an operations strategy, viz. facilities and vertical integration. We present a typology for the analysis of network systems resulting in four basic network configurations. Coordination of activities within the network is contingent upon the configuration, thus resulting in four coordination approaches. The configuration and coordination analyzes can be used as a foundation for further research in the context of integrating manufacturing network and supply chain theory.

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1. Introduction

The fact that business today is international is indisputable. During the last decade there has been an explosive increase in both international trade and foreign direct investment, and many markets are now truly global. The role of manufacturing companies has changed from supplying domestic markets with products, via supplying international markets through export, to supply international markets through local manufacturing. Hence, the research on international issues in manufacturing has evolved from global sales and marketing into global manufacturing. Except from making competition even fiercer, the trend of globalization has changed the ways of providing customers with products and therefore also the objects that are analyzed, be it the company, the manufacturing network, or the supply chain.

As a result of globalization, the vast majority of manufacturing in large companies is carried out in value networks. We regard a value network as a network of facilities, possibly owned by different organizations, where time, place or shape utility is added to a good in various stages such that the value for the ultimate customer is increased. However, the manufacturing related activities and issues in the network are viewed from different angles. This can be exemplified by two major research tracks—*manufacturing network* research and *supply chain* research—both focusing on the value network, but using different approaches. Manufacturing networks theory stems from the operations management field whereas the logistics management perspective dominates supply chain theory. The aim of this paper is to analyze how the structure of value networks is treated in the two research tracks respectively.

The history of each track affects how the network is viewed upon and which activities that are analyzed. Research on manufacturing networks has its roots in the manufacturing management of the single factory, resulting in

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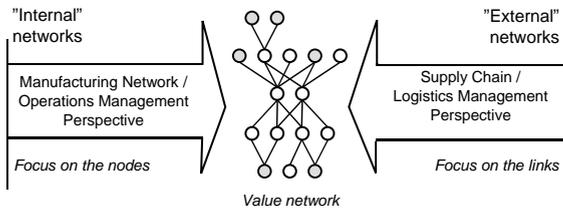


Fig. 1. Different points of view on the value network.

that scholars tend to study the network as a wholly owned and internal network where all facilities are under full financial control. Conversely, research on supply chains from a logistics perspective tends to analyze the network as an external network with facilities owned by different organizations. Logistics research furthermore sets out from its roots in physical distribution and materials management and focus on the links between the nodes (and to some extent distribution nodes), whereas manufacturing network research tend to focus on the (manufacturing) nodes themselves. These different points of view are visualized in Fig. 1.

Companies operating on a worldwide basis with dispersed value networks have realized that it is not enough to just master the manufacturing and logistics activities in isolation, but rather that they must integrate the two. Hence, there is a value in merging the knowledge from the two research tracks. This paper sets out to analyze manufacturing networks and supply chains to establish a foundation that can be used to integrate parts of the two research areas. The following two sections briefly describe how the two research tracks have evolved from the 1960s up to the present. Thereafter we devote one section to the operations strategy perspective, which is the perspective we use as means for our analysis, focusing on two so-called decision categories; facilities and vertical integration. Manufacturing network and supply chain theory are then compared from an operations strategy perspective. Finally, we show how the two research tracks complement each other by introducing a typology for configuration of and coordination in a value network. We also provide management implications of the typology, some concluding remarks, and ideas for future research.

2. Manufacturing networks from an operations management perspective

The research on manufacturing networks has its origin in the operations management of the single facility. The practice of operations management as a discipline with strategic implications started with the Skinner [1] paper, discussing how to configure and organize manufacturing operations within the well-defined factory entity. The research on operations management during the 1970s followed in Skinner's footsteps and was dominated by issues such as "the focused factory" and "economies of scale". With the increasing trend

of globalization of markets, the idea of scale economies prevailed and products were manufactured at the home market and exported to international customers. If business was good, sales offices were normally established around the world.

During the late 1970s and the early 1980s more scholars noticed the need to manage not only the single factory, but also multi-plant organizations. However, the literature review in Shi and Gregory [2] shows that the research during this period mainly was concerned with location-based criteria. When the multi-plant structure was set, each factory was basically treated as a separate single facility and networking issues were ignored (see e.g. [3]). Furthermore, even though markets had become global, manufacturing was still fairly geographically concentrated, which also explains why most operations management research still could focus on the single factory and not on the network.

Nevertheless, during the late 1980s and 1990s it was impossible for manufacturing to withstand the trend of globalization, and companies established more and more factories on a wider international basis. Research on operations management was extended from multi-plant to network issues. Shi and Gregory [2] view a manufacturing network as a factory network with matrix connections, where each node (i.e. factory) affects the other nodes and hence cannot be managed in isolation. Khurana and Talbot [4] emphasize that each factory both influence, and is influenced by, the entire manufacturing network.

Concerning research on manufacturing networks, it is possible to identify two dominating areas—research on configuration issues and research on coordination issues. The former has its origins in the multi-plant research, and location-based criteria (in various sorts) dominate (see e.g. [5,6]). The latter is mainly concerned with technology transfer and diffusion, as well as within-network learning (see e.g. [7,8]). However, in some instances attempts have been made to integrate the two issues to get an overall view of the manufacturing network (see e.g. [2,9,10]).

It is noteworthy that although research on operations management has been extended to govern manufacturing networks, almost no attention is paid to the physical distribution to and from the manufacturing facilities, or on warehousing. Skinner [11] argues that manufacturing today comprise "the value chain of product realization", including R&D, procurement, production, distribution, customer service, and warranty repairs. However, in spite of Skinner's broad definition of manufacturing, most manufacturing network researchers ignore the supply chain management issues that are so important for the total effectiveness of a network organization (see e.g. the demarcations in [2]).

3. Supply chains from a logistics management perspective

The research on supply chains has its origin in logistics management. The practice of logistics as a formal business

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