Research on Logistics Capability of Service-oriented Manufacturing

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Abstract

In this paper, we take service manufacturing as the research background to study the logistics capability. The paper first points out that the servitization of manufacturing means the integration of manufacturing and service, including the servitization of manufacturing process and manufacturing products. Then the supply chain under service-oriented manufacturing is analyzed, and four characteristics of service-oriented manufacturing are given. Finally, the logistics capability is analyzed comprehensively, and the logistics capability includes the macro logistics capability, the logistics service ability and the logistics elements ability.

Keywords

Service-oriented manufacturing, logistics capability.

1. Introduction

The acceleration of the process of economic globalization has led to the worldwide expansion of manufacturing regions and services. Many traditional manufacturing companies have shifted their own non-core business to third-party logistics enterprises. In the region a specialized Logistics Park has been formed gradually. To maintain strong competitiveness, they focus on service-oriented manufacturing. For example, Toyota takes the OEM as the center in Japan, attracting logistics service providers gathered in the surrounding areas. Then a clustering effect of the logistics park model is formed. In Australia, Toyota arranges a network of automotive spare parts logistics parks. By providing professional parts logistics services, they occupy the absolute aftermarket. The servitization of manufacturing has become a new trend in the world. The intrinsic value chain has been extended to the upstream and downstream services.

Service-oriented manufacturing is a highly efficient and innovative manufacturing model. It is based on customer demand management, through the integration of products and services, customer participation and service production (such as manufacturing services outsourcing), to achieve decentralized manufacturing resources integration and their core competitiveness synergy [1, 2]. Greenfield put forward the Producer Services in 1966. The real meaning of the discussion originated in the early 1990s, when the academic community put forward the concept of service-oriented manufacturing and service embedded manufacturing [3]. At that time, the service-oriented manufacturing mainly focused on the traditional inventory management and flexible production stage. Service-oriented manufacturing was a revolutionary transformation of the traditional supply chain system. The successful large-scale manufacturing enterprises had integrated their manufacturing capabilities and services, which distributed around the world and led to the formation of global integration [4]. From the performance point of view, service-oriented manufacturing is the integration of services and manufacturing industry, the penetration from service industry to the manufacturing industry and the expansion from the manufacturing industry to service industry [5]. From the internal mechanism, it represents a new economic model, which changes the needs from the product to the customers and intermediate production services, driven by the new production environment and consumer culture of the informatization network [6, 7]. It includes logistics, value stream, service flow, capital flow and information flow.

The research on logistics services and real manufacturing integration focuses on the conceptual model. Pieter Van Donk, Mortensen and Lemoine constructed the framework model of manufacturer

and the third party logistics service provider integration [8]. They also studied the main business processes in cooperation. Some scholars had further proposed three element conceptual model based on profit-satisfaction-customer loyalty for manufacturers and service providers [9]. Other scholars thought there is a strong correlation between the third party logistics service providers and automobile manufacturers, and logistics service performance plays an important role in the establishment of industrial brands [10]. These studies have laid an important theoretical foundation for the application of logistics services in the manufacturing industry.

2. The Servitization of Manufacturing Industry

The integration of manufacturing and service has become an obvious trend. Service-oriented manufacturing reflects the dynamic process of the enterprise from the manufacturing center to the service center. From the perspective of value chain, the former value added is mostly produced in the manufacturing process, and now the value added mainly comes from the research and development design, solution and so on, which can be created by advanced services. The servitization of the manufacturing industry includes the servitization of the manufacturing process and the manufactured products [11]. The conceptual model is illustrated in Fig. 1.

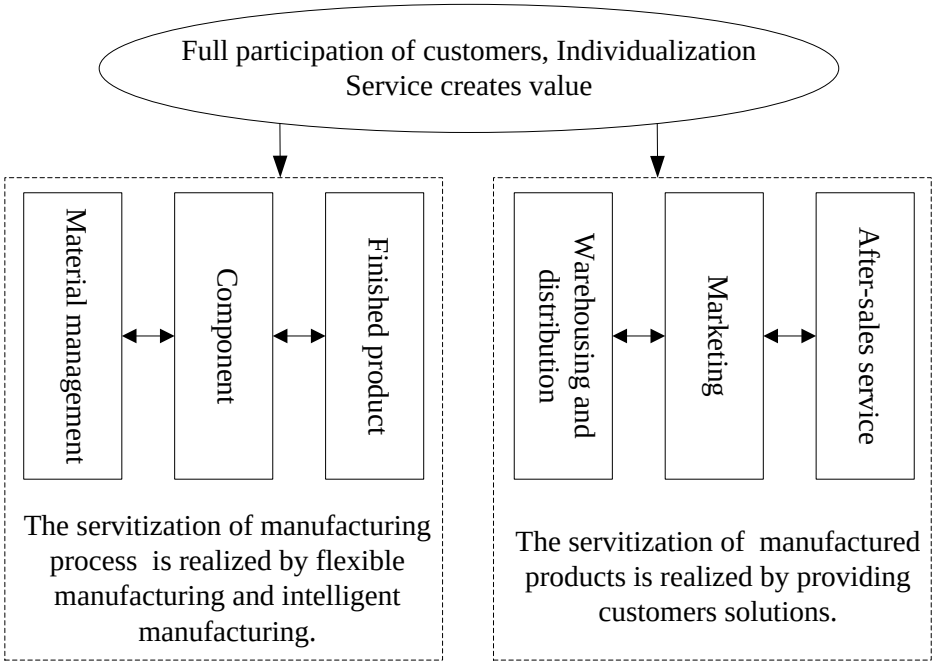

Fig. 1 The conceptual model

2.1 The Servitization of Manufacturing Process

The servitization of the manufacturing process refers to the increase of the productive service elements needed in the manufacturing process, which becomes the key source of the enterprise's competitiveness. With the manufacturing value chain continues to expand and extend, the added value rate of the manufacturing process is getting lower, the rate of the specialized production services like R&D design, product marketing, logistics and distribution is getting higher. Service-oriented manufacturing is a new model. In order to strengthen the market competitive advantage, enterprises make the service sector into the product life cycle, through the promotion of product and service integration. They establish a manufacturing system that provides life-cycle activities, and achieve an efficient, intelligent and innovative manufacturing mode. The servitization of manufacturing process mainly occurs in the value chain support link, as well as supply chain management, marketing and other basic value chain links. The development of flexible manufacturing, network co-manufacturing, intelligent manufacturing and other innovative production mode bring more choices to the enterprise value chain length and business scope. Manufacturing enterprises can use the integration or market-oriented way to achieve the promotion of internal production services efficiency. The service of manufacturing products is based on the

"internal service function" or "independent service market", which depends on the service level of the manufacturing industry itself and the market capacity of the professional service demand.

2.2 The Servitization of Manufactured Products

The servitization of manufacturing products refers to the enterprise to take the existing products as a platform, to establish a wide range of "product + service" combination, to provide customers with product-related value-added services, such as product online monitoring, system solutions based on product, and total integration and general contracting services. Manufacturing companies not only sell products to customers, but also provide services attached to the physical products, and the latter in the proportion of all product value of manufacturing enterprises is increasing day by day.

The servitization of manufacturing products mainly occurs after the products are produced, as well as after-sales links, around the physical products to enhance the value of additional services. "Product + service" system is to meet the individual needs of customers, improve their competitiveness and provide a system product and service closely integrated. The servitization of manufacturing products mainly includes three levels: primary, intermediate and advanced services, which correspond to different service contents, such as product function, product value-added, integration scheme and so on. With the deepening of the service degree of manufacturing enterprises, manufacturing enterprises is changing the production and sales of products to provide customers with product-related services, customer support services, comprehensive services, etc., and then provide customers with solutions.

3. The Characteristics of Service-oriented Manufacturing

3.1 Supply Chain Analysis Under Service-oriented Manufacturing

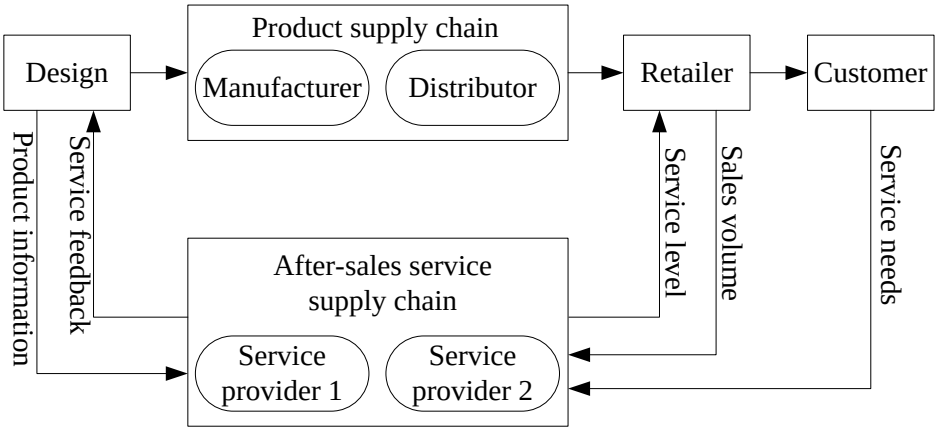

Fig.2 Hybrid supply chain coordination

Due to the particularity of hybrid supply chain structure, the mechanism of information sharing is different from the traditional manufacturing or service supply chain.The information sharing in the hybrid supply chain may be bothway information sharing between the upstream and downstream [12]. A hybrid supply chain consisting of design-production-sales and after-sales services is described in the Fig.2. As the customers have bought the products, they will need a repair service after a period of time, but the number of orders for maintenance services is determined by the number of sales of products. Therefore, the demand information sharing of sales products will help the ability management of after-sales service. At the same time, the level of after-sales service also affects the products sales. The overlong service waiting time will lead to poor reputation, then resulting in a drop in demand. Therefore, the information sharing of the after-sales service level will also help the inventory management of product sales link.

3.2 The Characteristics of Service-oriented Manufacturing

The main purpose of service-oriented manufacturing is through the full participation of customers, manufacturing enterprises gradually extended to the service area, to provide customers with their personalized needs of products (products + services). Its value chain is extended. Knowledge, manpower and industry are important parts of service-oriented manufacturing. The three mutually

influence and promote each other so that the service-oriented manufacturing gets rid of the traditional low-tech, low value-added and other shortcomings. It has some new features. As follows:

(1) The core of service-oriented manufacturing is no longer the product, but the service and all-around solutions.

(2) Service-oriented manufacturing's operation mode which is customer-centric had replaced the traditional product-centric manufacturing mode. The former emphasizes awareness of the customer, operator and knowledge integration. It is useful to the effective mining of customer needs in the service manufacturing chain and the realization of personalized production and service.

(3)The service area of service-oriented manufacturing is gradually expanding. It is concerned about the value perception among the customer, service enterprises and manufacturing enterprises, rather than blindly to pursue vertical integration. If customers or enterprises can take the initiative to participate in service-oriented manufacturing activities in the network, and form the service-oriented manufacturing system of dynamic stable structure in the dynamic cooperation, it can achieve the best optimal allocation of resources.

(4) Service-oriented manufacturing requires companies to take the initiative to perceive customer needs, and actively encourage customers to participate in the entire product or service production process. According to their different requirements, it provides individual needs of products or services. Through the modular cooperation, different enterprises actively provide products and services to meet other customers' requirements. The final purpose is to achieve profit sharing.

4. Analysis of Logistics Capability

4.1 Macro Logistics Capacity Composition

4.1.1 Flexibility Ability

Flexible ability means that when facing urgent needs, such as customer's individualized demand, and facing supply chain's upstream and downstream production demands, the enterprises are still able to complete logistics operations. It is shown as the additional capacity of various logistics activities in the fluctuating supply chain environment. The ability to manage service-oriented manufacturing enterprises is different from the traditional manufacturing enterprises or service enterprises. It is necessary to manage the two types of capabilities of production and service effectively to provide the whole product service package. For example, the quality provided by the invisible services will affect the customer's overall assessment of the product. Therefore, service-oriented manufacturing has two different production characteristics of the manufacturing and service industries, which determines the service-oriented manufacturing enterprise's capacity management complexity and comprehensive.

4.1.2 Organization and Management Ability

(1) Logistics Planning Ability

Logistics planning ability refers to the ability that the enterprises utilize the existing resources to make the most reasonable logistics solution in the shortest time according to the customer's demand and the actual situation. Enterprises contrast customer's needs and existing logistics system problems then planning and reengineering the enterprise logistics system again under the service manufacturing mode. It includes both logistics strategic planning and logistics implementation planning. The logistics strategic planning is the development direction and the way long-term plan. The logistics implementation planning is the ability to plan personnel and equipment, then to ensure the reliability of each logistics link work. High level of planning ability can enhance the enterprise's competitiveness then promote industrial structure optimization.

(2) Information Management Ability

The establishment of an effective information logistics network can make the whole logistics system more closely, whether it is to the supply chain or the customer's response, it is more agile. At the same time, information management make managers more specially manage of the entire logistics network, and then make the contact of the various enterprises or departments in the logistics process more

tightness. Also, it reduces the input of information management labor costs, make customers easily understand the product logistics process in real time, strengthens the contact of enterprise so that to strengthen enterprise's logistics capacity and competitiveness.

4.1.3 Logistics Cost Ability

The logistics cost of the enterprise under the mode of service manufacturing refers to the total cost of the normal operation of the logistics. The cost of enterprise logistics under the service-oriented manufacturing model consists of three parts: one is the transportation cost, the full cost of the transportation of a certain amount of goods, such as the depreciation expense, labor cost, insurance fee, handling fee, tool maintenance costs and so on. The second is the cost of warehouse. Because of the uncertainty of the demand for materials, distribution centers need to have a certain amount of material's cost caused by loading and unloading, cargo sorting, logistics processing, cargo transport, cargo storage and other activities. Third, the management cost refers to the cost of the organization and management of logistics activities occurred in the material, labor, labor information and other aspects, including manufacturing orders processing costs, procurement costs, and office supplies and so on.

4.2 The Composition of Logistics Service Ability

4.2.1 Product Reprocessing Ability

Product reprocessing abilities include distribution processing, packaging and warehousing capabilities. Warehousing and inventory management capabilities refer to the strategic planning capacity, purchasing decision-making capacity, and the maximum turnover rate of enterprise logistics system in the service-oriented manufacturing model. It is vulnerable to be affected by the warehouse area, type and storage methods.

4.2.2 Transportation Ability

The transportation capacity mainly refers to the transportation strategic planning ability, the transportation network planning ability, the material transportation mode, the transportation plan ability, the transportation capacity between the two logistics nodes in the logistics network and the entire logistics network circulation capacity in the service manufacturing mode of enterprise's logistic service [13]. Service-oriented manufacturing model of the enterprise logistics system distribution centers are generally more than one. Distribution capacity is also an indispensable part of the distribution network in the service-oriented manufacturing model of enterprise logistics capacity. It is mainly refers to the design and planning capabilities of the distribution network, the distribution operations management and so on. And it will generally be affected by the number of distribution vehicles, type, distribution, personnel quality, line and time, loading capacity and other conditions.

4.2.3 Comprehensive Ability

The comprehensive ability is mainly reflected in the information processing, response time and order processing. Information processing is an important activity of logistics management in the service-oriented manufacturing mode, and it is an important guarantee to ensure the smooth progress of logistics activities. Information processing capability refers to the ability of collection, analysis, handling and decision making in the service manufacturing mode by logistics information platform or information system.

Response time refers to the accumulation time that enterprise spent at different stages in production and logistics under the service-oriented manufacturing model, and the rapid response to the target market, it is an accumulation time effect.

Order processing refers to the timely processing of customer's demand information by the order management department, which is one of the keys to logistics activities.

4.3 The Composition of Logistics Elements Ability

Logistics elements include tangible elements and intangible elements, which refers to the input of equipment, labor and information technology in the whole logistics system. Facilities and equipment resources refer to the hardware equipment needed for logistics activities, and information technology

resources refer to the software strength of the logistics system, followed by user evaluation, value-added products and so on.

To sum up, the logistics capability system of service oriented manufacturing based on the components of logistics capability is described in this paper, as shown in Table 1.

Table 1 Components of service oriented manufacturing logistics capability

Logistics Capability	Subdivision	Contents
Macro Logistics Capacity	Flexibility Ability	Response demand, matching of logistics activities
	Organization and Management Ability	Logistics planning ability and information management ability
	Logistics Cost Ability	Transportation cost, storage cost and management cost
Logistics Service Ability	Product Reprocessing Ability	Circulation processing, packaging, storage
	Transportation Ability	Transportation and distribution
	Comprehensive Ability	Information processing, response time, order processing
Logistics Elements Ability	Tangible Elements Ability	Equipment required for logistics and logistics operations
	Intangible Elements Ability	Value-added ability and user feedback

5. Conclusion

Service-oriented manufacturing is a new manufacturing mode and production organization mode, which can change the extensive development model of the manufacturing industry and optimize the industrial structure. Service-oriented manufacturing enterprises change their focus from the product itself to product lifecycle service. They treat customer demand as the starting point, and attract technology partners, logistics enterprises, information service providers involved in providing solutions, thus providing integrated solutions for customers. In this process, the service interface between the service-oriented manufacturing enterprise and the customer extends to each other's organization. In the service-oriented manufacturing model, the customer is no longer the passive product receiver, but the active participant, and the customer and the enterprise jointly provide a comprehensive solution. In this case, it is inevitable to release a large number of logistics demand, which poses new challenges to the traditional logistics infrastructure.

This paper analyzes the logistics capability of service-oriented manufacturing by combing the mechanism and characteristics. The logistics capability includes macro logistics capability, logistics service ability and logistics elements ability. Here, the macro logistics capability includes flexible ability, management ability and logistics cost ability. The logistics service ability includes product reprocessing ability, transportation ability and comprehensive ability. The logistics elements ability includes tangible and intangible elements ability. The research of this paper further deepens the connotation of logistics capability in service-oriented manufacturing.

Acknowledgements

This work was supported by the Social Science Foundation of Jiangsu Province, China (Grants No 15GLC004), the Natural Science Foundation of Jiangsu Province, China (Grants No BK20160512), and the Humanity and Social Science Youth foundation of Ministry of Education of China (Grants No 16YJCZH027). These supports are gratefully acknowledged.

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