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An Overview of the Service-Oriented Transformation of China's Manufacturing Industry

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Abstract

The servitization of manufacturing is the development direction of the manufacturing industry. The new round of technological revolution and industrial transformation in recent years has further driven the process of servitization in manufacturing. In response to the current confusion regarding the concept of service-oriented manufacturing, based on existing research, it is proposed that the essence of service-oriented manufacturing lies in manufacturing enterprises providing value-added services based on their own products to users. Service-oriented manufacturing is characterized by universality and diverse models. The main drivers of the development of service-oriented manufacturing include increasing product complexity, consumption upgrades, the development of new-generation information technology, and the pursuit of growth in the manufacturing industry. At the same time, service-oriented manufacturing shows significant differences across industries. It plays an important role in reshaping competitive advantages, promoting the green development of industries, improving total factor productivity, and addressing trade frictions.

Keywords

Servitization of manufacturing; service-oriented manufacturing; servitization.

1. Introduction

Currently, the new round of technological revolution and industrial transformation is advancing in depth. Industrial integration, particularly the deep integration of advanced manufacturing and modern services, has become an important feature of global economic growth and industrial evolution. At the same time, China's manufacturing industry is accelerating its transformation and upgrading towards intelligence, greening, and servitization. New technologies and elements are being organically integrated with manufacturing, and the fusion of manufacturing and services is accelerating. The industrial scope of manufacturing is constantly expanding, its connotation is becoming richer, and the boundaries between advanced manufacturing and modern services are increasingly blurred. The degree of integration between manufacturing and services is continuously increasing, with service-oriented manufacturing becoming an emerging form and trend in the development of the manufacturing industry. Promoting service-oriented manufacturing helps manufacturing enterprises innovate their business models, restructure industrial chains and value chains; it also promotes the development of the manufacturing industry towards high-end production, assists manufacturing enterprises in enhancing competitiveness and industry control; and it contributes to the formation of a new development pattern that centers on domestic circulation and promotes mutual reinforcement between domestic and international circulations.

The concept of service-oriented manufacturing or servitization has been around for 30 years. While international corporate practices can be traced back to earlier periods, it remains a relatively new concept in China. Although academic research and government documents, both

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domestically and internationally, have provided definitions or descriptions of service-oriented manufacturing and related concepts, there are still unclear aspects. There are different interpretations among government authorities, academic circles, and enterprises, leading to misinterpretations and misapplications of service-oriented manufacturing in policy formulation, implementation, and business practices, particularly when there is a tendency to overly broaden the scope of service-oriented manufacturing. To correctly understand service-oriented manufacturing, it is essential to clarify the relationship and boundaries between services and manufacturing. While the implementation subject of service-oriented manufacturing is relatively easy to reach a consensus on—manufacturing enterprises or manufacturing enterprise groups—the definition of the scope of services varies widely. For example, one view suggests that any service activity conducted by a manufacturing enterprise can be considered service-oriented manufacturing; another view holds that only service activities related to manufacturing or physical products qualify as service-oriented manufacturing. Both of these interpretations have certain one-sidedness.

2. Service-Dominant Logic

2.1. The connotation and essence of Service-Dominant Logic

(1) Service as the Core of Economic Exchange

Service-Dominant Logic challenges the traditional logic of product exchange by shifting the focus from products (goods) to services. Traditional logic holds that value is primarily determined by the characteristics and attributes of goods, while Service-Dominant Logic emphasizes the value creation process in service exchanges.

(2) Value Co-Creation

Service-Dominant Logic focuses on value, not the inherent characteristics of products or services themselves, and highlights co-creation of value through the interaction between service providers and service recipients. This co-creation means that value formation depends on the roles of participants and their modes of interaction, emphasizing the dynamic and complex nature of the exchange process.

(3) Resource Integration and Sharing

Service-Dominant Logic posits that economic exchanges are based on the integration and sharing of resources, which include not only tangible products but also intangible resources such as knowledge, skills, and experience. Thus, Service-Dominant Logic emphasizes the importance of cross-organizational and cross-boundary resource integration capabilities in creating and exchanging value.

(4) Focus on Relationships and Interaction

Unlike traditional transaction views, Service-Dominant Logic stresses the relationship and interaction between service providers and recipients. This relationship does not occur only at the point of transaction but continues to develop and evolve throughout the service process, emphasizing the importance of customer participation and feedback.

(5) User Experience and Participation

Service-Dominant Logic underscores the importance of user experience, placing the user at the center of the value creation process. The design and delivery of services need to be approached from the user's perspective, focusing on their needs, expectations, and satisfaction to enhance the value of the service.

(6) Dynamics and Adaptability

Service-Dominant Logic views the service economy as dynamic and adaptable, requiring adjustments and improvements based on market changes, technological advancements, and

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evolving customer needs. This flexibility and adaptability enable businesses to better respond to market shifts and competitive challenges.

In summary, Service-Dominant Logic offers a new market logic and theoretical framework, emphasizing the importance of services, interactions, and value co-creation, contrasting sharply with traditional product-centered economic logic. Through Service-Dominant Logic, researchers and practitioners can better understand and explain the processes of value creation and exchange in modern economic activities.

3. The Connotation and Characteristics of Servitization in Manufacturing

3.1. The Conceptual Connotation of Servitization in Manufacturing

Servitization in manufacturing refers to the increasing integration of service elements into the production process of manufacturing industries. The output of manufacturing shifts from simply providing goods or goods-related items to offering comprehensive solutions that include both products and services. Manufacturing enterprises achieve the extension of the industrial chain and the enhancement of the value chain through deep customer involvement in design and the input and provision of service elements.

Servitization in manufacturing can be further divided into input servitization and output servitization. Input servitization refers to the increasing proportion of service elements in all input factors of manufacturing enterprises' production and operations. Output servitization refers to the growing share of service-related outputs and revenues in the production and income of manufacturing enterprises.

Related concepts to manufacturing servitization include productive services, service-oriented manufacturing, and the integration of manufacturing and services. These concepts are interconnected yet distinct. Productive services emphasize services as intermediate input elements in manufacturing rather than final consumer goods; service-oriented manufacturing highlights the new manufacturing model in which services are an indispensable and crucial factor in both the input and output processes of production; the integration of manufacturing and services refers to the new industrial development form in which advanced manufacturing and modern services are increasingly intertwined, co-evolving, and exhibiting deepening integration.

3.2. The Characteristics of Servitization in Manufacturing

Compared to traditional product-based manufacturing, servitization in manufacturing is a new industrial form of integrated development between manufacturing and services. It has characteristics in aspects such as the form of final products, frequency of supply and demand transactions, composition of input factors, industrial organizational models, and changes in input and output, as detailed in Table 1.

Table 1 Comparison between Product-Based Manufacturing and Service-Oriented Manufacturing.

Comparison Dimension	Product-Based Manufacturing	Service-Oriented Manufacturing
Final Product Form	Tangible physical products	Tangible products + Intangible services
Supply and Demand Transaction Frequency	One-time transaction with minimal after-sales service	Multiple transactions, full lifecycle solutions

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Input Factor Composition	Land, factory equipment, capital-intensive	Labor, knowledge, technology, data-intensive

From the perspective of input factors, the core elements invested in product-based manufacturing enterprises are traditional factors such as land, factory equipment, and capital. In contrast, the core elements invested in service-oriented manufacturing enterprises have shifted to new production factors such as labor, knowledge, technology, and data.

In terms of industry organizational models, traditional product-based manufacturing enterprises mainly enhance their control over the industrial chain through vertical integration or expand production scale and consolidate market position through horizontal integration. In comparison, service-oriented manufacturing enterprises gather numerous companies to build tightly coupled industrial chains, forming a service-manufacturing network system characterized by division of labor, collaboration, and complementary advantages.

Regarding the form of final output, the output of traditional product-based manufacturing is tangible physical products. As servitization in manufacturing develops further, the proportion of tangible physical products gradually decreases, while the proportion of intangible services in the output gradually increases, transforming into service-oriented manufacturing.

From the perspective of supply and demand transaction frequency, traditional product-based manufacturing sells physical products through one-time transactions and ownership transfers. Under the service-oriented manufacturing model, manufacturing enterprises provide integrated, full-lifecycle solutions to customers through multiple transactions, combining "products + services."

In terms of input-output changes, traditional manufacturing enterprises mainly reduce production costs by expanding production scale to gain economies of scale, while service-oriented manufacturing enterprises primarily improve business performance by achieving economies of scope.

4. The Driving Forces Behind the Development of Service-Oriented Manufacturing

The emergence and development of service-oriented manufacturing are driven not only by the increased complexity of products, the growth of personalized customer demands, and the development of new-generation information technologies, but also by the strategic choice of enterprises seeking differentiated competitive advantages, exploring new market spaces, and finding new sources of profit.

4.1. The increase in product complexity expands the demand for service-oriented manufacturing

The process of economic development is one of deepening social division of labor, increasing the degree of indirect production, and expanding product complexity. Modern industrial products, ranging from dozens of components to millions of components, require specialized knowledge and skills for the design and manufacturing of each intermediate and final product. Although manufacturing enterprises strive to make products user-friendly from the design stage, the increasing complexity of products makes it more difficult for users to operate them, and even harder to understand the internal structure and parameters of the products, thus hindering tasks such as the installation, debugging, and maintenance of precision equipment. Compared to manufacturing enterprises, users, who lack the knowledge of "how the product is designed and manufactured," also face challenges in maintaining the product's efficient operation. Furthermore, for some product users who purchase in small quantities, maintaining a complete team for product operation and maintenance is not cost-effective. As a result, many

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industrial product users, in order to focus on their core competencies, reduce costs, or optimize product performance, are increasingly willing to outsource these service-related tasks. They expect that, in addition to providing products, the production materials and processing equipment should offer more high-value-added services.

4.2. The upgrade of consumption drives the continuous growth of demand for personalized services

In conditions of low economic development and limited household income, the pursuit of low prices and cost-effectiveness is the mainstream of social consumption, which is aligned with large-scale production methods. Manufacturing enterprises produce standardized products on a large scale to minimize product processing and manufacturing costs. As economic development progresses and disposable income increases rapidly, consumers are no longer satisfied with basic living needs but instead desire differentiated goods. As a result, the market has been segmented into smaller niche markets, driving companies to shift from "mass production" to "mass customization."

However, in the era of "mass customization," consumers demand products that are low-cost, high-quality, and capable of meeting personalized needs. Enterprises primarily achieve this goal by enhancing the flexibility and adaptability of the manufacturing process. As economic development and living standards further improve, consumer demands gradually shift toward the personalized stage. Consumers are no longer content with products that only provide basic utility; instead, they seek more personalized value from products, such as better alignment with individual physical conditions and usage habits, as well as psychological satisfaction. Driven by personalized demands, manufacturing enterprises are compelled to shift from simple processing, manufacturing, and product delivery to providing a combination of "products + services," thus moving toward "servitization."

4.3. The development of new-generation information technology has expanded the space for services

Driven by "Moore's Law," the rapid development of technologies such as computers, software, the internet, and communications has led to a continuous decline in IT hardware costs and enhanced performance, with increasingly widespread applications in the industrial sector. Currently, IT systems widely adopted by leading manufacturing enterprises include Computer-Aided Design and Manufacturing (CAD/CAM), Enterprise Resource Planning (ERP), Manufacturing Execution Systems (MES), Product Lifecycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM), and Office Automation (OA) systems. In the product development field, there are also numerous highly specialized industrial software solutions.

Especially with the advancements in new-generation information technologies such as the Internet of Things (IoT), mobile internet, big data, cloud computing, and artificial intelligence, the manufacturing industry is evolving towards digitalization, networking, and intelligence, forming an information-physical system (CPS) that tightly integrates resources, information, materials, and people.

In the future, manufacturing enterprises will be able to generate, transmit, and analyze industrial big data, including materials, equipment, and products, in real-time. They will have the ability to sense status, perform real-time analysis, make autonomous decisions, execute precisely, and continuously learn and improve. Under these conditions, manufacturing enterprises can integrate and utilize their own, their suppliers', and customers' resources, information, and data to innovate service models. For example, by obtaining real-time product condition information sent back by built-in sensors, they can instantly issue warnings about potential failures and provide remote technical support; by analyzing the massive data

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generated during the user's use of the product, they can offer personalized usage recommendations; leveraging highly flexible product development design systems and reconfigurable production systems, they can customize personalized products for users at a low cost and deliver them promptly.

4.4. The need for manufacturing enterprises to pursue growth and improve profit margins

The modularization of products, specialization of enterprises, and the intensification of market competition have led to increasingly smaller differences in the quality, functionality, and appearance of final products. The issue of homogenization has become more prominent, resulting in lower customer switching costs and increasing costs for manufacturing enterprises to acquire and retain customers. This has also caused product prices to continuously decline, thereby eroding the profit margins of manufacturing enterprises.

In this context, the differentiated demand for services from customers not only provides new growth opportunities for manufacturing enterprises but also allows them to increase customer loyalty and improve profit margins through the provision of value-added services. The increase in customer demand for services and the shift of added value to service components have driven more and more manufacturing enterprises to undergo servitization. They are transitioning from being product-centered to customer-centered, shifting from focusing on processing and assembly to "manufacturing + services," moving from one-time product transactions to offering long-term services, and changing from deriving value solely from products to a combination of "products + services" as the source of value. Service business has become an important direction for enterprises to enhance their competitiveness and profitability. According to the World Trade Organization, the value-added share of services in manufacturing exports accounts for 32% of exports from developed countries and 26% from developing countries. Among the Fortune Global 500 companies, 56% are engaged in the service industry. In the U.S., which has the highest level of servitization, manufacturing-service integrated companies now account for 58% of the total number of manufacturing enterprises.

4.5. The industry differences in service-oriented manufacturing

Overall, the increase in product complexity, economic development level (income level), and advancements in information technology are key factors driving the servitization transformation of manufacturing enterprises. However, due to the different characteristics of each industry and the varying advantages of different enterprises, the level of servitization varies significantly across industries and companies.

The level of servitization increases with product complexity (specialized knowledge). Industries such as machinery and equipment involve high product complexity, with installation, debugging, operation, maintenance, and servicing requiring a large amount of specialized knowledge. In contrast, industries such as basic raw materials and light industrial products have relatively low product complexity. Data shows that in the Netherlands, the service output ratio of the broadcasting, television, and communication equipment industry is as high as 59.68%, while the service output ratio in industries like basic metal products and pulp and paper products averages only 1.61% and 2.82%, respectively.

The level of servitization increases with the degree of digitization. Data is a core driving force for service-oriented manufacturing. Service-oriented manufacturing models, such as online monitoring, information value-added services, and full lifecycle management, rely on data from equipment operation and user interaction. Service-oriented models such as personalized customization require manufacturing enterprises to have highly flexible production lines and supply chains, which are based on the digitalization, networking, and intelligence of the

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manufacturing industry. Therefore, industries with a high level of digitalization in manufacturing processes and product digitization usually generate more value-added services.

The level of servitization increases as the material effect intensity of the product decreases. As mentioned earlier, users do not purchase or use products to obtain the products themselves, but to gain the utility those products provide. The material effects that products provide vary. Some products have a high material effect intensity, where utility is derived directly from the consumption of the product itself, such as food and drink to solve hunger or fertilizers to improve soil fertility. In these cases, the potential for extending services is smaller. On the other hand, products with lower material effect intensity provide utility not through direct consumption, but through the result of using the product, such as a car providing mobility or a drill creating a hole according to standards. This allows for greater space to extend services.

5. The current situation of the servitization transformation of China's manufacturing industry

5.1. Technology-driven and digital transformation

Many Chinese manufacturing enterprises are adopting new-generation information technologies such as the Internet of Things (IoT), big data analytics, and artificial intelligence to achieve intelligent management and optimization of the production process. Through real-time data monitoring and analysis, companies can predict equipment failures in advance and optimize production schedules, thereby improving production efficiency and product quality.

Both the government and enterprises are jointly promoting the construction of industrial internet platforms, facilitating information sharing and collaboration across various stages of the manufacturing industry. These platforms not only support internal production management within enterprises but also connect upstream and downstream of the supply chain, enabling global operations and intelligent service delivery.

5.2. Innovation in servitization business models

Many manufacturing companies are gradually shifting from traditional product sales models to expanding their business into value-added services. This transformation is not just about offering the products themselves, but providing comprehensive services such as customized design, after-sales technical support, remote monitoring, and maintenance, to help customers enhance production efficiency and equipment utilization. For example, companies can customize product designs based on specific customer needs and operating environments, while also offering necessary technical training and on-site support to ensure excellent performance during operation. With remote monitoring technology, companies can track equipment status in real-time and provide early warnings for potential issues, addressing them promptly through remote maintenance measures, thus minimizing production downtime.

Customized services not only increase the added value of products but also deepen the collaboration between companies and customers, enhancing customer satisfaction and overall market competitiveness. With the diversification of market demands and the increase in personalized consumer needs, the role of manufacturing companies in the servitization transformation has become increasingly crucial. Companies must continuously innovate their service models to adapt to the rapid changes in the market and the ever-evolving highly customized demands of customers. This comprehensive service transformation is not only a response to market trends but also provides an important strategic advantage for companies to maintain a leading position in a highly competitive market.

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5.3. Talent cultivation and management capability enhancement

In response to the growing trend of China's manufacturing industry transitioning to a service-oriented model, many companies are actively increasing their efforts in training and recruiting technical talent. This initiative aims to enhance employees' expertise in key areas such as service design, technical support, and customer relationship management. As the manufacturing industry undergoes deeper intelligent and digital transformations, Chinese companies are ensuring that their employees stay up-to-date with the latest industry technologies and trends through ongoing skill enhancement programs. Training content covers a comprehensive range of skills, from industrial internet applications and data analysis to intelligent manufacturing and service optimization, in order to meet the challenges of rapidly changing markets and diverse customer demands. By recruiting highly experienced and specialized professionals, Chinese companies are addressing technical gaps within their internal teams in specific fields. These technical experts not only bring fresh ideas and solutions but also contribute to the overall improvement of team skill levels and innovation capabilities through collaboration and knowledge sharing with local teams.

Alongside talent development, Chinese manufacturing companies also place a strong emphasis on improving employees' soft skills, such as cross-departmental collaboration, customer communication, and problem-solving abilities. Enhancing these skills not only helps improve service quality and customer satisfaction but also drives the company's ability to maintain a leading position in global competition and steady market share growth.

Through a dual approach of skill updates and talent reserves, China's manufacturing industry is actively addressing the challenges and opportunities of service-oriented manufacturing, continually pushing enterprises towards higher value chains, and striving for sustainable development and enhanced international competitiveness.

At the same time, many companies are establishing comprehensive service management systems, including after-sales service networks, customer feedback mechanisms, and service quality assessment systems, to ensure the timeliness and reliability of service delivery.

5.4. Policy support and market opportunities.

The Chinese government encourages enterprises to invest in the development of service-oriented manufacturing through fiscal and tax incentive policies. For example, companies engaged in high-value-added services such as technical services and after-sales services can benefit from tax breaks, reducing their burdens and encouraging them to invest more in services and improve service quality.

The government supports manufacturing companies in technological and service innovation through innovation incentive policies. For instance, the establishment of technology innovation funds provides financial support to companies for the research and development of new technologies, products, and service models. The introduction of these funds not only helps companies reduce innovation costs but also promotes their exploration and practice in the service field.

The government also supports enterprises in enhancing their service levels and efficiency through measures such as establishing technical service platforms and promoting demonstration projects. For example, the construction of smart manufacturing demonstration bases and outsourcing service demonstration cities provides enterprises with technical training, market expansion, and international service support, accelerating the development and application of service-oriented transformation.

These policies provide strong support for the service-oriented manufacturing transformation, motivating companies to enhance their service and innovation capabilities, advancing manufacturing industries towards the high end of the value chain, and promoting economic

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structural optimization and sustainable development. With the continuous improvement and implementation of policies, service-oriented manufacturing is expected to play an increasingly important role in China's manufacturing sector.

With the upgrading of consumer demand and the growing trend for personalization, the development of service-oriented manufacturing is driven by market demand. Companies are gradually shifting their business strategies, no longer focusing solely on the production and sales of products, but instead turning their attention to the comprehensive enhancement of services. This shift is reflected in the provision of customized and value-added services, effectively responding to the segmentation and personalization of market needs.

In terms of market segmentation, companies gain a deep understanding of the demand characteristics and preferences of different consumer groups, precisely targeting market segments, and developing customized solutions for each. For example, some high-end manufacturing companies focus on providing customized high-end equipment and solutions for specific industries to meet customers' high demands for product quality, functionality, and service.

Regarding personalized demand, as consumers increasingly emphasize product personalization and user experience, manufacturing enterprises continue to optimize product design and service models to offer solutions that better align with customer-specific needs. For instance, certain companies collaborate closely with clients to create tailored product designs, provide technical training, on-site support, and customized after-sales services to ensure that customers receive the best possible product experience and performance during use.

Additionally, with the intensifying market competition and the growing pursuit of quality and service by consumers, manufacturing companies are continuously innovating and improving service levels. Through value-added services such as remote monitoring and intelligent maintenance, they effectively enhance product production efficiency and equipment utilization. The introduction of these services not only increases the added value of products but also strengthens the close cooperation between businesses and their customers, enhancing the company’s market competitiveness and customer satisfaction.

Overall, market demand-driven forces are driving the transformation of manufacturing toward service-oriented models. Through continuous innovation and improvement in service capabilities, companies are effectively seizing the opportunities presented by market segmentation and personalization, opening up new avenues for sustainable growth.

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