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Application Prospect Analysis and Key Issues Research of AI Technology in Service-oriented Manufacturing

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Abstract. This study provides a comprehensive review of the development of service-oriented manufacturing and explores the prospects of AI technology in this field. It includes an in-depth analysis of the history, trends, and typical cases of service-oriented manufacturing both domestically and internationally. It includes an in-depth analysis of the history, trends, and typical cases of service-oriented manufacturing both domestically and internationally. The paper highlights the current status and challenges faced by China's service-oriented manufacturing, distilling the main The paper highlights the current status and challenges faced by China's service-oriented manufacturing, distilling the main development models such as intelligent services, third-party outsourcing, and full lifecycle services. By examining specific enterprise cases, the paper reveals innovative transformation paths in China. By examining specific enterprise cases, the paper reveals innovative transformation paths in the practical implementation of service-oriented manufacturing. By examining specific enterprise cases, the paper reveals innovative transformation paths in the practical implementation of service-oriented manufacturing. The aim is to optimize service processes through AI technology, enhance production efficiency and service quality, and provide theoretical support and practical guidance for the deep integration of manufacturing and service industries. The aim is to optimize service processes through AI technology, enhance production efficiency and service quality, and provide theoretical support and practical guidance for the deep integration of manufacturing and service industries.

Keywords: Service-oriented Manufacturing; Application of Artificial Intelligence; Manufacturing Transformation; Development Strategies; Typical Case Analysis; Intelligent Services.

1. Overview of Service-based Manufacturing

1.1. The Significance of Carrying out Service-oriented Manufacturing

Service-oriented manufacturing, as a production-service integration business model, refers to the traditional manufacturing basis, through the addition of value-added services and other means, to meet the personalized needs of customers, enhance the added value of products and the market competitiveness of enterprises, and extend the life cycle from product manufacturing to product services. Carrying out service-oriented manufacturing is of far-reaching significance in many aspects under the current global economic situation.

Firstly, in the context of the transformation of the kinetic energy of economic growth, service-oriented manufacturing represents a new trend in the transformation of the manufacturing industry from "manufacturing-centered" to "service-centered". Globally, the proportion of the service industry is rising, and the manufacturing industry also needs to improve its service content in the whole economy, otherwise it will face the risk of marginalization. Service-oriented manufacturing is a positive response to the transformation and upgrading of the manufacturing industry, which is conducive to promoting the optimization of the industrial structure and improving the overall quality of the economy.

Secondly, service-oriented manufacturing can improve the core competitiveness of enterprises. By providing customized, high value-added services, enterprises can establish closer ties with their customers, expand the marginal returns of their products and services, and thus cultivate a loyal customer base. This service-based differentiated competitive strategy, compared with simple price competition, can bring enterprises a more sustainable source of profit and enhance their market risk resistance.

Third, service-based manufacturing helps to foster innovation and improve productivity. The integration of services incentivizes manufacturing firms to focus on product performance throughout the life cycle and to make investments in preventive maintenance and fault repair. Such future-oriented investments can drive technological innovation and also motivate firms to optimize their production processes, reduce waste, and ultimately improve efficiency and reduce costs.

Furthermore, service-oriented manufacturing can strengthen the integration capacity of the supply chain. With the deep integration of manufacturing and service industries, manufacturing enterprises are no longer independent production and manufacturing units, but have become a link in the service supply chain network. By providing or integrating services to upstream and downstream enterprises, all parties in the industry chain can realize the optimal allocation of resources, accelerate the flow of information, and improve the response speed and flexibility of the entire supply chain.

In addition, service-oriented manufacturing can bring social benefits. As consumers' demands for product quality, performance and after-sales service continue to rise, service-oriented manufacturing can better meet consumers' personalized needs and provide a better consumer experience, thereby improving the overall level of social well-being. At the same time, through the provision of high-end services, it can also create more employment opportunities for industry practitioners and promote sustainable socio-economic development.

Finally, in the face of intensifying globalized competition, service-oriented manufacturing provides new ways for enterprises to develop international markets. With the reduction of transaction costs and the development of communication technology, services are no longer subject to geographical constraints. Utilizing advanced information technology tools, manufacturing enterprises can provide products and related services across regions, helping local enterprises to realize transnational operations and improve their competitiveness in the global market.

The deep integration of artificial intelligence technology in the manufacturing industry has injected a strong technological impetus into service-oriented manufacturing. Its application in demand interaction, product design, intelligent production, service process optimization and customer service has significantly improved the level of personalization and intelligence of services. With the help of big data to deeply analyze user behavior, AI technology helps enterprises accurately grasp the pulse of the market and tailor-made personalized products and services. In addition, the extensive application of intelligent robots, intelligent production lines and other advanced technologies in the field of intelligent manufacturing not only significantly improves production efficiency and flexibility, but also reduces the operating costs of enterprises. In summary, the integration and innovation of service-oriented manufacturing and AI technology will give rise to digital productivity and bring disruptive development and upgrading for enterprises.

In summary, service-oriented manufacturing is not only a necessary way for the manufacturing industry to cope with the challenges of globalized competition and achieve sustainable development, but also an effective strategy for enterprises to innovate their management and services and explore high value-added growth modes. Looking to the future, service-oriented manufacturing will pay more attention to the synergistic improvement of technological innovation and customer experience, and occupy an increasingly central position in industrial development.

1.2. Connotation of Service-oriented Manufacturing

Service-oriented manufacturing is a product of the extension of the manufacturing industry to the service industry, which is an emerging production and business model that combines the traditional manufacturing industry with the modern service industry, and enhances the core competitiveness of enterprises through the provision of high value-added services. The core of this model lies in adding service levels to traditional product manufacturing, transforming it into the provision of comprehensive solutions.

In elaborating the connotation of service-oriented manufacturing, we need to start with its definition and characteristics. Service-oriented manufacturing is not only a series of services attached after the sale of products, but also the integration of the concept of service in the whole process of product design, research and development, production, distribution and use, with a view to realizing a high degree of integration of products and services. In a sense, service-oriented manufacturing transforms the traditional manufacturing industry's source of profit, shifting from a single reliance on physical products to the use of services to create value and differentiated advantages.

The qualities of service-oriented manufacturing are usually demonstrated in the following dimensions.

First, the transformation of products into services, which implies the integration of various types of services related to the product into the production process of the product. Such services cover consulting, training, operation, maintenance and reuse and recycling of product use.

Secondly, oriented to customer needs, service-oriented manufacturing focuses on designing and providing services according to the actual needs of customers, so as to improve the market adaptability of products and customer satisfaction.

Further, the digitization of processes, using advanced digital tools, such as the industrial internet, big data and AI, to enhance information exchange, data analysis and knowledge management between product design and service delivery.

In addition, the construction of a win-win ecological platform model is also one of its important features. Service-oriented manufacturing advocates the co-creation of value with partners in different industrial chain segments, shaping a mutually beneficial and win-win ecological environment. The connotation of service-oriented manufacturing is also reflected in the blurring of the boundaries between manufacturing and service industries. The clear boundaries between traditional manufacturing and service industries are gradually blurred, and service activities have become the core value creation process of manufacturing enterprises.

Service-oriented manufacturing requires companies to have in-depth insight into customer needs, to be able to design products that meet the individual needs of consumers, and at the same time can provide the appropriate customization services, in order to provide a total solution, rather than simple product sales.

In addition, service-oriented manufacturing also manifests itself as an ongoing, interactive relationship maintenance. This requires enterprises to maintain close communication links with customers at all stages before and after product sales, and to enhance brand loyalty and customer stickiness through services, so as to build a long-term cooperative relationship. In such a context, the integrated application of AI technology can effectively enhance the intelligence level of service-oriented manufacturing, strengthen the ability of enterprises to deal with complex problems and improve decision-making efficiency, and thus promote the enhancement of service depth and breadth.

In summary, the connotation of service-oriented manufacturing covers multiple dimensions, from value-added services of products, customer needs satisfaction, informatization of process operation, win-win cooperation business model, to blurring of the boundaries between manufacturing and services and the establishment of continuous interactive relationship. Subsequent chapters of this dissertation will further explore the practical application of service-oriented manufacturing in China,

the problems and the opportunities and challenges of improving service levels and innovative service offerings through the integrated application of AI technologies.

1.3. Key Drivers of Service-Based Manufacturing

The driving forces of service-oriented manufacturing are multifaceted, covering a wide range of dimensions, including technological development, market demand, industrial policy and corporate strategy. Against the backdrop of increasing global competition, manufacturing enterprises are constantly seeking to create greater value through services to meet market changes and customer needs, thus promoting the development of service-oriented manufacturing.

Technological progress is one of the important driving forces for the development of service-oriented manufacturing. With the rapid development of information technology, the Internet, cloud computing and big data, the integration of new-generation information technology with traditional manufacturing has had a far-reaching impact, providing brand-new technical support for service-oriented manufacturing. For example, through big data analysis, enterprises can understand market trends and consumer preferences more effectively, so as to provide accurate personalized services. In addition, IoT technology enables equipment to be interconnected, enabling remote monitoring, diagnosis and maintenance, which greatly promotes the process of servitization of the manufacturing industry.

Another key driver is the shift in market demand. In this day and age, consumers are no longer limited to functionality, but are more interested in the services attached to the product and the consumer experience. This change in demand has prompted the manufacturing industry to provide a full range of solutions from design, production, sales to after-sales service. Service-oriented manufacturing is able to meet this diversified and personalized market demand and provide customers with richer value.

Industrial policies and national strategies also have a decisive impact on the development of service-oriented manufacturing. Many countries and regions have regarded service-oriented manufacturing as a key way to enhance industrial competitiveness and realize sustainable development, and have successively introduced a series of supportive policies. For example, the Chinese Government has promoted the "Made in China 2025" plan, which explicitly points out the need to develop service-oriented manufacturing and enhance the overall service capacity and level of the manufacturing industry.

The strategic adaptation of firms is reflected in the fact that more and more firms see service-based manufacturing as an important means of improving their competitiveness. In global value chains, providing high value-added services for products and technologies has become an effective way for firms to capture higher profits. Service-based manufacturing enables firms to form stable customer relationships and create a continuous stream of revenue, thereby protecting against market risks.

In summary, service-oriented manufacturing has become irreversible as a trend, and its main driving forces include technological innovation, changes in market demand, policy orientation and corporate strategic adjustments. These factors are intertwined and together shape the development trajectory of service-oriented manufacturing. In the future, with the further development and application of cutting-edge technologies such as artificial intelligence, service-oriented manufacturing will usher in even broader development prospects. Therefore, enterprises and policymakers need to continue to pay attention to and grasp these drivers in order to better promote the development of service-oriented manufacturing and realize the transformation from a "manufacturing power" to a "manufacturing power".

1.4. Models and Paths of Service-oriented Manufacturing

The mode and path of service-oriented manufacturing is a key path for the transformation and development of the modern manufacturing industry towards servitization, driven by technology and the market. The path involves the deep change from product-oriented to service-oriented, as well as the strategic layout, operational implementation and improvement of innovation capability in the

process. Analyzed at both the theoretical and practical levels, the development mode and transformation path of service-oriented manufacturing reflect the characteristics of diversification and systematization.

In terms of model, the initial form usually starts with the provision of product-derived additional services, such as installation, maintenance, consulting, logistics, etc., and then gradually expands to the provision of system solutions. Such high value-added services not only enhance the user experience, but also create a more stable source of income. Further transformation is the formation of a performance-based contract model, that is, manufacturers no longer just sell products, but also to provide products within the period of use, including maintenance, upgrading, including a package of solutions, the function and performance of the product as a service selling point. This model has been successfully applied in areas such as aero-engine manufacturing, for example, through the "power by the hour" billing model, in which the fees paid by the customer are linked to the actual running time of the equipment.

With regard to the path, transformation first requires the integration and reconstruction of the supply chain and value chain. Instead of relying solely on a single manufacturing process, service-oriented manufacturing requires the construction of a customer-centered service supply chain system, on the basis of which knowledge management and innovation management can be implemented to enhance all-round service capabilities. For example, remote monitoring and predictive maintenance through advanced information and communication technologies and the Internet of Things (IoT) can maximize user satisfaction and optimize the service process.

The deep integration of AI technology has injected infinite possibilities into the model and path of service-oriented manufacturing. With its superior capabilities in deep data analysis, learning and decision-making, AI significantly enhances service-oriented manufacturing in a number of dimensions, including real-time response to personalized services and intelligent maintenance. For example, AI-equipped robots are able to autonomously identify and handle common problems on the production line or provide personalized and customized recommendations in service processes. This deep integration not only significantly improves efficiency, but also helps manufacturers gain deeper insights into consumer needs, thereby building closer customer relationships. In addition to the technical aspects, manufacturing companies face many challenges on the service-oriented manufacturing path, such as professional capabilities in service design, organizational coordination for cross-border integration, and business model design for service innovation. Enterprises need to build an organizational culture and operational processes that are in sync with service innovation on the basis of manufacturing expertise. In addition, the ability to respond quickly to market changes, especially the ability to capture and utilize consumer insights provided by big data, is crucial for service-oriented manufacturing enterprises.

In short, the modes and paths of service-oriented manufacturing are diverse and dynamic, requiring enterprises to explore and practice continuously with the support of advanced technologies such as AI. The transformation from traditional manufacturing to service-oriented manufacturing is not only an upgrade of productivity, but also a complete reshaping of value concepts and business models. In the future, with a deep understanding and systematic application of the service-oriented manufacturing model, combined with the integration and innovation of AI and other cutting-edge technologies, enterprises can take the lead in global competition.

2. Current Status and Trends in Global Service-oriented Manufacturing Development

2.1. Global Evolution of Service-Based Manufacturing

Service-oriented manufacturing is an industrial model that combines the characteristics of manufacturing and service industries, and its evolution shows the fundamental transformation of manufacturing from product-oriented to service-oriented. Globally, service-oriented manufacturing has experienced a development path from the initial after-sales service, to the synchronized design of

products and services, and then to the deep integration of services into the entire production and operation process.

Initially, the germ of service-oriented manufacturing originated from after-sales services provided by traditional manufacturing companies. During this period, services were often seen as an added value to the product, focusing mainly on areas such as warranty, maintenance and parts supply. Enterprises used these services to strengthen the market competitiveness of their products and consolidate customer adhesion. However, as the market becomes increasingly competitive, relying solely on the functionality and quality of products is no longer sufficient to maintain long-term market leadership, so companies are beginning to explore new business growth points.

Subsequently, against the backdrop of increasingly diversified and personalized consumer demands, service-oriented manufacturing has gradually shifted its focus to product life cycle management. This involves the careful design of service-oriented aspects of products from design, production, sales to use and maintenance, so that services are no longer simply attached to the product, but are closely integrated with the product's development and design process to enhance customer experience and create greater value.

In recent years, with the deepening of economic globalization and the information technology revolution, especially the rapid changes in Internet technology, service-oriented manufacturing is gradually integrating cutting-edge digital technologies, including cloud computing, big data, the Internet of Things and artificial intelligence. Modern enterprises are not only providing physical products, but also providing various related services through platforms and networks, such as remote monitoring, online maintenance, data analysis and personalized customization services, etc., to promote the transformation of service-oriented manufacturing into intelligent and networked, and thus enhance the flexibility, efficiency and responsiveness of the manufacturing process.

In the development wave of service-oriented manufacturing, some advanced countries and regions have shown remarkable leadership. Take Germany as an example, its Industry 4.0 strategy has effectively promoted the transformation of manufacturing to service-oriented manufacturing; the United States, through its manufacturing renaissance plan, regards services as a new path to enhance the competitiveness of the manufacturing industry; and Japan emphasizes the integration of service design thinking at the early stage of product development.

Another important milestone in global service-based manufacturing is model innovation. In this context, new business models such as Performance-based Contracting and Solutions Provider have emerged. These models have changed the profit sources and value-added pathways of traditional manufacturing companies by integrating products and services into one solution to meet more complex and differentiated customer needs.

Finally, the development of global service-oriented manufacturing is also manifested in the industrial chain extension and ecosystem construction of manufacturing enterprises. Enterprises not only improve their own service system, but also through cooperation with upstream and downstream enterprises to build a service ecosystem, forming a more conducive to sustainable development of the cooperation network. For example, by joining forces with clothing designers, fabric suppliers and other parties, textile and garment manufacturing enterprises can also provide more comprehensive solutions in the layout of global garment manufacturing.

In summary, the evolution of global service-oriented manufacturing has gradually transitioned from a single after-sales service to a full-service model of product life cycle, and then to a smart service model that is deeply integrated with digital technology, thus promoting the innovation of business models and the upgrading and transformation of the industrial chain. In this process, policies, corporate strategies and technological innovations in many countries and regions have jointly shaped the development trajectory of service-oriented manufacturing, which in turn has had a profound impact on the future of the global manufacturing industry.

2.2. Global Service-oriented Manufacturing Development Trends

With globalization and the rapid development of information technology, service-oriented manufacturing has become increasingly prominent in the global industrial structure. This part will take into account the data and research in recent years to explore in depth the major trends in the development of global service-oriented manufacturing and provide a systematic analysis of its impact on the future manufacturing model.

In recent years, there have been several notable global trends in service-based manufacturing.

First, the expansion and optimization of service content is one of the most important features. Manufacturing enterprises have begun to expand upstream and downstream of the value chain, providing value-added services such as design, R&D, logistics, marketing and after-sales services. By expanding their service content, enterprises are able to more comprehensively meet customer needs, thus enhancing market competitiveness and corporate profits. For example, GE and Siemens have made service business an important engine of growth.

The second trend is the deep integration of digitalization and intelligent technologies. New-generation information technologies, especially artificial intelligence (AI), big data, cloud computing and the Internet of Things (IoT), have found wide application in service-oriented manufacturing. Through these technologies, companies can not only realize the intelligence of their products, but also improve the efficiency and quality of their service processes. For example, through remote monitoring and predictive maintenance of equipment, manufacturing companies are able to achieve timely and personalized service.

Third, environmental sustainability is increasingly becoming central to service-oriented manufacturing considerations. The global emphasis on environmental protection has led to the further practice of concepts such as eco-design, green supply chains and circular economy in service-oriented manufacturing. Enterprises are constantly exploring ways to reduce resource consumption and emissions in their production and service processes, and pursuing development models that harmonize with environmental protection. For example, by providing services such as product leasing, sharing and recycling, they extend the life cycle of products and reduce the generation of waste.

The fourth is the formation and optimization of GSCs. With the development of service-oriented manufacturing, traditional supply chains are being transformed into global service supply chains (GSCs) that include service providers. The management of global service supply chains has become more complex and needs to rely on efficient information systems for cross-country and cross-time zone collaboration. At the same time, the optimization of service supply chain also helps enterprises to better manage service costs, improve service response time and build closer customer relationships.

At the same time, the development of global services-based manufacturing has shown some regional characteristics. In developed countries, services-based manufacturing is mainly reflected in the growth of high value-added services, such as high-end design, financial leasing and data-driven customization. In contrast, in developing countries, it is more often reflected in the growth of the combination of manufacturing and traditional services, such as the expansion of manufacturing into maintenance and emergency services businesses.

In summary, the global trend of service-oriented manufacturing focuses on the continuous expansion of the scope of services, the deep integration of technology, the implementation of the concept of sustainable development, and the formation and optimization of global service supply chains. These trends all show a pattern of service-oriented manufacturing moving towards greater depth, and they are considered to be the key to the future competitiveness of the manufacturing industry. It is worth noting that this process is not only driven by technological and market factors, but also by policy support and the reorganization of the global industrial chain, which play an extremely important role. Therefore, for any enterprise or country that tries to develop sustainably and maintain a competitive advantage in the global service-oriented manufacturing field, it becomes a key task to grasp these trends and make a strategic layout tailored to local conditions. Through in-depth analysis and

implementation, manufacturing enterprises can rely on advanced technologies such as AI to create a smarter and more responsive service-oriented production system, and promote traditional manufacturing to a higher level of the value chain.

2.3. Typical Practices and Cases of Global Service-oriented Manufacturing

The diversity and innovativeness presented by typical practices and cases of global service-based manufacturing provide intuitive cases for understanding the application of AI technologies within this field. This section specifies a few typical cases that are trend-setting in the field of service-based manufacturing and analyzes their characteristics in terms of AI technology application.

General Electric (GE) is transforming its traditional manufacturing operations into service-based manufacturing through its smart manufacturing platform, Predix, which combines the Internet of Things, cloud computing, and big data analytics to allow customers to monitor and control equipment and assets on a global scale. For example, in the aero-engine sector, GE can accurately predict when engine components will be repaired, deploy services and resources in advance, and reduce fuel consumption by optimizing engine performance. This predictive maintenance-based service not only improves equipment reliability, but also increases customers' operational efficiency, thus realizing the deep integration of manufacturing and services.

Rolls-Royce's Power by the Hour model for aero-engine services is another example of service-oriented manufacturing. The company utilizes large amounts of data collected by sensors, combined with AI algorithms, to enable real-time health monitoring and performance analysis of aircraft engines. This service not only helps airlines reduce unplanned downtime, but also wins the market's favor with optimized maintenance processes and cost savings.

The BMW Group combines AI technology with service-oriented manufacturing to provide personalized design and innovative services in automobile manufacturing. Customers can configure the features of their cars according to their preferences, and the AI system can instantly respond to customer needs, optimize the production process and supply chain design, and ensure highly efficient customized production. With this service capability, BMW has not only strengthened its interaction with customers, but also significantly improved customer satisfaction.

Amazon has leveraged its advanced technologies in cloud computing, big data, and AI to create Amazon Web Services (AWS), which provides powerful IT infrastructure services to businesses of all sizes around the world. The success of AWS lies in its ability to standardize and modularize its cloud service offerings and provide highly customizable service solutions based on the actual needs of customers' businesses. This innovative service model greatly reduces IT costs for organizations while increasing operational flexibility and efficiency.

Schneider Electric provides energy management and automation solutions utilizing the EcoStruxure architecture. Through integrated smart devices, software, applications and services, Schneider Electric helps customers enable data collection, analysis and optimization from sensors to the cloud. Data processed using AI technology can guide best practices for energy use, enabling energy efficiency optimization and cost savings, which are key to its service-based manufacturing strategy.

These cases demonstrate how companies can gain an edge in a competitive marketplace by integrating AI technologies into their service-based manufacturing operations, not only to improve consumer experience and provide value-added services, but also to increase productivity and reduce costs. Notably, each of these practices emphasizes the importance of data and the ability to analyze and leverage that data to deliver high-quality services through the use of AI. The global case of service-based manufacturing reveals to companies’ possible paths for transformation, which are important lessons and insights for designing service-based manufacturing strategies and fostering growth in the field.

2.4. International Experience in Service-oriented Manufacturing

Driven by the wave of globalization, service-oriented manufacturing has become an important direction for the transformation and upgrading of heavy industry in many developed countries. Service-oriented manufacturing in this context incorporates the latest technologies, such as Artificial Intelligence (AI), Internet of Things (IoT) and other advanced technologies, which enhance the level of intelligence in the service process and provide new opportunities for achieving sustainable development. This section will extract successful experiences and insights from international cases of service-oriented manufacturing to provide lessons for China's development in similar areas.

Germany's "Industry 4.0" is a typical representative of service-oriented manufacturing, the core of which is to promote the digital revolution in manufacturing, with the construction of smart factories, automation and intelligence of the production process, thereby significantly improving efficiency and quality. In this process, AI technology has become an important cornerstone to support the initiative. Through in-depth analysis and prediction of massive data, AI can provide real-time decision support for the production process, ensuring that products and services are more in line with consumer demand. Driven by the Industry 4.0 strategy, German companies such as Siemens and Bosch have not only improved their own manufacturing strength, but also created richer value for global customers through intelligent value-added services.

The United States, with its leading Internet and information technology strength, has shown great potential in the field of service-oriented manufacturing. General Electric (GE), for example, after the launch of its "Predix" platform, through the integration of machine data and human intelligence, so that the scope of services is no longer limited to a single product or service sales, but rather a comprehensive solution based on data analysis and optimization of the supply. The platform has successfully realized remote monitoring and maintenance of equipment, significantly reduced maintenance costs and improving operational efficiency.

Japan, on the other hand, has focused on combining lean production concepts with modern technology in the area of service-oriented manufacturing. For example, Nippon Heavy Industries, Inc. manages the whole life cycle of product use and maintenance by building an intelligent AI-based service system. Through the collected usage data, AI technology can predict equipment failures and provide early warning beforehand, which ultimately not only improves customer satisfaction, but also further expands the business scope of the enterprise.

In Sweden, Atlas Copco has adopted the Equipment as a Service (EaaS) business model, moving away from the traditional sale of hardware to a usage-oriented service for customers. Through the equipment operation data collected by sensors and analyzed by AI, customers are able to pay according to the actual use, and at the same time can obtain continuous maintenance and upgrade services. This change has not only changed customers' consumption habits, but also inspired manufacturing companies to continuously explore new service models.

The United Kingdom has made a systematic policy push in service-based manufacturing by promoting a network of "Catapult" centers, which are innovation centers designed to accelerate the translation of scientific and technological achievements into market applications. Under this framework, UK manufacturing firms have access to cutting-edge AI technologies and research, driving innovation and the development of service capabilities in niche markets.

These international experiences provide rich lessons and references for service-oriented manufacturing in China. From them, we can see that a mature service-oriented manufacturing system not only needs to strengthen technological innovation, but also needs to build a complete set of service value chain with high efficiency, reliability and customer orientation as the goal. The introduction of emerging technologies such as artificial intelligence has brought a new path of transformation and upgrading for the traditional manufacturing industry, especially with great potential to improve service levels and optimize customer experience.

Based on these international experiences, China can start from the following dimensions in accelerating the development of service-oriented manufacturing:

The first is to deepen the progress of the industrial Internet, using cloud computing, big data and AI technologies to increase the share and value of services in production.

Second, drawing on the examples of cutting-edge enterprises to drive innovation in service-oriented manufacturing models, such as EaaS, to provide personalized and differentiated service strategies with market demand as the beacon. Furthermore, through policy support and incentives, catalyze the convergence of manufacturing and information technology to create a more efficient and intelligent production service system.

Finally, it focuses on the protection of intellectual property rights and the construction of standards to lay the institutional foundation for the sound development of service-oriented manufacturing.

Incorporating these experiences and taking into account China's actual situation will help China's manufacturing industry to realize the transformation from production-oriented to service-oriented, and thus win new advantages in the global manufacturing arena.

3. Current Situation and Problems of Service-oriented Manufacturing Development in China

3.1. Current Situation of Service-oriented Manufacturing Development in China

As a kind of upgrading and transformation of the traditional manufacturing industry, service-oriented manufacturing integrates diversified competitive elements such as production, technology, management and services, and brings new growth points for manufacturing enterprises. As the world's second largest economy, China has made remarkable progress in the field of service-oriented manufacturing in recent years, but the level of development is uneven and there is still a certain gap with developed countries.

At the national level, the Chinese Government attaches great importance to the development of service-oriented manufacturing, and has successively introduced strategic plans such as "Made in China 2025", which clearly takes service-oriented manufacturing as an important direction for the innovative development of the manufacturing industry. In addition, the establishment of various industrial transformation and upgrading funds and national demonstration zones has provided financial and policy support for the innovative development of service-oriented manufacturing.

At the level of industrial practice, some industry-leading large-scale enterprises, such as Huawei and Haier, have deeply implemented the servitization strategy, expanding from a single product manufacturing business to the provision of integrated solutions and ecosystem services. By integrating upstream and downstream resources and creating open innovation platforms, these companies are leading the development direction of China's service-oriented manufacturing industry.

In terms of industry distribution, service-oriented manufacturing is developing more rapidly in the electronics and information, automotive and equipment manufacturing industries. In these industries, manufacturing and services are gradually integrating, enhancing the added value of the product value chain through the provision of customized design, remote monitoring and maintenance, intelligent manufacturing and circular economy services. However, in traditional manufacturing industries, the integration of service-oriented manufacturing is slower, and the precipitated practitioner experience and service capabilities need to be further enhanced.

In terms of technological support, informatization and intelligence have become key factors in promoting service-oriented manufacturing innovation. New technologies represented by the industrial Internet, big data, cloud computing and artificial intelligence play an important role in all aspects of product design, production, sales and service. The application of these technologies not

only improves the efficiency of manufacturing services, but likewise enhances the customer experience.

At the level of regional development, due to the strong technological base and developed market economy in the eastern coastal region, service-oriented manufacturing has shown strong vitality and agglomeration effect, such as the Yangtze River Delta, the Pearl River Delta and other regions have formed a more mature service-oriented manufacturing cluster. Comparatively speaking, due to the late start of the central and western regions, the market and technology accumulation is limited, the development of service-oriented manufacturing is still in the primary stage, the regional differences are significant.

With regard to exchanges and cooperation, China's service-oriented manufacturing enterprises have gradually strengthened their international cooperation and exchanges. Many enterprises have integrated into the global value chain and acquired advanced international technology and management experience through overseas mergers and acquisitions and the establishment of R&D centers. Such cooperation has not only brought about technological upgrading, but also facilitated the intermingling of service concepts and market cultures.

Despite China's achievements in the area of service-oriented manufacturing, it still faces challenges such as a shortage of specialized personnel, insufficient capacity for technological innovation on its own, and insufficient alignment of service concepts with international standards. The existence of these problems constrains the potential for the in-depth development of service-oriented manufacturing and needs to be addressed through continued policy support and industry self-innovation.

In summary, although China's service-oriented manufacturing is still in the stage of development and improvement, it has initially formed a good pattern of expanding into diversified service areas with high-tech manufacturing as the core. Looking ahead, with the increasing in-depth exploration and practice of service-oriented manufacturing, as well as the wide application of artificial intelligence and other high-tech, China's service-oriented manufacturing industry will have huge growth space and broad prospects for development.

3.2. Problems in the Development of Service-oriented Manufacturing in China

Although China's service-oriented manufacturing industry possesses certain competitive advantages globally, a series of urgent problems still exist in the rapid development of the industry. These problems have seriously constrained the quality and effectiveness of the development of the service-oriented manufacturing industry, and require the joint attention of the State and enterprises and the adoption of measures to improve them.

First, in terms of resource provision and capacity building, China's service-oriented manufacturing industry is often still confined to low-end manufacturing services. The lack of top-level design and strategic planning has led to insufficient service innovation capacity and weak competitiveness in the field of high value-added services. Meanwhile, the lack of service talents is also a problem for this industry, especially in key positions, where there is a shortage of highly skilled service-oriented talents, which limits the improvement of service quality and the innovative development of new service models.

Furthermore, China's service-oriented manufacturing industry is still in the process of development, the standard system is not yet perfect. The construction of systems such as service standards, quality standards and evaluation indicators is lagging behind, and it is difficult to form an industry consensus. This affects the quality-of-service delivery to a certain extent and reduces customer satisfaction.

In addition, compared with product manufacturing, service-oriented manufacturing requires higher operational and management capabilities of enterprises, which require more refined and personalized management. However, many enterprises lack effective management improvement and innovation in transformation and upgrading, and internal management levels such as corporate culture,

organizational structure and incentive mechanism have not yet been able to match the characteristics of service-oriented manufacturing.

Moreover, service-oriented manufacturing is a systematic project that requires close cooperation between enterprises upstream and downstream of the industrial chain. However, at present, the collaboration mechanism between service-oriented manufacturing enterprises in China is not perfect enough, and there is a lack of information-sharing platforms, which leads to a lack of obvious synergistic effects. This isolated service system restricts the improvement of service innovation and efficiency.

At the technological level, although China has made some progress in the research and application of new-generation information technologies such as AI, when applying these advanced technologies to service-oriented manufacturing, enterprises still suffer from a low level of technological integration and limited application scenarios. The lack of in-depth technology activation use fails to give full play to the advantages of AI technology in service-oriented manufacturing.

In terms of market development, the vast majority of China's service-oriented manufacturing industry focuses on the domestic market, and its ability to develop the international market is relatively weak. This is in sharp contrast to the competitive situation of the global service-oriented manufacturing industry, and the lack of an international business strategy directly restricts the enterprise's market expansion and the enhancement of brand influence.

There is also a lack of policy and regulatory support. Although the State has introduced a number of policies to encourage the development of the service-oriented manufacturing industry, the systematic and targeted nature of the relevant support policies is not yet strong enough, especially in the areas of tax incentives, financial support, and intellectual property protection, which need to be further strengthened in terms of formulation and implementation.

In conclusion, China's service-oriented manufacturing industry is facing challenges in the transformation and development of talent construction, management innovation, standard system improvement, technology integration and application, industry chain collaboration, market development and policy support. To realize the leap from a manufacturing power to a manufacturing power, it is necessary to comprehensively understand the key issues of service-oriented manufacturing from a systematic and strategic height, and take effective measures accordingly to promote its healthy, rapid and sustainable development.

4. Main Models of Service-oriented Manufacturing Development in China

4.1. R&D and Industrial Design Models

In the development of service-oriented manufacturing, the research and development and industrial design model is a key link, which integrates R&D capabilities and cutting-edge design concepts into the manufacturing process in order to enhance the added value of products and services. This model places special emphasis on originality, innovation and the centrality of design in product development, focusing not only on the realization of product functions, but also on the enhancement of user experience and the aesthetic expression of product forms.

Under this model, manufacturing enterprises are no longer simple product producers, but transformed into solution providers, which involves interdisciplinary research teamwork and forward-looking analysis of user needs. Through in-depth cooperation with scientific research institutions, companies can access the latest scientific and technological achievements and quickly transform them into product design ideas, speeding up the market introduction of new products.

Industrial design plays a crucial role in this model. It is not just about designing the appearance of a product, but also includes all-round consideration of the product user experience, functional layout, material selection, production process, environmental impact assessment and final market positioning. Designers and engineers need to be user-centered, start from the user's needs, and use AI technology,

such as Artificial Intelligence Assisted Design (AIAD), simulation, and other tools to improve the efficiency and quality of design.

Using AI-assisted design tools, it is possible to acquire user behavioral data and use machine learning to deeply analyze user preferences and habits, so as to conceptualize design solutions or improve existing designs based on such information. In addition, the technology helps design teams to understand market trends and ensure that product designs are both relevant to current market needs and forward-looking.

It is worth emphasizing that products under the R&D and industrial design paradigm are often regarded as symbols of "intelligence", and the application of AI technology not only runs through the whole process of product design, but also plays an important role in the realization of product functions. Taking smart wearable devices as an example, their design is not only stylish, but also relies on AI technology to track health data in real time, providing users with customized health management services. In addition, this model also focuses on the sustainability of product development. As global environmental awareness increases, it is particularly important to consider the recycling, reuse or degradation of products at the design stage. Industrial designers need to use environmentally friendly materials and design products that can be easily disassembled to facilitate resource recycling and disposal once the product reaches the end of its life cycle.

Chinese companies have achieved remarkable results in research and development and industrial design mode. For example, Huawei's smartphone products have not only continued to innovate technologically, but have also won numerous international awards for their exterior design; in addition, pioneering companies in the home appliance industry, such as Haier and Midea, have strengthened the international competitiveness of their products through industrial design, and have continued to improve the user experience.

However, China's service-oriented manufacturing still faces a number of challenges in the development of research and development and industrial design models. The first is the relative lack of investment in R&D resources by enterprises, which is a gap compared with the international advanced level. Secondly, design concepts are not forward-looking enough, still mainly imitating and following, and lack of innovative designs rooted in the local market. Furthermore, the level of product intelligence needs to be improved, especially in the deep application of artificial intelligence technology.

In the future, enterprises should increase investment in key technologies such as artificial intelligence, big data and cloud computing, cultivate composite talents who understand both technology and design, and enhance original design capabilities in order to gain a firm foothold in both domestic and international markets, and use research and development and industrial design mode as a powerful weapon to enhance the competitiveness of service-oriented manufacturing.

4.2. System Integration Model for Product Integration

In exploring the development of service-oriented manufacturing, the system integration model of product integration has become an important form of realization. This model is product-centered, and through the integration of various resources and components, it further incorporates system integration services on the basis of providing a single product, which increases the added value of the product, improves competitiveness and meets the market demand for complex systems.

The essence of the system integration model is to integrate different products and services together to form a complete solution to cope with the increasingly complex technology and market environment. In service-oriented manufacturing, system integration should not only consider the technical parameters of the product itself, but also take into account the overall layout of products and services to realize the organic combination of hardware and software. When we incorporate AI technology into this model, we can greatly enhance the degree of intelligence of the service and the

adaptability to cope with the environment, effectively improving the efficiency and quality of the integrated service.

In the process of product integration, which mainly centers on customer demand, market research and data analysis are used to determine the final solutions to be provided. ai technology plays an extremely critical role in this process, and through big data analysis, machine learning and other methods, it is able to make effective predictions of customer demand and provide accurate guidance for product integration.

Product integration in the system integration model usually involves cross-industry collaboration. ai technology can provide intelligent communication protocols and workflow optimization solutions for cross-industry integration, guaranteeing seamless splicing of products and services from different industries and ensuring work efficiency and success. For example, AI can minimize the gap between products and market needs by algorithmically interfacing industrial design and user experience.

In practice, the system integration model highlights its great potential through customized solutions. Taking intelligent manufacturing as an example, AI technology can integrate manufacturing resources such as machine tools, automation equipment, sensors, etc. to provide industry-specific manufacturing system solutions through intelligent scheduling and resource optimization. In fields such as automotive manufacturing, aerospace, and large-scale engineering projects, system integration using AI technology is particularly critical, as it not only ensures production efficiency, but also shortens the product development cycle and improves the overall service level through intelligent decision-making assistance.

However, we face a number of challenges to achieve efficient product integration and system integration. These include inconsistencies in technical standards, barriers to information interoperability among various industries, and data security and privacy protection issues in the integration process. Therefore, strengthening the development of industry standards, promoting collaborative work among different industries, and safeguarding data security and user privacy are key to the future development of service-oriented manufacturing, especially under the system integration model.

In summary, the system integration model of product integration has an important strategic value in the future service-oriented manufacturing field. Using AI technology, it can not only realize the intelligent integration of products and enhance the added value of services, but also help manufacturing enterprises to broaden the scope of services and innovate business models. To realize the maximum potential of this model, it is necessary for the manufacturing, service, and information technology industries to work together to build a synergistic ecosystem that will enable our manufacturing industry to remain competitive globally and provide consumers with a better and more convenient service experience.

4.3. Smart Service Penetration Model for Products

The intelligent service penetration mode of products is a key orientation in the development of service-oriented manufacturing, which is based on information technology and artificial intelligence and focuses mainly on enhancing the added value and competitiveness of product services through intelligent means. Empowered by AI technology, traditional manufacturing products are not just entities that satisfy basic functional needs, but intelligent solutions that are deeply integrated with services, and they can actively identify consumer needs and provide personalized, predictive and solution-oriented services in real time.

With the increasing maturity of technologies such as the Internet of Things, cloud computing, big data, intelligent perception and machine learning, intelligent services for products continue to penetrate all aspects of manufacturing. By integrating intelligent sensors and connectivity modules in their products, manufacturers have achieved real-time monitoring of product usage status, and by analyzing the massive amount of data collected, they provide scientific maintenance

recommendations and optimization solutions for product usage. For example, by analyzing the operating data of industrial equipment, the intelligent service system is able to predict potential failures of the equipment and carry out maintenance in advance, which greatly reduces the unplanned downtime of the production line and improves the overall production efficiency.

The in-depth promotion of smart services requires enterprises to transform their traditional production concepts from mere product manufacturers to service providers offering comprehensive solutions. In this transformation process, enterprises not only provide physical products, but also need to build a supporting service system, including training, maintenance, upgrading and recycling phases, to ensure that the product realizes the maximum value in the entire life cycle.

In addition, the intelligent service penetration model of products also requires companies to start considering the content and form of subsequent services at the product design stage, so that they are closely integrated with the functional design of the product. This means that the early stages of product design require interdisciplinary cooperation, for example, mechanical engineers need to work with software developers to ensure that the product has sufficient service compatibility and future upgradability.

In practice, there are numerous successful cases of intelligent service products. For example, some high-end machine tool manufacturers through remote monitoring and diagnostic systems, can be used by customers to implement real-time monitoring of machine tool efficiency, energy consumption and production quality, while providing remote troubleshooting and optimization recommendations. These services not only improve the operational efficiency of the equipment, but also to a certain extent change the business model of machine tool manufacturers, that is, from a single equipment sale to provide comprehensive services.

In order to better realize the penetration of intelligent services, manufacturing enterprises also need to improve relevant policies and standards. This includes regulations on product data security and privacy protection, technical standards in the process of intelligent upgrading, and evaluation systems for service quality. In addition, enterprises should also strengthen cooperation with upstream and downstream industrial chains, form industrial alliances, and jointly promote the development of standards and the implementation of intelligent services.

In summary, the intelligent service penetration mode of products provides a new growth point and competitive advantage for service-oriented manufacturing. This mode, with the help of AI technology, makes manufacturing products become active responders to user needs and continuous optimizers of service quality. For manufacturing enterprises, transforming and upgrading and investing in the field of intelligent services is one of the effective ways to practice service-oriented manufacturing, which is an important strategic choice to stay ahead in the fierce market competition. In the future, along with the continuous breakthroughs in AI technology and related fields of technology, we have reason to believe that the intelligent service penetration mode of products will play a greater role in service-oriented manufacturing, drive the transformation and upgrading of the manufacturing industry, and promote the in-depth integration of manufacturing and services.

4.4. Third-party Service Outsourcing Development Model

When exploring the development mode of service-oriented manufacturing, the third-party service outsourcing mode, as an efficient and flexible mode, is gradually becoming an important path for domestic and foreign enterprises to optimize resource allocation and enhance core competitiveness. This mode refers to manufacturing enterprises entrusting non-core business segments or functions to professional third-party service providers in order to focus more on their core manufacturing business. This section will mainly analyze the characteristics of the third-party service outsourcing development model, its implementation process and its application and prospects in service-oriented manufacturing.

First of all, the essence of the third-party service outsourcing model is based on the urgent need of manufacturing enterprises to optimize resource allocation and management. In the context of globalized competition, enterprises often choose to transfer auxiliary, non-core service functions such as logistics, maintenance and IT support to professional third-party service providers in order to improve response speed and resource utilization efficiency. This cooperation model allows manufacturing companies to focus on key areas such as product development, marketing and quality management, while non-core areas are left to professional teams for more efficient management and execution.

Furthermore, there are significant advantages to outsourcing third-party services. This not only can effectively reduce the operating expenses of enterprises, but also can improve the quality of service and professional level. In the logistics industry, for example, outsourcing allows manufacturers to save money on warehousing, transportation, and staff training, and to enjoy more efficient and customized services by leveraging the expertise and technology of third-party logistics companies.

However, implementing a third-party service outsourcing model is not without its challenges. The first step is to select the right service provider. Manufacturers need to make a comprehensive assessment of the professional competence, credibility, technical strength and service responsiveness of the outsourced service provider. This choice not only affects service quality, but also the robustness of the entire production chain and the brand image of the organization. An inappropriate choice may lead to service interruptions, quality degradation and even cooperation disputes.

The booming development of AI technology brings new opportunities for the third-party service outsourcing model. On the one hand, AI can improve service efficiency, especially in data processing, intelligent diagnosis, and customer behavior prediction; on the other hand, AI technology can personalize services and optimize solutions through algorithms to tailor service solutions for each customer. Therefore, combined with AI technology, third-party service outsourcing can further realize its potential and enhance the overall service-oriented manufacturing value chain.

The use of third-party service outsourcing is increasing in a variety of industries. For example, by outsourcing part of their IT operation and maintenance services to external professional service partners, some automobile manufacturers are able to focus more on research and development of new technologies and market expansion, while ensuring the stability and sophistication of their IT systems. In addition, electronics manufacturers choose to outsource their logistics services to leverage the global network and optimized logistics solutions of third-party logistics companies to improve product delivery efficiency and customer satisfaction.

Looking ahead, the third-party service outsourcing model will continue to evolve as the line between manufacturing and service industries blurs. Manufacturing enterprises will pay more attention to the selection and management of partners to ensure service quality and synergistic benefits. At the same time, third-party service outsourcing will develop in the direction of intelligence, networking and platformization, combining cloud computing, big data, Internet of Things and other new information technologies to provide more diversified, intelligent and efficient service support for service-oriented manufacturing.

In general, the third-party service outsourcing development mode is one of the important development directions of the current and future service-oriented manufacturing field. It can not only help traditional manufacturing enterprises achieve resource optimization and cost control, but also provide strong support for enterprises to quickly adapt to market changes. Through effective third-party collaboration and the application of AI technology, the development of this model will promote the evolution of service-oriented manufacturing to a higher level and create greater value for customers.

4.5. Modes of Operation of E-commerce Platforms

In the process of discussing the diversified models of service-oriented manufacturing, the operation paradigm demonstrated by e-commerce platforms is regarded as a modern service industry form with

great research value. With the rapid change and wide application of Internet technology, e-commerce has become an indispensable link between manufacturing and consumers. By integrating resources and optimizing processes to reduce transaction costs, this model provides manufacturing enterprises with an efficient and convenient online sales channel and customer service platform.

The operation of e-commerce platforms is based on two main models: B2B (Business to Business, i.e. business-to-business) and B2C (Business to Consumer, i.e. business-to-individual consumer). In the context of service-based manufacturing, B2B platforms enable paperless transactions between manufacturers and business customers, suppliers, distributors, etc., optimize supply chain management, and provide personalized services. Meanwhile, B2C platforms directly interface with end-users, realize the whole chain of transactions from manufacturers to consumers, and collect real-time user feedback to flexibly respond to market changes. The essence of e-commerce platform is a kind of information technology and business model innovation, through the platform to gather the resources of all parties to build an ecosystem. This system not only covers the release of product information and transactions, but also includes a series of services such as payment, logistics and after-sales services. In this system, AI technology can play a key role, including but not limited to: intelligent recommendation system personalized matching of user needs, big data analysis to assist enterprises in making accurate market decisions, and optimization of logistics and inventory management through machine learning.

The importance of e-commerce platforms that emphasize user experience is becoming more and more prominent in the specific operation process. The user-friendliness of user interface design, the convenience of the interaction process, and the flexibility of payment and logistics solutions are all key factors in enhancing user satisfaction and loyalty. In a service-oriented manufacturing environment, e-commerce platforms also need to be capable enough to support manufacturers in providing customized solutions and after-sales services, as well as to be able to handle large amounts of data and complex user requirements.

There is no shortage of successful cases. Alibaba Group is an outstanding representative of the B2B e-commerce model, whose platform not only provides an extremely broad marketplace, but also offers manufacturers a series of intelligent services such as production planning and inventory management through a data-driven approach. On the other hand, Amazon is a typical example of the B2C model, which creates a high level of user satisfaction through a strong logistics system and customer service, providing an efficient sales and feedback channel for service-oriented manufacturing.

In the Chinese market, there are numerous successful practices, including JD Group, which has significantly improved the efficiency and quality of its service-based manufacturing business by establishing its own logistics system and realizing full control of goods from warehousing to delivery. In addition, Jingdong's use of big data and cloud platform services has created a more intelligent and personalized service path for manufacturers, further promoting the development of service-oriented manufacturing business.

To summarize, the operation mode of e-commerce platforms has become the cornerstone of service-oriented manufacturing, and its progress not only promotes the in-depth integration of information technology and manufacturing, but also provides a broad platform for enhancing production efficiency, innovating business models and improving user experience. Looking ahead, with the wide application of AI technology in service-oriented manufacturing, the operation mode of e-commerce platforms is expected to become more intelligent, personalized and refined, thus creating more value for the manufacturing industry and consumers.

4.6. Product Life Cycle Service Model

The product lifecycle service model is a service system that covers the entire process of product design, manufacturing, use and end-of-life, and is committed to providing customers with comprehensive and long-lasting product solutions. Thanks to the assistance of AI technology, the

whole life cycle service model can be further deepened and optimized, thus realizing a more efficient and intelligent service experience.

The core of this model is to integrate the resources of manufacturing and service industries to enhance the added value of products and market competitiveness. Its focus is not only on the sale of products, but also on the continuous creation of value throughout the life cycle of the product, thus building a long-term cooperative relationship between manufacturing enterprises and users. In this process, the use of AI technology is particularly critical, and its powerful data processing capabilities and learning performance can track and analyze the massive amount of data in the life cycle of the product in real time, thus providing more accurate and personalized services.

In the design and development of products, AI can effectively shorten the design cycle and reduce the cost of prototype testing by means of simulation and optimization. At the same time, with the help of data analysis, AI can provide in-depth insight into market demand and ensure that new products are closely linked to consumer expectations. Entering the manufacturing stage, AI technology can monitor the production process in real time, quickly identify and respond to challenges in production, and then improve manufacturing efficiency and product quality. And during the use of the product after sale, Internet of Things (IoT) devices transmit data on the product's usage status in real time. After analysis by AI, this data not only predicts potential failures and triggers preventive maintenance, but also provides users with targeted improvement suggestions based on usage, thus optimizing the user experience.

Currently, some manufacturing leaders have begun to try to deeply integrate AI into the full life cycle service model of their products. For example, aircraft manufacturers use flight data analytics to optimize maintenance schedules and reduce operating costs; automotive companies use AI technology to provide users with customized car maintenance services; and home appliance manufacturers integrate smart hardware into home devices to achieve remote monitoring and fault warning. These examples prove that with the empowerment of AI, the full life cycle product service model can not only create more profit points for enterprises, but also significantly improve user satisfaction and loyalty.

However, to fully realize a full life-cycle service model for their products, companies must address several challenges.

First of all, technically, it is necessary to build an intelligent service system that covers perception, analysis, decision-making and execution. This requires enterprises not only to have data collection and processing capabilities, AI algorithm design capabilities, but also to have the ability to transform the wisdom of the product.

Secondly, at the management level, it is necessary to break the traditional organizational structure and process boundaries, and establish a cross-sectoral and cross-business synergy mechanism in order to achieve resource sharing and complementary advantages.

In addition, companies need to be committed to cultivating service-oriented talent and leveraging external conditions such as policies and regulations to ensure data security and protect user privacy.

In summary, the whole life cycle service model proposes a lasting and comprehensive intelligent service concept by virtue of AI technology. The model closely integrates the production capacity of the manufacturing industry and the customer relationship of the service industry, and provides users with more detailed and personalized services with the help of powerful data processing and analysis capabilities. Looking ahead, with the continuous evolution of technology and the gradual acceptance of the market, this model is expected to be widely used in the manufacturing industry, thus promoting the transformation and upgrading of the manufacturing industry.

4.7. Brand-led Market Competition Model

As an important model for the development of service-oriented manufacturing, brand-led market competition is increasingly becoming a key way for enterprises to shape their comparative advantages.

This section will explore in detail the implementation of brand-led market competition in Chinese service-oriented manufacturing and the mechanisms and implications behind it.

As an intangible asset of an enterprise, a brand not only represents the historical deposits of the enterprise but also carries the trust and expectation of consumers for its products and services. In the context of globalization, with the intensification of market competition, a strong brand is increasingly becoming a sword for enterprises to gain market share. By establishing a strong brand, service-oriented manufacturing enterprises can improve customer loyalty, shape product differentiation, increase consumer recognition, and thus realize effective market development and maintenance.

With the empowerment of AI technology, the market competition model of brands has been revitalized, and AI technology provides enterprises with powerful tools to deeply understand consumer needs, predict market trends, and participate in product development and service innovation. With the help of big data analysis, enterprises can gain insight into consumer behavior patterns and provide more personalized and customized services, thus significantly enhancing brand influence. For example, with the help of intelligent recommendation systems, companies can enhance the user experience while increasing user stickiness through precise marketing, further strengthening the brand position.

However, to realize the leading role of brand in the fierce market competition is not an overnight success. Enterprises need to develop a long-term brand strategy planning and sustained investment in brand building. Brand building and shaping not only requires the precipitation of time, but also requires enterprises to continuously pursue excellence in product quality, innovation and service level. In addition, the credibility of the enterprise is also important to enhance brand influence. Enterprises need to make continuous efforts in integrity management, compliance management, etc., to lay the foundation of brand trust with practical actions.

For the Chinese market, enterprises also have to face the challenges of consumer upgrading and market segmentation. Consumers' needs are increasingly diversified and personalized, and they not only pay attention to the functionality of products, but also pay more attention to the quality of service and experience. Therefore, service-oriented manufacturing enterprises should continuously improve service quality, enhance service innovation capability, and utilize AI and other technological means to provide services that exceed customers' expectations, so as to enhance the core competitiveness of the brand.

In fact, there have been many cases that prove the successful application of the brand-led market competition model in the service-oriented manufacturing sector. For example, a well-known home appliance brand has successfully created high value-added branding by creating a total home solution and providing a high-quality after-sales service system, which has enabled it to take the lead in the highly competitive home appliance market. This brand-led, peripheral layout of products and services model, through the establishment of a strong brand ecosystem, enabling enterprises to continue to expand market share, forming a unique competitive advantage in the market.

In summary, the application of the brand-led market competition model in service-oriented manufacturing requires not only thoughtful and persistent implementation of brand strategy, but also close integration with advanced technologies such as AI and keen insights into consumer needs and market changes. This model requires companies to maintain the quality of their products and services while continuously strengthening their branding and innovation practices to ensure that they maintain competitiveness and brand influence in a changing market environment.

4.8. Two-way Service Model for Inspection and Testing

The importance of inspection and testing as an important part of quality assurance in the manufacturing process cannot be overstated. However, in the context of service-oriented manufacturing, inspection and testing services are no longer a one-way quality monitoring process, but have evolved into a two-way service model, which not only provides the original inspection and

testing services, but also provides feedback and optimization suggestions for the production process and product design through the data collected by a variety of means, including sensors and machine vision. In the AI technology, inspection and testing two-way service model has become a new way to improve service effectiveness and enhance the competitiveness of the manufacturing industry.

In the traditional production model, inspection and testing are often carried out only after the completion of production to ensure that the product meets the established quality standards. Although this practice has its own rationality, but there is a feedback lag, the improvement of the problem of inefficiency. With the rise of service-oriented manufacturing, inspection and testing services are gradually integrated into the entire manufacturing process, not only in the end of production inspection of product quality, but also in the product design, manufacturing process, and even the use of products in real-time collection of data, real-time monitoring of product performance, product iteration and process optimization to provide the basis.

The essence of the two-way service model lies in the aggregation and deep analysis of data. In this framework, AI technology plays an indispensable role. With cutting-edge sensors and intelligent analytics, manufacturers can not only monitor the production environment and product quality in real time, but also extract valuable insights from massive amounts of data about processes, material properties, equipment status, and more. This feedback gives manufacturers the ability to quickly pinpoint problems and fine-tune them to continuously optimize product quality and improve manufacturing efficiency.

The integration of AI further promotes the personalized and intelligent innovation of inspection and testing services, such as personalized quality control programs, predictive maintenance, troubleshooting, etc. can be realized. This not only enhances the overall reliability of products, but also improves user satisfaction. In addition, intelligent inspection services help to reduce labor costs in the manufacturing process, reduce the workload of employees, and at the same time build a solid platform for the inheritance and accumulation of knowledge and experience of highly skilled craftsmen.

In addition, the inspection and testing two-way service model also promotes closer cooperation between manufacturers and service providers. Many inspection service providers are able to use the data insights provided by AI technology to work with manufacturers to develop new inspection technologies, set stricter quality standards, and even directly participate in the optimization of the manufacturing process.

However, the promotion and implementation of the two-way service model for inspection and testing also faces a series of challenges. Technically, how to ensure the accuracy and security of data, optimize data processing and analysis algorithms, and improve the learning ability and adaptability of the AI system are problems that need to be solved. In terms of management, how to break down inter-departmental barriers and realize data sharing and cross-departmental cooperation is also one of the difficulties in promoting this model. And from the policy level, the relevant regulations and standards are not yet perfect, how to promote the flow of information and technological innovation while safeguarding commercial confidentiality and personal privacy also requires the joint efforts of the government and industry associations and other relevant parties.

In summary, with the continuous progress of AI technology, the two-way service model of inspection and testing has become a new path worth exploring in the field of service-oriented manufacturing. Through technological innovation and model optimization, it can continuously promote the development of service-oriented manufacturing, stimulate the new vitality of the manufacturing industry, and enhance its competitiveness in the global market. In order to achieve this goal, the industry and the research community need to continue in-depth cooperation to jointly promote the optimization and upgrading of the inspection and testing service model, and to explore more potential of AI technology in service-oriented manufacturing.

4.9. "Internet Plus" Collaborative Innovation Manufacturing Model

In the in-depth exploration of the various modes of service-oriented manufacturing, the "Internet +" collaborative innovation manufacturing mode has become a development direction that cannot be ignored. This model emphasizes that with the help of Internet technology, the boundaries between manufacturing and service industries are gradually blurred, and through collaborative innovation to realize resource sharing, complementary capabilities, and interchangeable advantages, providing customers with a new channel for value creation. In the context of service-oriented manufacturing, this model not only reshapes the entire process of product development, production and sales, but also shows great potential in enhancing the management efficiency of the supply chain and promoting product innovation and service personalization.

The "Internet Plus" collaborative innovation manufacturing model relies on two core elements: the Internet platform and the collaborative innovation mechanism. As the technical support of the model, the Internet platform provides manufacturing enterprises with a space for data exchange, information integration and communication collaboration, thus breaking the traditional time and geographical restrictions and enhancing the transparency of business processes and the possibility of cross-regional collaboration. The collaborative innovation mechanism, on the other hand, intends to jointly promote technological innovation and service upgrading through the establishment of cooperative relationships between upstream, downstream and related stakeholders in the industrial chain, forming a partner network with shared benefits and risks.

Through the implementation of the "Internet Plus" collaborative innovation manufacturing model, traditional manufacturing enterprises have gained significant advantages in several aspects of the transformation of service-oriented manufacturing enterprises. First, based on the powerful data processing and analysis capabilities of the Internet, enterprises are able to make accurate market forecasts and product customization, and achieve rapid matching of personalized services and demand response, thereby enhancing market competitiveness. For example, the user behavior analysis and big data mining technology of the Internet platform enables manufacturing enterprises to accurately capture consumer demand and quickly adjust product design and production plans. Second, building an Internet-based ecosystem can optimize cooperation among suppliers, manufacturers and consumers, stimulate innovation and reduce collaboration costs inside and outside the industry chain through shared platforms and open interfaces. This not only improves the efficiency of supply chain management, but also accelerates the marketing of new products.

With regard to the effectiveness of the "Internet+" collaborative innovation manufacturing model in practical application, many studies have shown that enterprises participating in collaborative innovation networks have significantly improved their innovation speed, production efficiency and customer satisfaction. A well-known smart home appliance manufacturer, for example, has realized consecutive years of sales growth by establishing partnerships with Internet service providers and software developers, and by continuously introducing new smart products that are well received by consumers.

Although the "Internet Plus" collaborative innovation manufacturing model has brought many benefits to service-oriented manufacturing, it also faces a series of challenges and problems in the actual implementation process. For example, data security and privacy protection have always been one of the core concerns of Internet platforms. For this reason, enterprises must build robust network security protection mechanisms and fine privacy protection measures to ensure the security of corporate and customer data. In addition, when adopting this model, enterprises also need to think deeply about the flexible adjustment of corporate culture and organizational structure, the coordination of interests in cross-industry cooperation, and the sharing of risks in the event of innovation failure, among other key issues.

Combining the huge potential and challenges of the "Internet+" collaborative innovation and manufacturing model, for the development of China's service-oriented manufacturing industry, it is necessary to continue to strengthen the construction of Internet infrastructure and improve the legal

and regulatory system of data security, so as to provide a solid guarantee for collaborative innovation. At the same time, enterprises are encouraged to increase their investment in the technological research and development and application of collaborative innovation platforms, and actively cultivate the spirit of interdisciplinary cooperation and innovation capabilities to build an open innovation ecosystem. Through the above measures, the positive role of the "Internet +" collaborative innovation manufacturing model in the transformation and upgrading of service-oriented manufacturing enterprises can be fully realized.

5. Typical Cases of Service-oriented Manufacturing in China

5.1. Guangzhou Radio Builds Service Advantage on Manufacturing Advantage

In exploring the development model of service-oriented manufacturing, Radio Guangzhou demonstrates how it can effectively combine its manufacturing advantages to create service advantages, thus standing out in the competitive market. Guangzhou Radio is an industry giant with a deep manufacturing tradition, and its manufacturing advantages are reflected not only in its strong production capacity, but also in its strict control of product quality and continuous technological innovation. With the intensification of market competition and the diversification of customer needs, Radio Guangzhou has gradually realized the transformation from traditional manufacturing to service-oriented manufacturing.

Building a competitive advantage in AI is the key foundation of Guangzhou Radio Group's success in promoting service-oriented manufacturing. The company has actively adopted and integrated cutting-edge technologies such as Artificial Intelligence (AI) to optimize its production process and management model, thereby significantly enhancing the intelligence of its products. In addition, by using AI technology to collect and analyze user usage data in large quantities, Guangzhou Radio Group is able to gain a more accurate insight into market demand and provide personalized designs and services to customers. For example, the intelligent radio products developed by them can adaptively adjust parameter settings according to the user's usage habits and scenarios, thus providing a more intimate and efficient user experience.

Relying on its profound accumulation in the manufacturing field, Guangzhou Radio Group has made innovative attempts in the service field. They have launched a maintenance service network all over the country, which has greatly improved customer satisfaction through quick response and professional maintenance guarantee. In addition, the company also realized the standardization and intelligence of after-sales service process by building an online platform, which reduced service costs and improved service efficiency. This initiative not only reduces customers' waiting time when there are problems with the products, but also enhances their trust and loyalty to the brand.

Radio Guangzhou Group not only pours its heart into education and training and professional consulting services, but also helps customers deeply master product applications through diversified training and seminars, constructing a bridge of knowledge sharing and technical exchange within the industry. In the field of consulting services, the company provides personalized solutions for the pain points of different industries, effectively promoting the optimization of customers' business processes and the improvement of operational efficiency. This series of service initiatives not only boosted product sales, but also strengthened the company's brand influence and competitive position in the market.

Radio Guangzhou Group also extends its service dimension to the whole life cycle management of its products, from design, production, sales to use, maintenance until end-of-life, realizing the monitoring and management of the whole process, thus promoting the optimal allocation of resources and environmental protection. Through the integrated services of whole life cycle management, Radio Guangzhou Group not only consolidates its manufacturing advantages, but also demonstrates its attitude and commitment to sustainable development and social responsibility to customers and

society. This moves highlights Radio Guangzhou's foresight in the optimal utilization of resources and the achievement of environmental protection goals.

In short, Guangzhou Radio has demonstrated the great potential of service-oriented manufacturing in practical application by deepening its technical advantages and experience accumulation in the manufacturing field and expanding them into service advantages. Through the organic combination with artificial intelligence technology, Guangzhou Radio has opened a new chapter in the transformation from manufacturing to service-oriented manufacturing, and provides a successful case worthy of reference for the same industry.

5.2. Haier's Service Transformation based on Networking Strategy

Haier Group, as a globalized home appliance brand, stands out in the transformation of service-based manufacturing. The company has fully embraced a service transformation based on a networked strategy, and is committed to digitally realizing the transformation from a traditional manufacturer to an Internet-based enterprise in order to meet the growing personalized needs of consumers.

Haier's service transformation is closely centered on its "user-centric" network strategy. The core of this strategy is to build a user-centered open platform, based on the integration of online and offline development, using big data and Internet technology, constantly expanding the service boundary, and reconstructing the relationship between enterprises and users. Through its platform-based ecosystem "Haier Smart Home", Haier has collaborated with many partners to build an all-round service delivery system.

In the process of innovation, Haier focuses deeply on product intelligence, which has given rise to the acceleration of the research and development and application of intelligent home appliances. Products such as smart refrigerators, smart washing machines and smart air conditioners, on top of incorporating intelligent modules and sensors, have realized remote control and fault diagnosis through the use of Internet of Things (IoT) technology. This initiative not only significantly optimizes user experience, but also greatly enriches the content and form of services.

In addition to the grinding of intelligent products, Haier has also gradually built up an online service system. With the aid of AI technology, Haier has developed a series of online customer service tools and applications, such as intelligent voice assistants and online troubleshooting guides, to achieve round-the-clock uninterrupted customer service. The realization of this series of services depends on Haier's in-depth application and integration of AI technology.

In order to further promote the strategic layout of networking, Haier is actively exploring the potential applications of the Internet of Things (IoT). With the help of home appliances with built-in IoT technology, Haier has successfully built a seamless connection between home appliances and users. Through an integrated control center, users can conveniently monitor and manage multiple smart devices in their homes, truly appreciating the charm of smart life. As the core standard for measuring the effectiveness of service-oriented manufacturing transformation, service quality is the focus of Haier's attention, and the company utilizes data analysis to improve service quality. By collecting and analyzing user feedback and usage habit data, Haier continuously optimizes product performance and service processes. At the same time, big data analysis provides Haier with accurate insights into market dynamics and consumer behavior, which guides product development and service innovation and ensures that products and services are closer to market demand.

Haier also pays great attention to sustainable development in its transition to service-oriented manufacturing. For example, Haier's refrigerators and washing machines are not only smart and environmentally friendly, but also provide follow-up services such as trade-in and repair and maintenance, which prolongs the service life of the products and reduces the waste of resources. This ecological and environmental protection-oriented service transformation, while realizing commercial value, also demonstrates corporate social responsibility.

By empowering its products with intelligent and networked features, Haier has transformed its traditional manufacturing service model and realized its transformation to high-quality, personalized and intelligent services. Haier's case not only demonstrates the development potential of service-oriented manufacturing, but also provides valuable experience for the transformation of other manufacturing enterprises in the face of the wave of digitalization. In the future, with the continuous progress and application of AI technology, enterprises relying on the networked strategy for service transformation are expected to reach a higher level of service innovation and promote the development of service-oriented manufacturing to a broader field.

5.3. Other Typical Business Practices

In exploring the diverse enterprise practices within the service-oriented manufacturing field, some enterprises have become leaders in the field with their innovative and strategic practices. In addition to Guangzhou Radio Corporation and Haier Group, this section will focus on analyzing how several other typical firms are utilizing AI technologies to advance their service-oriented manufacturing practices and thus gain a competitive position in the market.

Alibaba Group has successfully integrated the concept of service-oriented manufacturing through its e-commerce platform operating model. The company uses big data and AI technology to provide personalized recommendations for product information and achieve a direct connection between sales and manufacturing. In the process, Ali's manufacturing partners are able to quickly adjust production strategies based on real demand, reduce inventory pressure and improve efficiency. In addition, Ali's cloud computing and intelligent logistics systems provide solid technical support for service-oriented manufacturing.

Also noteworthy is Xunlei, which combines its advantageous Internet-based services and storage and computing capabilities with service-oriented manufacturing through the 'Internet Plus' collaborative innovation manufacturing model. Through the cloud computing platform, Xunlei servitizes the processing capacity of massive data to help cooperative manufacturing enterprises efficiently carry out product design, production process management and market feedback analysis, accelerating the product iteration process.

Huawei, on the other hand, has excelled in its product life cycle service model. Its smartphone manufacturing business not only focuses on product design and production quality, but also upgrades its after-sales service system through AI technology. For example, Huawei's cell phones use AI auto-diagnostics to identify and alert users to potential hardware problems in a timely manner, reducing the need for unnecessary after-sales service while improving user satisfaction.

In addition to this, Gree Electric Appliances has demonstrated a positive and enterprising spirit in the brand-led market competition model. They have successfully integrated AI technology, which enables Gree smart home appliances to learn users' habits in real time and adaptively adjust their operating status, thus achieving remarkable results in energy saving and personalized service. Meanwhile, the back-end production management system also utilizes AI for intelligent production scheduling and fault warning, effectively improving production efficiency and product reliability.

However, on the road to exploring service-oriented manufacturing, companies will inevitably encounter various challenges. For example, how to ensure data security and user privacy, as well as how to safeguard the continuity and stability of smart services. These challenges not only involve technical aspects, but also cover a wide range of management, legal and ethical aspects.

Therefore, in promoting service-oriented manufacturing, enterprises must establish a sound risk assessment and management mechanism to ensure the sound and sustainable development of the entire service system. This requires enterprises to comprehensively consider all kinds of potential risks and formulate corresponding coping strategies, so as to ensure that they maintain their leading position in the fierce market competition.

To summarize, service-oriented manufacturing has shown a diversified trend in the practice of enterprises in China. According to their own characteristics and market demand, each enterprise applies AI technology to different stages, especially the customization of goods, the production process, the use of products and after-sales service, creating a new model of service-oriented manufacturing. Through these practices, not only has the potential of AI technology been fully explored, but also the level of manufacturing services has been significantly improved, providing rich case references and practical experience for the transformation and upgrading of service-oriented manufacturing in China. In the future, with the continuous progress of technology and the increasing maturity of the market, the exploration and practice of enterprises in the field of service-oriented manufacturing will be more in-depth, thus promoting the development of the entire manufacturing industry in the direction of service-oriented and intelligent.

6. Countermeasure Suggestions for Promoting the Development of Service-oriented Manufacturing in China

6.1. Increased Promotion of Service-oriented Manufacturing

In the tide of service-oriented manufacturing, publicity and promotion activities are not only a kind of information transmission, but also an important link in constructing social cognition and shaping the market environment. Although the development of service-oriented manufacturing in China has achieved certain results, its popularity and extensiveness still need to be improved. Increasing the publicity and promotion of service-oriented manufacturing can effectively enhance its status in the minds of enterprise decision-makers and consumers, stimulate the market demand for service-oriented manufacturing, and further promote the transformation of manufacturing into a service-oriented industry.

First, publicity and promotion should aim at emphasizing the strategic significance and long-term value of service-oriented manufacturing. Guiding documents on service-oriented manufacturing, such as white papers and guidebooks, can be prepared and released to introduce to the public the connotation and advantages of service-oriented manufacturing and its development trend in the global manufacturing industry. At the same time, targeted public service announcements and thematic campaigns can be carried out with the help of traditional and new media platforms, such as television, radio, the Internet and social media, in order to increase public awareness of service-oriented manufacturing.

Furthermore, manufacturing enterprises should take the lead in publicizing and promoting service-oriented manufacturing by showcasing their success stories and experiences in the field of service-oriented manufacturing. By organizing open houses, participating in industry exhibitions, and compiling and sharing case studies, companies can demonstrate the practical application of service-oriented manufacturing and the benefits it brings. Such interaction and experience sharing will not only set an example for the industry, but also inspire other enterprises to engage in service-oriented manufacturing.

Again, strengthening cooperation and exchanges with professional organizations is also an effective strategy for publicity and promotion. The government and industry organizations can join hands with professional consulting firms and scientific research institutions to jointly organize seminars, training courses, workshops and other activities on service-oriented manufacturing, so as to promote its cutting-edge concepts and technologies. At the same time, these organizations can also be encouraged to conduct market analyses and policy research reports related to service-oriented manufacturing, so as to provide accurate information services and consulting guidance for enterprises and decision makers.

In addition, it is also important to deepen the cultivation of service consciousness through education and training. The education sector and enterprises should work together to create and popularize courses and teaching materials that are closely related to service-oriented manufacturing, and

skillfully integrate service awareness, customer relationship management and service product development into the higher education and vocational education system. The aim is to strengthen the service consciousness and innovation ability of school students, so as to provide high-quality talents for the service-oriented manufacturing field.

Ultimately, the government should play a guiding and incentive role, using policy support, financial and tax incentives and other measures to motivate enterprises to actively carry out promotional activities in the field of service-oriented manufacturing. For example, for those enterprises that have successfully implemented service-oriented manufacturing and promoted it effectively, the government can provide certain financial subsidies or tax breaks to encourage them.

In summary, increasing the publicity and promotion of service-oriented manufacturing is an important measure to promote its development. Through multi-channel and multi-form publicity and education activities, we can increase the visibility and recognition of service-oriented manufacturing in all walks of life, educate market players, cultivate the market environment, and ultimately arrive at the integrated development of manufacturing and service industries.

6.2. Strong Support for Service-oriented Manufacturing-related Groundwork

The promotion of service-oriented manufacturing relies on sound groundwork, including talent training, standardization, infrastructure development and data support. Strong support for the basic work in this area is an important guarantee to ensure the sustainable development of service-oriented manufacturing. At present, the rational application of AI technology shows incomparable advantages in improving the efficiency and quality of service-oriented manufacturing foundation work.

First of all, the construction of the talent team is fundamental to support service-oriented manufacturing. There is a growing demand for composite talents combining manufacturing and services, and there is currently a relative shortage of professionals in the fields of artificial intelligence, big data analysis, and system integration. Higher education and vocational training should be synchronized with the industry's needs, expanding talent training programs and adding corresponding professional courses to fundamentally improve the quality of talents and practical ability. At the same time, the industry needs to deepen cooperation with academia to jointly conduct research in related fields, not only to cultivate technology research and development talents, but also to focus on cultivating composite management talents with a sense of innovation and service consciousness.

Secondly, a unified service-oriented manufacturing standard system should not be overlooked. Standardization plays a fundamental role in reducing transaction costs, improving service quality and achieving resource sharing. The development process of relevant standards should be accelerated to create a set of service-oriented manufacturing standard systems that are commonly recognized by the industry, such as service process standards and quality control standards. In this process, AI technology can support the development and monitoring of standardized operations through models and algorithms to ensure that the standards developed can meet the needs of practical applications.

Third, the improvement of infrastructure is pivotal to service-oriented manufacturing. Efficient network facilities and data centers are the cornerstone of service-oriented manufacturing. Therefore, we need to accelerate the construction and optimization of new infrastructures, such as cloud computing and the Internet of Things, and increase investment in key infrastructures, such as data centers and smart logistics.AI technology, with its superior data-processing capabilities, can play a huge role in enhancing infrastructure intelligence. For example, AI can be used to optimize energy use, predict maintenance times, and improve safety and security.

Further, data support is an indispensable part of service-oriented manufacturing. Real, high-quality data is a prerequisite for AI technology to work. Therefore, it is especially necessary to establish a sound mechanism for data collection, processing and analysis. At present, China still needs to break through a number of technical bottlenecks in the integration of data resources, and must accelerate the construction of cross-industry and cross-field sharing mechanisms to solve the problem of data

islands. On this basis, data mining and analysis using AI technology will better serve product innovation and service quality improvement.

Ultimately, not to be overlooked is the construction of innovative infrastructures such as smart manufacturing experience centers shared service platforms. They not only have the ability to attract and bring together relevant enterprises, but also provide a place for service-oriented manufacturing to be practically verified. Through field experience and experimentation, enterprises can more intuitively comprehend and master the concepts and methods of service-oriented manufacturing, so as to more elegantly adapt to and lead the market demand.

Overall, attaching great importance to and strongly supporting the basic work related to service-oriented manufacturing is of inestimable importance to enhancing the service competitiveness and innovation ability of the whole industry. AI technology, as a supporting force, can not only enhance the intelligent efficiency and accuracy of the basic work, but also accelerate the deep integration of service-oriented manufacturing and information technology, thus strongly promoting industrial upgrading and economic growth.

6.3. Developing Service-oriented Manufacturing based on Clustering and Agglomeration

Cluster and agglomeration effects play an extremely important role in the development of service-oriented manufacturing. Cluster refers to the formation of industrial clusters by gathering geographically adjacent and associated enterprises and institutions together, while agglomeration refers to the high spatial concentration of factors such as resources, capabilities and information. This paper analyzes the strategy of service-oriented manufacturing development from the perspective of clustering and agglomeration in order to accurately grasp the core competitiveness of service-oriented manufacturing.

First, clustering can enhance cooperation among firms and bring economies of scale and scope to firms. In the context of service-oriented manufacturing, firms must compete not only on product quality, but also on service quality, speed and personalization to meet consumer demand. By clustering geographically, firms can more easily share information and realize the exchange of knowledge and technology; and at the same time cooperate with each other to provide integrated service solutions, thereby reducing costs and improving service speed and quality.

Second, agglomeration effects can also bring more significant innovation benefits. Service-oriented manufacturing requires enterprises to be able to respond to market changes in a timely manner and rapidly develop new products and services. In a cluster environment, there are a large number of supporting enterprises and R&D organizations around the enterprise, which can effectively promote the generation of technological innovation and business model innovation. For example, Germany's Industry 4.0 and China's Manufacturing 2025 strategies both emphasize innovation-driven development, and clustering can improve the efficiency and effectiveness of this innovation process.

In addition to this, service-oriented manufacturing can integrate local resources more efficiently through clustering and agglomeration. The close geographical clustering of local firms helps build a strong local network. Such networks not only deepen companies' insights into the local market, but also enable better integration of local supply chain resources, which in turn reduces logistics costs, improves responsiveness and injects more vitality into the local economy.

In areas where manufacturing industries are clustered, the Government and industry associations should play an active role in catalyzing and accelerating the formation of clusters through the provision of support services such as research financing and personnel training. Further, the establishment of facilities such as public technology service platforms and innovation centers can create opportunities for exchange, cooperation and joint research and development, thereby enhancing the innovation capacity of enterprises.

The application of AI technology has been particularly prominent in strengthening clustering and agglomeration effects. Using data analysis and pattern recognition, AI technology helps accelerate

the dissemination of knowledge and the iteration of technology, and enhances the ability to provide personalized services. Through cloud computing and big data technologies, enterprises in service-oriented manufacturing are able to access a wider range of market information and consumer demand data, thus accurately predicting market trends and quickly responding to market changes.

Special attention should also be paid to the protection of intellectual property rights and the promotion of fair competition in the process of agglomeration and cluster development of service-oriented manufacturing industries. Clusters are often also places where innovations are concentrated, and ensuring intellectual property protection undoubtedly promotes enterprises to invest more in R&D, while also protecting the dynamism of technological innovation.

In order to maximize the effects of clustering and agglomeration, it is necessary for the Government to formulate appropriate policy support, such as tax incentives and subsidies for technology research and development funds, and at the same time to strengthen exchanges and cooperation within the industry and to enhance the overall competitiveness and service capacity of enterprises in the clusters. This not only helps to enhance the international competitiveness of local enterprises, but also serves as an important strategy to attract foreign investment to further open up the market.

In summary, the development of service-oriented manufacturing based on clustering and agglomeration is an important strategic choice that follows the laws of economic development and the direction of market demand. Through policy guidance, infrastructure support and technological innovation, the overall strength of service-oriented manufacturing can be effectively improved, and industrial upgrading and sustainable development can be promoted.AI technology, as a key driving force in this process, provides new development momentum and possibilities for service-oriented manufacturing.

6.4. Focus on the Pivotal Role of Industry Associations

Industry associations play a pivotal role in the evolution of service-oriented manufacturing in China. As a bridge between the government and enterprises, industry associations can efficiently integrate industry resources, reconcile the interests of all parties, and improve the service quality and standard of the entire manufacturing industry. Exploring the potential of industry associations in service-oriented manufacturing is of far-reaching significance in leading the industry to comprehensive upgrading and change.

First, industry associations can become leaders in knowledge sharing and technological innovation. By building a mechanism for knowledge sharing within and outside the industry, industry associations can promote the convergence and dissemination of advanced concepts and innovative technologies in service-oriented manufacturing. For example, they can organize symposiums, workshops and academic forums to bring together experts and scholars in the field of AI technology, as well as domestic and foreign enterprises that have made outstanding contributions to the field of service-oriented manufacturing, to share their experiences and analyze difficult problems. This will not only promote the updating of industry knowledge, but also help the application of new technologies, thus enhancing the overall innovation capability and competitive advantage of the industry.

Second, industry associations can guide and promote the transformation of enterprises towards actively embracing AI technology by formulating industry standards and norms. Service-oriented manufacturing involves a large number of industries and market segments, and different enterprises will face various technical and management issues in the course of development. By studying and formulating unified standards and specifications, such as service process specifications, data exchange format standards and relevant standards for AI technology applications, industry associations can ensure the quality and safety of technical services, as well as reduce the cost of interactions between enterprises and accelerate the efficient operation of the entire industry.

Furthermore, industry associations can help their members grasp the direction of market development and changing trends through strategic collaboration. With the rapid development of the service-oriented manufacturing sector and the ever-changing market demand, enterprises can have a head start in the competition if they can gain timely insight into the market dynamics. Industry associations can issue regular industry reports, provide market analysis, policy interpretation, industry dynamics and other information to help members develop or adjust business strategies to avoid blind development and enhance market adaptability and foresight.

In addition, industry associations can provide strong support in policy formulation and communication between government and enterprises. Service-oriented manufacturing plays a pivotal role in China's manufacturing upgrading strategy, and the wide application of AI technology has become an important component of the country's strategic emerging industries. By utilizing the platform of industry associations, the real needs and suggestions of enterprises, as well as the difficulties and challenges encountered in the process of industry development can be fed back to the government, providing practical and reliable references for the government's policy formulation. Under the government's policy guidance and support, enterprises can obtain corresponding guidance and assistance in technology investment and market expansion.

Finally, industry associations should be committed to strengthening collaboration and cooperation among their members. Under the background of service-oriented manufacturing, the cooperation between enterprises is no longer limited to the traditional supply chain relationship, but shows more business model integration and synergistic development trend. Industry associations can build a platform to facilitate resource sharing, mutual support and partnership among member enterprises, so that they can jointly solve technical problems in the production process and share the results of market expansion.

In summary, strengthening the pivotal role of industry associations is not only beneficial to converging industry resources and promoting technology and information exchange, but also helps to coordinate the relationship between enterprises and the government and cultivate a good development ecology for service-oriented manufacturing. By actively interacting and cooperating with industry associations and continuously improving their own service consciousness and capability, enterprises will be conducive to breaking the traditional industrial boundaries and promoting the sustainable development of service-oriented manufacturing in China.

6.5. Facilitating Holistic Corporate Change with a Service-oriented Manufacturing Culture

In the process of manufacturing transformation, the evolution of enterprise culture also plays a crucial role. Service-oriented manufacturing culture is a form of enterprise culture that organically combines manufacturing and service industry, which emphasizes the concept of customer-centeredness and focuses on service value innovation. Under the trend of the deep integration of AI technology and manufacturing industry, the cultivation and development of service-oriented manufacturing culture is of profound significance for enterprises to realize overall change.

First, the positive impact of a service-oriented manufacturing culture on business change is explored. A service-oriented manufacturing culture can help enterprises fundamentally reshape their values, as reflected in a refined understanding of and rapid response to customer needs. It also enhances teamwork and a sense of lifelong learning, which are necessary for companies to adapt to new technologies and market requirements. In addition, the service-oriented manufacturing culture also provides fertile soil for the concept of servitization in the manufacturing industry, which prompts enterprises to more easily accept new technologies and new modes, and accelerates the application of AI technology in service-oriented manufacturing.

Driven by the service-oriented manufacturing culture, significant changes have also occurred at the enterprise management level. Taking the introduction of AI technology as an example, top managers have begun to rethink the business processes and organizational structure of enterprises. For example, by exploring the integration of AI capabilities in the production process, logistics, and customer

service, the enterprise's decision-making has become more dependent on data analysis and customer feedback. At the same time, this change in mindset also drives the improvement of enterprise incentive mechanism and performance appraisal, making it more in line with the requirements of service-oriented manufacturing.

Another major change brought about by the transformation of corporate culture and organizational structure is the reconstruction of products and services. The vision of modern enterprises is no longer limited to product manufacturing, but to deeply penetrate service elements into the whole life cycle of products, from design, production to after-sales. This signifies that enterprises are moving towards providing rich value-added services and opening up innovative business models based on them. Thanks to the use of AI technology, services have become more intelligent and personalized, not only broadening the interaction channels with consumers, but also significantly improving the efficiency and professionalism of services.

As the concept of service-oriented manufacturing deepens within companies, the skill sets of employees shift. Employees in the manufacturing industry are being asked to be more service-oriented and capable, which is prompting companies to make corresponding adjustments in their human resources and training systems. With the help of cutting-edge technologies such as AI, companies are able to provide their employees with instant, personalized learning resources and modes, thus helping them adapt to the new requirements of service-oriented manufacturing. This not only improves the comprehensive quality of employees, but also builds the core competitiveness of enterprises.

However, the cultivation of a service-oriented manufacturing culture is not an overnight achievement; it requires long-term and systematic efforts by enterprises at multiple levels. Specifically, enterprises should firstly recognize the importance of service-oriented manufacturing culture from a strategic height and integrate it into their corporate culture and strategic planning. Secondly, an open platform should be built to encourage exchanges and cooperation among employees of different departments and levels, as well as interaction with external customers and partners, so as to jointly create an environment for service innovation. Finally, it is necessary to establish a sound incentive and feedback mechanism within the enterprise to continuously promote the deepening of service-oriented manufacturing culture.

In conclusion, cultivating and strengthening the service-oriented manufacturing culture is a key part for enterprises to comply with the new trend of economic development and realize continuous innovation and overall change. In today's rapid development of AI technology, enterprises can take this opportunity to take service as the driving force to actively promote the innovation of enterprise culture, organizational structure and product service mode, and ultimately achieve transformation and upgrading to win the advantage of market competition.

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