

Challenges and Breakthrough Strategies for China's Manufacturing Industry Upgrading under the Background of Global Industrial Chain Reconstruction

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Abstract

In an environment of rapid reconstruction of the global industrial chain, China's manufacturing industry faces many challenges such as lack of technological innovation, poor resilience of the industrial chain, pressure from green transformation, and talent shortage. To achieve the goal of manufacturing industry upgrading, it is necessary to consolidate the foundation of independent technological innovation, enhance the security level of the supply chain, lead the trend of green and low-carbon development, improve the talent training model, and establish a modern manufacturing system structure. By strengthening the R&D capability of core technologies, building an independent and controllable supply chain system, promoting the implementation of green manufacturing, and improving the supply level of innovative talents, China's manufacturing industry can enhance its international competitiveness and achieve high-quality development.

Keywords

Reconstruction of the Global Industrial Chain, China's Manufacturing Industry, Technological Innovation, Green And low-Carbon, Supply Chain Resilience

1. Introduction

With the accelerated restructuring of the global industrial chain, the competitive landscape of the manufacturing industry is undergoing profound changes. Driven by the rapid evolution of emerging technologies and the complex international situation, China's manufacturing industry must address the urgent task of transformation and upgrading, facing multiple challenges such as technical barriers, industrial chain disruptions, and green and low-carbon requirements. China's manufacturing industry urgently needs to achieve breakthroughs in innovation-driven development, supply chain resilience building, and green development. By constructing an independent and controllable technological system and improving a modern manufacturing system, it can gain the initiative in the reconstruction of the global industrial chain and achieve more quality progress.

Driven by factors such as the COVID-19 pandemic, geopolitical tensions, and rapid technological advancements, the global economic landscape is facing profound reshaping, and the reconstruction of the global industrial chain has become an irreversible trend. Against this background, China's manufacturing industry, as a key part of the global supply chain, is facing new challenges and opportunities. The reconstruction of the global industrial chain has given birth to the development trend of supply chain regionalization and diversification, and has also driven the accelerated return of manufacturing industries in developed countries. These countries have vigorously implemented localization plans and widely applied digital and intelligent manufacturing technologies, pushing the manufacturing industry chain into a stage of profound transformation.

1.1 Main Manifestations of Global Industrial Chain Reconstruction

Increasingly prominent trend of supply chain regionalization and diversification: To address the risk of supply chain disruptions caused by globalization risks and emergencies, more and more countries and enterprises have begun to reshape their supply chain structures. They improve their risk resistance by deploying manufacturing industries in their home countries or neighboring countries. Especially in high-end manufacturing fields such as medical devices and electronic products, regional supply chain layouts are gradually becoming the mainstream pattern.

Further strengthening of manufacturing reshoring and localization strategies in developed countries: Developed economies such as the United States and Japan advocate the "manufacturing reshoring" strategy to promote the recovery and rise of their domestic manufacturing industries and reduce reliance on external supply chains. This trend is particularly evident in mid-to-high-end manufacturing fields such as chip production, precision instruments, and new energy. Through tax incentives and policy subsidies, these countries attract enterprises to return and build more compact and coherent industrial chain closures.

Rapid development of intelligent manufacturing and digitization promotes the rapid transformation and upgrading of manufacturing industry chains: The extensive application of artificial intelligence, 5G technology, and the Internet of Things has made intelligent manufacturing a key approach to addressing the reconstruction of global industrial chains.

Facing the impact of the digital wave, the manufacturing industry is transforming towards high-tech content and high added value, achieving intelligent, flexible, and networked production links, improving production efficiency and quality, and enhancing the flexibility of the supply chain.

1.2 Dual Impacts of Global Industrial Chain Reconstruction on China's Manufacturing Industry

(1) Positive Impacts

Significantly promoting intelligent upgrading and digital transformation: With the increasingly prominent digital trend of the global industrial chain, China's manufacturing industry has accelerated its move towards intelligent transformation by introducing intelligent manufacturing and industrial internet, which can help improve production efficiency and product quality. Investments in automated and digital workshops and intelligent logistics have given the manufacturing industry stronger overall competitiveness [1].

Global supply chain adjustments have raised the requirements for independent innovation capabilities: This has forced China's manufacturing industry to improve its technological R&D and core technology research capabilities. In the independent R&D of key components and high-end equipment, enterprises have increased their investment scale, gradually getting rid of dependence on imports, and strengthening their ability to independently control the industrial chain [2,3].

(2) Negative Impacts

The problem of dependence on key technologies and core components has been fully exposed: Due to the reconstruction of the global industrial chain, technical blockades in some key fields have been further strengthened, especially in the fields of chips and high-end equipment manufacturing. Chinese enterprises are facing the dilemma of "necklace choking" in technology supply chains and urgently need to rapidly advance the R&D and breakthroughs of independent core technologies.

Significant increase in the instability of the international market: Due to trade protectionism and geopolitical games, some developed countries have adopted tariff and non-tariff barrier measures against Chinese manufacturing products, leading to obstacles in the export of some manufacturing products. Especially high-end manufacturing goods and technology-intensive products face large-scale trade friction risks in European and American markets, increasing the uncertainty of the manufacturing industry's foreign trade.

1.3 Case Analysis: Impacts of China-US Trade Frictions on High-End Manufacturing

The China-US trade friction is a typical case in the reconstruction of the global industrial chain, which has had a profound impact on high-end manufacturing.

Semiconductor manufacturing has been impacted by the reconstruction of the chip industry chain: Due to the China-US trade friction, the United States has implemented chip sales bans and technical blockades on Chinese high-tech enterprises, causing Chinese chip manufacturing enterprises to face the crisis of core technology supply disruptions. China has accelerated the pace of independent chip R&D, implemented domestic substitution measures, and accelerated the upgrading of the autonomy level of the semiconductor industry chain.

The layout of the new energy vehicle industry chain has been adjusted: The U.S. government has implemented incentive measures to attract new energy vehicle manufacturing to return to the United States, creating obstacles for Chinese new energy vehicle brands to enter the U.S. market. This change has driven the Chinese new energy vehicle industry chain to re-plan its layout, relying more on the domestic market and countries along the "Belt and Road" to diversify the market [4].

2. Core Challenges Facing the Upgrading of China's Manufacturing Industry

Against the backdrop of global industrial chain restructuring, the upgrading of China's manufacturing industry faces multiple dilemmas, concentrated in the areas of technological innovation, supply chain risk resistance, green and low-carbon transformation, and talent institutional mechanisms. These challenges significantly restrict the high-quality development of the manufacturing industry and pose tough tests for enhancing international competitiveness.

2.1 Technical Bottlenecks and Inadequate Independent Innovation Capability

At present, the issue of China's manufacturing industry being controlled by others in core technologies remains severe. In core technology areas typified by high-end chips, industrial software, and key components, there has long been a reliance on imports, leading to constraints in international trade frictions. With the intensification of technological blockades, the problem of "stuck neck" in key technologies has frequently emerged, highlighting the shortcomings in independent innovation capabilities [5].

Insufficient R&D investment and weak basic research make it difficult for the innovation system to support industrial upgrading. Some enterprises one-sidedly pursue short-term economic gains while neglecting the continuous accumulation of long-term technologies, resulting in an extreme shortage of core technologies. Lagging basic research fails to provide a solid foundation for cutting-edge technological innovation, which is unfavorable to building an independent and controllable industrial chain and technological system.

2.2 Insufficient Resilience of Industrial and Supply Chains

The resilience of China's manufacturing industry chain and supply chain still shows significant shortcomings. Due to the acceleration of globalization, the layout of some industrial chains is overly concentrated, resulting in weak risk response capabilities when the external environment changes. Some manufacturing enterprises have been forced to suspend production due to supply chain disruptions, demonstrating the drawbacks of insufficient industrial chain resilience.

There is overcapacity in low- and mid-end manufacturing, while shortages in high-end links are evident. This structural imbalance prevents the industrial chain from forming upstream-downstream coordination and limits the overall competitiveness of the manufacturing industry. Especially in high-end equipment manufacturing and core component production, the phenomenon of technological hollowing-out is extremely prominent, making it difficult to meet the needs of high-quality development.

2.3 Increased Pressure for Green and Low-Carbon Transformation

Under the constraints of the "dual carbon" goals, the manufacturing industry faces multiple challenges in achieving green transformation. Traditional high-energy-consuming and high-pollution industries such as steel, chemicals, and cement manufacturing are in the stage of implementing green upgrades, facing pressures related to technological innovation and costs. Achieving the established goals of carbon peaking and carbon neutrality requires enterprises to adopt green and low-carbon technologies in production processes to reduce energy consumption and carbon emissions per unit of output value.

Some enterprises lack motivation in environmental protection investments, and the renewal process of green technologies is slow, resulting in a low overall greening level in the industry. The green manufacturing standard system is not yet sound, making it difficult for enterprises to obtain precise technical guidance and policy support, which hinders the pace of green upgrading.

2.4 Talent and Institutional Bottlenecks

Cultivating and reserving high-skilled talent is a core priority for the transformation and upgrading of the manufacturing industry. Currently, there is a widespread shortage of high-skilled talent in the manufacturing sector, especially in the fields of digitalization, intelligent manufacturing, and green technologies. The supply of interdisciplinary talent is far from sufficient, and there is a serious disconnect between the education system and industrial needs.

The mismatch between policy guidance and market-oriented mechanisms also restricts the upgrading of the manufacturing industry. The orientation of some policies is too macro and lacks specificity, making it difficult for enterprises to implement them in practice. During the implementation of industrial policies, prominent regional development imbalances have made it difficult for manufacturing industries in some regions to benefit from policies, further widening regional development gaps.

3. Breakthrough Strategies for Manufacturing Upgrading in the Context of Global Industrial Chain Reconstruction

Facing the reconstruction of global industrial chains, China's manufacturing industry must achieve breakthroughs in fierce international competition. It should actively address challenges in technological innovation, supply chain security, green transformation, and talent mechanism reform. By implementing technology-driven strategies, enhancing industrial chain resilience, promoting green manufacturing, and optimizing talent mechanisms, China can form a modern manufacturing system with international competitiveness [6].

3.1 Technology Innovation-Driven Strategy

As global technological competition intensifies and core technology blockades deepen, increasing R&D investment has become a key pathway for manufacturing upgrading. Through a multi-stakeholder investment system guided by the government, led by enterprises, and collaborated by society, continuous efforts should be made to tackle basic research and key technical problems. Priority should be given to overcoming bottlenecks in critical fields such as chip design, industrial software, and high-end equipment, achieving a shift from "following" to "leading" in technological development.

Building an independent innovation system is the fundamental support for enhancing the core competitiveness of manufacturing. By optimizing innovation incentive mechanisms, enterprises should be guided to establish technology innovation centers and laboratories, creating a deeply integrated innovation ecosystem of industry, academia, and research. Leveraging technologies such as big data and artificial intelligence, the intelligence level of manufacturing processes should be improved, and internationally competitive technology R&D centers should be established to promote the deep integration of Industry 4.0 and the Made in China initiative.

3.2 Enhancing Industrial Chain Resilience and Supply Chain Security

The risk of supply chain disruptions caused by global industrial chain reconstruction has made strengthening industrial chain resilience and supply chain security a strategic priority. Efforts should focus on building an independent and controllable key technology supply system, reducing excessive reliance on external markets through domestic

substitution and local production. In high-end manufacturing, joint efforts should be made to break through "neck-stuck" technology blockades and form a closed loop of independent innovation.

Improving upstream-downstream collaborative innovation in industrial chains helps enhance overall chain stability. By establishing regional manufacturing collaborative innovation centers, upstream and downstream enterprises can be driven to conduct technical docking and resource sharing, creating interactive mechanisms to prevent chain fragmentation. Key industries should be encouraged to operate in clusters, forming an industrial chain ecosystem with leading enterprises as the core and supporting enterprises as the backbone, thereby enhancing risk resistance.

3.3 Pathways for Green Manufacturing and Low-Carbon Development

Under the constraints of the "dual carbon" goals, green manufacturing has become a critical direction for upgrading China's manufacturing industry. Measures should be taken to advance energy-saving and emission-reduction technological innovations, comprehensively promoting green upgrades in production processes. Focus should be placed on researching and applying low-carbon manufacturing processes, such as green casting, energy-efficient welding techniques, and environmentally friendly material substitutions, to reduce carbon emissions and resource consumption during production.

Promoting circular economy development is a key approach to achieve green transformation. Systems for recycling waste materials and resource reuse should be established, urging manufacturing enterprises to adopt closed-loop operations across production, utilization, and recycling processes. The green manufacturing certification system should be implemented, encouraging enterprises to participate in green product certification and carbon footprint management, comprehensively upgrading green manufacturing standards and reducing the overall carbon emissions of industrial chains.

3.4 Talent Cultivation and Institutional Mechanism Reform

Manufacturing upgrading relies on the strong support of high-skilled talent. Establishing school-enterprise cooperation mechanisms can effectively alleviate the shortage of skilled talent. By promoting partnerships between vocational colleges and manufacturing enterprises, customized skill-enhancement courses for manufacturing can be developed to cultivate interdisciplinary talent with both theoretical knowledge and practical experience, injecting momentum into intelligent and green manufacturing.

Improving the business environment and enhancing the precision of policy support are core elements to stimulate manufacturing innovation. By streamlining administrative approval processes, improving intellectual property protection mechanisms, and optimizing talent introduction policies, a favorable environment for manufacturing development can be created. Local governments should be guided to formulate targeted support policies for manufacturing, implementing differentiated policy incentives based on industry-specific characteristics to enhance policy effectiveness.

By implementing a multi-pronged strategy focusing on technology-driven innovation, supply chain security, green and low-carbon development, and talent mechanism optimization, China's manufacturing industry will gain a more proactive and advantageous position in global industrial chain reconstruction, leading to a qualitative leap in industrial upgrading.

4. Case Analysis and Countermeasures

Against the background of global industrial chain reconstruction, China's manufacturing industry needs to win in the fierce international competition. It must rely on technological innovation, supply chain security and market diversification. Huawei and BYD, as representative enterprises of China's manufacturing industry.

4.1 Case 1: Huawei's Response Strategy in the Global Industrial Chain Reconstruction

Due to the dual pressures of Sino-US trade frictions and technological blockades, Huawei has encountered major challenges caused by the global industrial chain reconstruction. The core response strategy is to rely on independent research and development and supply chain substitution. In the dilemma of chip supply interruption and technological blockade, Huawei has increased its independent research and development efforts and established a technology system that can be independently controlled. Relying on the establishment of HiSilicon Semiconductor and Chip R&D Center, Huawei strives to promote the growth of its self-developed Kirin chip series and achieve localization replacement from design to manufacturing.

Huawei actively carries out overseas market expansion and diversified layout work, relying on accelerating the expansion of markets in Europe, the Middle East, Africa and other regions to reduce dependence on individual markets. Especially in the market scope of 5G communication equipment and smart terminals, Huawei has gradually created substitution effects in emerging markets with its technological advantages and diversified product series, and improved the global competitiveness of the brand. In the context of global industrial chain reconstruction, this strategy effectively resolves external risks and gives the supply chain stronger pressure resistance.

4.2 Case 2: BYD's New Energy Vehicle Industry Chain Layout

As a leading company in China's new energy vehicle field, during the global industrial chain reconstruction, BYD has shown a strong level of risk resistance. Its main strategy is the integration of localized production and supply chain. BYD has established production bases in many places at home and abroad to optimize the global supply chain layout, enhance the strength of local manufacturing, and effectively reduce the risks caused by external supply chain interruptions. In core areas such as batteries, motors and electronic control systems, BYD insists on independent research and development and production, forming a "powertrain integration" supply system pattern, which greatly improves the level of independent control of the industrial chain.

BYD still pursues a development strategy driven by technological innovation and market development. By continuously investing in the research of core technologies of power batteries and new energy vehicles, BYD has achieved breakthroughs in battery energy density and endurance. From the perspective of the market, BYD has expanded its share of the global market through cooperation with international auto giants such as Toyota and Daimler. By leveraging the dual pull of innovation-driven and market layout, BYD has won a foothold in the global new energy vehicle market.

4.3 Countermeasures and Suggestions: Joint Efforts of Government, Enterprises and Society

The government should continue to optimize the policy environment for the manufacturing industry, especially in the areas of technological innovation and green transformation, provide long-term and stable policy assistance to enterprises, and rely on the promulgation of special policies for key core technology research and industrial chain security measures to enhance the resilience of the manufacturing industry under global competition, build a policy adjustment system that is both flexible and efficient, and timely change the established direction of policies in accordance with changes in the international situation and the dynamics of technological progress.

As the main body in the market, enterprises should strengthen their initiative in technological innovation and supply chain management, build an innovation system driven by themselves by expanding the scale of R&D investment, and reduce their reliance on external key technologies and components. Enterprises should take the initiative to enter the global innovation network system, carry out technical cooperation with international top enterprises and scientific research institutions, introduce global innovative materials, and enhance their technical competition strength.

For the upgrading of manufacturing industry, the role of social forces is indispensable. Colleges and universities and scientific research institutes need to improve the level of training of high-skilled talents for manufacturing industry, and highlight the training of compound talents in the fields of intelligent manufacturing, green manufacturing and supply chain management.

In the complex background of the reorganization of the global industrial chain, promoting the upgrading of manufacturing industry is inseparable from the coordinated efforts of multiple parties such as government, enterprises and society. Only by using policy guidance, enterprise leadership and combining social coordination can China's manufacturing industry move forward with high quality and expand its voice and competitiveness in the global industrial chain.

5. Conclusion

China's manufacturing industry faces unprecedented challenges due to the restructuring of the global industrial chain, which also provides new opportunities to promote the upgrading and transformation of the manufacturing industry. In view of the background of the continuous strengthening of technological blockades and the increasing risk of supply chain disruptions, China's manufacturing industry needs to rapidly advance its pace of independent innovation, establish a key technology system that can be independently controlled, and enhance the comprehensive competitiveness of the manufacturing industry by improving the resilience of the industrial chain, promoting green and low-carbon development, and improving the talent training model. The manufacturing enterprise group led by Huawei and BYD, relying on technological innovation, supply chain integration and market diversification, has provided a helpful reference example for the upgrading of the industry. Through the cooperation of the government, enterprises and society to jointly create a modern manufacturing pattern, China's manufacturing industry will surely step onto a higher level in the global competition.

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