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Constraints and Suggestions on Digital and Intelligent Transformation of Advanced Manufacturing Industry in Guangdong Province

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Abstract

Economists have pointed out that "we should insist on placing the focus of the development of the economy on the real economy, deeply promote the new type of industrialization, strengthen the re-creation of the industrial base and the major technology and equipment Tackling, promoting the development of high-end, intelligent and green manufacturing industry, accelerating the construction of manufacturing province, vigorously develop strategic emerging industries, and accelerate the development of digital economy." This report takes the manufacturing powerhouse of Guangdong Province as a case study to examine the current state of its advanced manufacturing industry's digital transformation and to conduct an in-depth investigation and analysis of the constraints hindering this transformation. The findings of the research indicate that Guangdong Province's advanced manufacturing industry currently faces two major challenges: a strong reliance on external technologies for key innovations and a shortage of skilled personnel. On one hand, the government should increase support for green loans to provide financial backing for technological research and development, establish a shared intelligent technology platform for small and medium-sized advanced manufacturing enterprises to access technical assistance, and develop a management system for digital innovation to create a favorable environment for technological innovation in advanced manufacturing enterprises. On the other hand, advanced manufacturing enterprises should strategically allocate their financial resources to optimize their technological research and development environment, form policy observation teams to promptly adjust their development strategies and seize more policy benefits, and set up information feedback channels to understand the increasing demand for skilled personnel and enhance employee retention.

Keywords

Advanced Manufacturing Industry; Digital and Intelligent Transformation; Corporate Governance.

1. Background and Significance of The Research

1.1. Research Background

From 2016 to 2022, China's digital economy grew at an average annual compound rate of 14.2%. Among the 45 national advanced manufacturing clusters announced by the Ministry of Industry and Information Technology, Guangdong Province has 7 advanced manufacturing clusters, ranking second in the country. However, the development of advanced manufacturing in Guangdong Province faces numerous obstacles, and the path of digital and intelligent transformation is constrained by various factors, seemingly at a bottleneck. To address this,

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this article conducts an in-depth investigation and analysis of the constraints on the digital and intelligent transformation of advanced manufacturing, drawing on the successful experiences of Haier and Tesla, aiming to help more advanced manufacturing enterprises overcome these challenges during the digital and intelligent transformation phase.

1.2. Research Significance

The theoretical significance of this study lies in its in-depth analysis of the constraints on the digital and intelligent transformation of advanced manufacturing. This research offers a new perspective on defining the digital and intelligent transformation of manufacturing, and to some extent, it addresses the shortcomings in existing literature on this topic, thereby enriching the theoretical research in this field. The practical significance is that this research analyzes the constraints on the digital and intelligent transformation of advanced manufacturing in Guangdong Province, providing strong guidance for practice and promoting the orderly development of digital and intelligent transformation in advanced manufacturing enterprises. By thoroughly exploring the factors hindering the digital and intelligent transformation of advanced manufacturing enterprises in Guangdong Province, and considering the unique characteristics of each enterprise, the study proposes practical policy recommendations for addressing the main constraints on the digital and intelligent transformation of advanced manufacturing across different industries. This not only helps to overcome the challenges faced by the digital and intelligent transformation of advanced manufacturing in Guangdong Province but also provides valuable references and insights for the development of this transformation nationwide.

2. Analysis of Constraints on Digital and Intelligent Transformation of Advanced Manufacturing Industry

2.1. Technical Dimension

The constraints in the technical dimension primarily stem from two main areas: the strong external dependence on key technologies and a shortage of technical talent. This research, through field research and questionnaire surveys, collected extensive data from advanced manufacturing enterprises in Guangdong Province. Using methods such as descriptive statistical analysis and exploratory factor analysis, the data were processed to deeply analyze how the technical dimension hinders digital and intelligent transformation.

Regarding key technologies, the survey reveals that advanced manufacturing enterprises in Guangdong Province heavily rely on external sources for high-end equipment, core components, and advanced industrial software. Descriptive statistical analysis indicates that over 60% of these enterprises depend on imports for more than 50% of their key technology needs. This not only increases production costs but also poses significant challenges for technological upgrades and product innovation. For instance, in critical areas such as semiconductor chip manufacturing equipment and high-end CNC machine tools, almost all technologies and products are imported, with a limited number of domestically developed technologies and products. This heavy reliance on external sources severely hampers the enterprises' ability to innovate independently, making it difficult for them to respond quickly and adjust when faced with technological blockades and market fluctuations.

The shortage of technical talent is equally significant. Survey results show that over 75% of companies report that the lack of technical talent is a major obstacle to their digital and intelligent transformation. Exploratory factor analysis further confirms the negative impact of the shortage of technical talent on digital and intelligent transformation. The analysis reveals that the shortage of technical talent not only hinders the development and application of new technologies but also reduces the company's ability to maintain equipment and technology

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during production, leading to low production efficiency and unstable product quality. Moreover, the shortage of technical talent makes it difficult for companies to effectively implement new management strategies and technological applications during digital transformation, further complicating the process.

2.2. Organizational Dimension

The constraints at the organizational level primarily involve management strategies and organizational resilience. Interviews and surveys with corporate management revealed that some companies lack a clear strategic plan for digital and intelligent transformation. Descriptive statistical analysis shows that over 50% of companies fail to integrate their digital and intelligent transformation strategies with their overall development plans, leading to unclear transformation goals and scattered resource allocation. For example, after introducing new digital management systems, some companies failed to optimize and adjust their existing business processes, resulting in a disconnect between the system and actual operations, poor user experience, and ultimately the failure of the transformation project.

The lack of organizational resilience is a significant factor hindering the digital and intelligent transformation of advanced manufacturing in Guangdong Province. This transformation is a long-term and complex process, fraught with numerous uncertainties and risks. Using the Analytic Hierarchy Process (AHP), this study quantitatively analyzed organizational resilience. The findings indicate that some companies struggle to cope with technological changes, market competition, and policy adjustments, often leading them to abandon their transformation plans or alter their direction. Moreover, issues such as rigid internal organizational structures and poor communication within companies also impact organizational resilience, reducing their ability to adapt to changes in both internal and external environments. For instance, when facing market fluctuations, some companies, lacking flexible organizational structures and effective communication mechanisms, are unable to promptly adjust production plans and resource allocation, placing them at a disadvantage in market competition.

2.3. Environmental Dimension

The constraints in the environmental dimension are primarily reflected in area: the effectiveness of policy support. Although the government has introduced a series of measures to promote the digital and intelligent transformation of advanced manufacturing, there are issues in the implementation of these policies. Descriptive statistical analysis reveals that some policies lack specificity and practicality, making it difficult for enterprises to benefit substantially. For instance, the primary beneficiaries of these policies are large enterprises, while small and medium-sized enterprises (SMEs) struggle to meet the application criteria due to their smaller size and limited funds, thus failing to enjoy the policy benefits. Moreover, the policies lack coordination and a systematic framework to guide and support the entire process of digital and intelligent transformation in advanced manufacturing. For example, when applying for policy support, some enterprises find inconsistencies in policy requirements across different departments, leading to significant time and effort spent on the application process, yet still struggling to receive effective support.

Through the above analysis, this research constructs a constraint factor model based on the TOE theoretical framework. This model comprehensively analyzes the constraint factors and their mutual relations of digital and intelligent transformation of advanced manufacturing industry in Guangdong Province from three dimensions of technology, organization and environment.

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3. Suggestions on Digital and Intelligent Transformation of Advanced Manufacturing Industry in Guangdong Province

3.1. Policy Level

Specifically, the government should continue to increase financial support for the digital and intelligent transformation of advanced manufacturing by setting up special funds and offering tax incentives, encouraging companies to invest more in technology research and development, equipment upgrades, and talent development[1]. For example, the' Guangdong Strong Chip 'project has been launched to promote the application of independently controllable industrial-grade chips and address the shortcomings in perception, control, decision-making, and execution by developing a range of basic components and devices.

The government should also increase financial support for green credit to ensure funding for the digital and intelligent transformation of enterprises[2]. For example, the government could collaborate with financial institutions to launch green financial products, implement preferential interest rate policies for green credit, and offer special loan interest rate discounts to banks for advanced manufacturing companies engaged in green technology R&D. Additionally, the government should enhance the promotion and interpretation of these policies to improve enterprises' understanding and utilization efficiency. This would motivate them to innovate in green technology.

3.2. Industry Level

At the industry level, Guangdong Province should develop differentiated digital and intelligent transformation strategies based on the unique characteristics and needs of different industries. For strategic pillar industries such as next-generation electronics, green petrochemicals, and smart home appliances, the focus should be on promoting the coordinated digital transformation of the industrial and supply chains. For example, leading enterprises can drive the digital transformation of upstream and downstream companies, thereby enhancing the overall competitiveness and achieving efficient coordination within the industrial chain[3]. For strategic emerging industries like semiconductors and integrated circuits, and high-end equipment manufacturing, the emphasis should be on the research and application of key technologies to build internationally competitive industrial clusters. Furthermore, Industry organizations and associations should act as a bridge, fostering collaboration and exchange among companies, and sharing successful experiences and best practices.

3.3. Enterprise Level

At the enterprise level, advanced manufacturing companies should proactively drive digital and intelligent transformation. Companies should develop a clear strategy for digital and intelligent transformation, setting clear goals and paths. For example, they can adopt Haier's' RenDanHeYi' management model, which centers on user needs to drive the digital transformation of all processes and elements.

Additionally, the company should allocate funds reasonably to reduce its reliance on external sources of key technologies. On one hand, by funding innovation and entrepreneurship competitions, it can promote joint training programs between schools and enterprises, which helps identify and nurture talent. On the other hand, improving the welfare benefits of technical personnel can help retain talent. Additionally, forming a policy observation team can assist management in making decisions that better align with current trends.

4. Conclusion

Based on the above data research and analysis, we have drawn the following conclusions. On one hand, the government should increase support for green loans to provide financial backing

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for technological research and development, establish a shared intelligent technology platform for small and medium-sized advanced manufacturing enterprises to access technical assistance, and develop a management system for digital innovation to create a favorable environment for technological innovation in advanced manufacturing enterprises. On the other hand, advanced manufacturing enterprises should strategically allocate their financial resources to optimize their technological research and development environment, form policy observation teams to promptly adjust their development strategies and seize more policy benefits, and set up information feedback channels to understand the increasing demand for skilled personnel and enhance employee retention.

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