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A Multidimensional Path Analysis of Digital Transformation in Fujian's Manufacturing Sector

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Abstract: This study explores the multidimensional paths of digital transformation in Fujian's manufacturing sector, focusing on two contrasting case studies: Zhangzhou Sanbao Group, a traditional heavy industry player, and ABB Xiamen Industrial Center, a leader in automation and electrification. The research investigates the interplay of technological, organizational, and policy factors that shape digital transformation processes. By analyzing the technological advancements, organizational changes, and policy frameworks influencing these firms, the study identifies key enablers and barriers to digital adoption. The findings suggest that while large corporations benefit from advanced technologies and supportive policies, SMEs face significant challenges due to high adoption costs and limited access to cutting-edge solutions. The study provides insights for policymakers and business leaders on how to create a conducive environment for digital transformation, emphasizing the need for a holistic, integrated approach to overcoming barriers and fostering sustainable growth.
Keywords: Digital Transformation, Technological Innovation, Organizational Change, Policy Synergy, Automation, Artificial Intelligence

I. Introduction

1.1 Digital Transformation in China's Manufacturing Sector

Over the past four decades, China's manufacturing sector has made remarkable strides. Yet, the sector continues to struggle with the dilemma of being "large but not strong." Despite its scale, many enterprises face limitations in independent innovation, suffer from low product quality, and operate with inefficient management systems. The integration of digital technologies into manufacturing has emerged as a promising approach to improve quality and productivity, creating new avenues to reshape industrial competitiveness [1].

At present, the level of digitalization in China's manufacturing enterprises remains uneven. According to IDC's 2018 China Enterprise Digital Development Report, over 50% of firms remain at the pilot or partial deployment stage of digital transformation. Advanced capabilities in areas such as high-end chips, intelligent sensors, core software systems, and industrial control equipment lag significantly behind global benchmarks [2]. These technological gaps, combined with rising labor and production costs, have steadily eroded the traditional competitive advantages of Chinese manufacturers. Digital transformation has become not only a strategic imperative but also a critical response to industrial upgrading and survival in an increasingly complex economic environment. In recognition of this urgency, the Chinese government has launched multiple top-down initiatives to steer national industries toward digital reinvention. The Made in China 2025 plan identifies digitalization as a central pillar of manufacturing transformation. National-level strategies, such as the 14th Five-Year Plan and the 2035 Vision Outline, emphasize the need to foster digital infrastructure and accelerate the integration of digital technologies with the real economy. These policies aim to empower traditional sectors to achieve higher-quality growth and long-term resilience [3].

During the 13th Five-Year Plan period, China made significant progress in building digital infrastructure and nurturing new digital industries. As of 2023, the digital economy reached RMB 56.7 trillion, accounting for 43.5% of the country's GDP and ranking second globally. This expansion has laid a robust foundation for enterprise-level digital transformation. Three major trends have emerged. First, SMEs have significantly accelerated digital adoption, although 60% remain in early stages with limited functional integration [4]. Many of these firms are turning to digitalization to address operational inefficiencies and develop new business models. The widespread application of the industrial internet is enabling improved data flows and enhanced customer-centric strategies that rely on intelligent analytics and decision-making.

1.2 Regional Industrial Characteristics and Policy Context

The rise of the digital economy is not merely a technological shift but a foundational reconfiguration of industrial ecosystems. Globally, digital value chains are redefining how value is created, distributed, and captured. China's commitment to building a digital economy has been reinforced through national strategies that prioritize industrial digitalization as a pathway to sustainable development. As a coastal region with an open economy, Fujian has developed strong industrial clusters in electronics, machinery, materials, and logistics. Cities like Xiamen and Zhangzhou have attracted global and domestic investment, building diversified industrial systems with digital potential. In Xiamen, foreign enterprises such as ABB have introduced advanced technologies and global best practices, helping to localize Industry 4.0 principles. Zhangzhou, on the other hand, exemplifies the transformation path of traditional private enterprises actively

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upgrading through local digital ecosystems.

Fujian's provincial and municipal governments have adopted proactive policies to accelerate this shift. Incentive programs, public-private partnerships, and digital industrial parks have supported firms in upgrading their infrastructure and workforce capabilities. Integration of local innovation platforms and pilot projects has created favorable conditions for experimentation, capacity building, and cross-sector collaboration.

1.3 Research Objectives and Significance

This study seeks to explore the complex and multidimensional pathways of digital transformation in Fujian's manufacturing sector through detailed case analysis of Zhangzhou Sanbao Group and ABB Xiamen Industrial Center. These two firms represent contrasting models of digital development. Sanbao illustrates a traditional enterprise actively engaging in structural reform, while ABB offers insights into the integration of global digital leadership within a Chinese context.

The research is driven by the following objectives:

- To clarify the structural, organizational, and individual-level drivers that shape digital transformation trajectories.
- To analyze the challenges, enablers, and contextual variables influencing transformation processes across different firm types.
- To offer theoretical insights and practical recommendations for enterprises and policymakers seeking to implement scalable and resilient digital strategies.

The study emphasizes the need for localized approaches that align technological innovation with policy guidance and organizational readiness. The findings aim to inform both academic inquiry and managerial practice in the rapidly evolving field of industrial digitalization.

II. Literature Review

Digital transformation has emerged as a core strategy for manufacturing firms to achieve high-quality development in China. Several studies highlight its significant positive effects on total factor productivity (TFP) through innovation, technological efficiency, and knowledge spillover mechanisms. For instance, Liu [5] and Zhao et al. [6] confirmed that digital transformation promotes TFP by optimizing human capital structure, reducing costs, and enhancing firm innovation. Similarly, Yang et al. [7] uncovered the contagion effects of customer-side digitalization, which compels suppliers to innovate through both pressure and shared resources. At the supply chain level, digital transformation is found to improve supply chain diversification and resilience. Wu and Yao [8] revealed that digitalization reduces concentration in both upstream and downstream networks by lowering transaction costs, especially under systemic risks like trade tensions. Tao et al. [9] emphasized digitalization's backflow effects, where downstream firms' digital upgrades enhance upstream productivity. The integration of supply chain theory and digital technologies thus becomes essential for ensuring flexibility and competitiveness.

Policy and institutional frameworks also play a crucial role. Wang et al. [10] explored the enabling role of digital infrastructure policies, which not only boost enterprise-level digitalization but also promote competitive pressure and regional digital ecosystems. Government subsidies targeted at digital enterprises can drive wider industrial digitalization through inter-sector spillovers, as demonstrated by Yu et al. [11]. Likewise, digital finance, as shown by Wang et al. [12], alleviates financing constraints and enhances R&D, thus accelerating transformation in capital-intensive sectors.

Some studies investigate the firm-level consequences of digital transformation. Li et al. [13] found that digital transformation helps manufacturing enterprises shift toward real economy investments by improving competitiveness and operational efficiency. Financially, both Bai et al. [14] and Yin et al. [15] showed that digitalization enhances financial performance through cost reduction, innovation, and business model upgrades. Meanwhile, Hu et al. [16] noted that digital technologies significantly boost ESG scores by increasing transparency and internal management efficiency, contributing to firm value and sustainable development.

Innovation and value creation are central dimensions of transformation. Xie et al. [17] demonstrated that digital transformation upgrades innovation inputs and outputs, especially in state-owned and larger firms. Zhang and Sun [18] conducted a longitudinal case study showing how resource orchestration during different digital stages leads to evolving forms of value creation—from product-based to digitally-driven ecosystems. These studies provide rich insights into the dynamic, staged, and strategic nature of digital transformation in traditional manufacturing settings like those in Fujian.

III. Research Design

This study employs a comparative case study approach to analyze the digital transformation (DT) journeys of two representative firms in Fujian's manufacturing sector: Zhangzhou Sanbao Group, a leader in steel manufacturing, and ABB Xiamen Industrial Center, a global leader in electrification and automation. The research is designed to compare these companies' strategies, processes, and outcomes in their DT efforts, capturing the differences between traditional heavy industry and advanced manufacturing.

The study uses a multidimensional framework, focusing on technological innovation, organizational transformation, and policy alignment. Key components such as digital infrastructure, AI integration, automation, green supply chain development, and energy management systems will be evaluated. The research will also explore the role of government policies and industry collaborations in supporting or hindering transformation. Path analysis will model causal relationships between internal and external factors and DT outcomes, providing insights into enablers, barriers, and best practices in Fujian's manufacturing digitalization.

The case study materials for ABB Xiamen and Sanbao Group were derived from publicly accessible sources, including

corporate websites (ABB: https://new.abb.com/; Sanbao: https://sanbao-steel.com/), annual reports, press releases, and government-certified sustainability disclosures. These materials are openly available to any visitor, ensuring transparency and replicability of the analysis. Supplemental data on policy alignment were sourced from Fujian Provincial Government white papers (2018–2024) and China's National Bureau of Statistics

This study adheres to academic ethics standards for secondary data analysis. All corporate and policy materials used are publicly available and anonymized where required. No confidential or proprietary data were accessed, and the research avoids disclosing sensitive operational details. The analysis maintains objectivity by cross-verifying claims against multiple sources .

IV. Case Profiles

4.1 ABB Xiamen Industrial Center

Located in the Siming District of Xiamen, Fujian Province, the ABB Xiamen Industrial Center is a flagship facility of ABB Group, a global leader in electrification and automation technologies. (Figure 1) As one of ABB's major manufacturing and R&D hubs in China, the center plays a crucial role in the production of medium-voltage switchgear, circuit breakers, and other key power distribution equipment. The site represents ABB's strategic commitment to the Chinese market and its vision of high-end, green, and intelligent manufacturing. In recent years, ABB Xiamen has spearheaded a comprehensive digital transformation aligned with China's dual-carbon strategy and the broader push toward high-quality, low-carbon industrial development. A cornerstone of this transformation is the deployment of a large-scale smart energy system. The center has installed a 100,000-square-meter rooftop photovoltaic (PV) array, which feeds into an AI-powered smart energy management platform. This system orchestrates the integration of solar power, battery storage, EV charging stations, HVAC systems, and lighting infrastructure. By 2024, this system enabled the facility to source 50% of its electricity from renewable solar energy, reducing annual carbon emissions by approximately 13,400 tons.

Figure 1, ABB Xiamen Industrial Center (Source: https://new.abb.com/)

Figure 2, Robot arm is installing switch cabinet at ABB Xiamen(Sourece: https://new.abb.com/)

ABB Xiamen has also emerged as a national leader in green supply chain management. Recognized in 2024 as one of Xiamen's four new national-level green supply chain enterprises, the center not only focuses on its own emissions reductions but also collaborates closely with upstream and downstream partners to decarbonize the entire value chain. Its long-term sustainability roadmap includes achieving net-zero carbon emissions by 2050. The center's advanced production lines are equipped with robotic arms capable of lifting up to 500 kg and performing micrometer-level precision tasks.(Figure 2) These robots are integrated with AI algorithms and machine vision systems that enable high-speed, high-accuracy operations. This technological foundation has supported the launch of innovative products such as the UniGear 500 switchgear, which features a compact design and enhanced monitoring capabilities. Automation has significantly boosted productivity and reliability while enabling flexible and customized manufacturing.

ABB Xiamen has also become a global benchmark for smart manufacturing excellence. It is the first enterprise in China's power transmission and distribution sector to achieve Level 4 on the national intelligent manufacturing capability maturity model. The center utilizes AI-driven predictive maintenance and digital twin technologies to ensure operational resilience. By deploying IoT-enabled sensors and real-time data monitoring, the center can detect anomalies early and conduct

diagnostics remotely. Digital twin models simulate physical assets and processes to optimize performance, forecast maintenance needs, and minimize unplanned downtime, thus improving both cost-efficiency and system reliability.

To date, ABB Xiamen has invested more than 2 billion RMB in its transformation. The site stands as a model for combining energy efficiency, green infrastructure, and high-end automation to achieve sustainability and global competitiveness. Its experience offers valuable lessons for manufacturers seeking to navigate the path toward intelligent and low-carbon industrial transformation in China and beyond.

4.2 Sanbao Group

Founded in 1999 and headquartered in Zhangzhou, Fujian Province, Sanbao Group has evolved into one of China's leading modernized steel manufacturers. Specializing in high-strength construction steel, corrosion-resistant steel, hot-rolled coil products, and advanced metallurgical materials, the company has established a strong industrial presence. With over 6,000 employees and more than 20 billion RMB in fixed assets, Sanbao Group has consistently ranked among China's Top 500 enterprises by revenue, underscoring its significance in the national manufacturing sector. In response to growing demands for sustainability and technological advancement, Sanbao Group has actively embraced digital transformation and green manufacturing practices. One of its most notable achievements is the establishment of Fujian's first AI-operated full-continuous hot rolling line, producing ultra-thin, corrosion-resistant steel coils for the automotive, marine, and home appliance industries. This facility is supported by smart control centers that enable real-time environmental monitoring, full-process ultra-low emission management, and integrated recycling systems—demonstrating a strong commitment to ecological responsibility and production efficiency. Sanbao's focus on innovation is reinforced through strategic partnerships with prominent research institutions such as the China Metallurgical South Engineering Technology Company and the National Building Steel Inspection Center. These collaborations have enabled the group to secure over 200 intellectual property titles and establish cutting-edge research platforms including the "Sanbao Steel Technology R&D Center" and an "Academician Expert Workstation." These centers drive technological breakthroughs and support the company's long-term vision of intelligent manufacturing leadership.

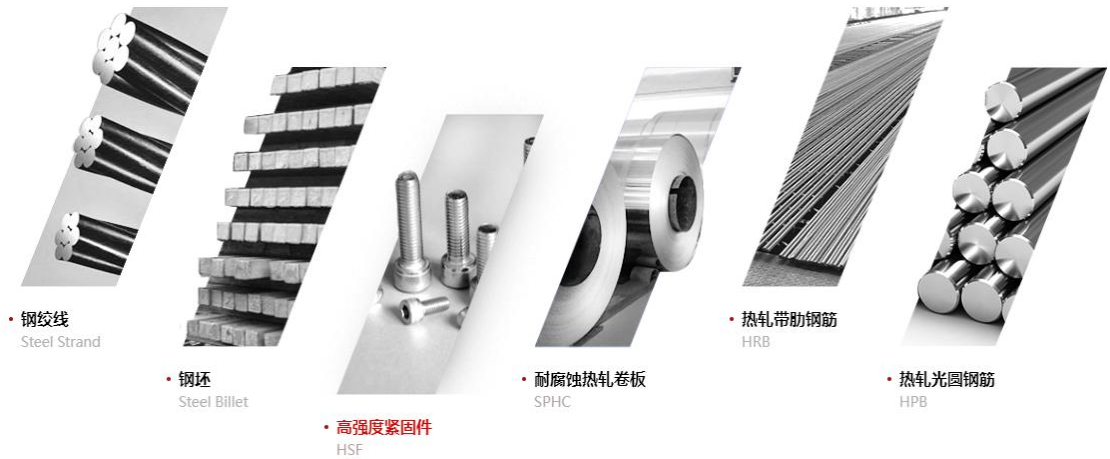

Figure 3, Sanbao Group's steel product.(Source: https://sanbao-steel.com/products)

The company also stands out for its sustainable production techniques, particularly its adoption of short-process electric furnace steelmaking. This method consumes 15–20% less energy than traditional blast furnace systems. Under full scrap-steel operation, energy consumption per ton of steel is approximately 330 kWh, placing Sanbao among the most energy-efficient producers globally. This translates to about 53 kg of standard coal per ton, significantly reducing the carbon intensity of its operations. Further solidifying its green credentials, Sanbao is developing three advanced industrial parks: the Sanbao Electromagnetic New Materials Park, the Sanbao Materials Park, and the Sanbao IoT Industry Park. These projects aim to create a 100-billion-RMB metallurgical materials cluster that integrates green supply chains and digitalized management systems, reinforcing the company's role as a regional industrial leader.

Figure 4, the power project participated .(Source: https://sanbao-steel.com/)

Sanbao's product innovation is another defining feature of its transformation. The group has successfully developed and commercialized 1mm ultra-thin hot-rolled steel coils—previously available only through cold rolling—alongside high-performance marine corrosion-resistant steels and structural steels for offshore wind power infrastructure. These products not only reduce the need for imported materials but also enhance efficiency in downstream applications and support national priorities such as ocean economy development.

Product	Specifications	Model	Usage	Standard
Structural Steel	1.0 ~ 16mm	Q195	Widely used for manufacturing anchor bolts, ploughshares, chimneys, roofing panels, rivets, low-carbon steel wire, thin plates, welded pipes, tie rods, hooks, brackets, and welded structures.	GB/T 700-2006 1,4
Structural Steel	1.0 ~ 16mm	Q215	Widely used for buildings, bridges, ships, and pipelines for fluid transportation.	GB/T 700-2006 1,4
Structural Steel	1.0 ~ 16mm	Q235, Q275	Widely used for manufacturing steel reinforcement or constructing plant frames, high-voltage transmission towers, bridges, vehicles, boilers, containers, and ships.	GB/T 700-2006 1,4
Low-Alloy Structural Steel	3.0 ~ 20mm	Q345	Widely used in bridges, vehicles, ships, buildings, pressure vessels, and special equipment.	GB/T 1591-2008 1,4,6
Low-Alloy Structural Steel	4.0 ~ 20mm	Q390	Widely used in ships, boilers, pressure vessels, petroleum storage tanks, bridges, power station equipment, lifting and transportation machinery, and other welded structures with higher load.	GB/T 1591-2008 1,4,6
Cold-Rolled Hot-Rolled Steel Strip	1.2 ~ 16mm	SPHC	Widely used for manufacturing various panels, welded structural parts, cold and hot rolled thin steel plates, and galvanized, tin-plated, and plastic-coated thin steel plates made from them.	JIS G3131-2010 9,11

Figure 5, Standards for Sanbao Group Steel Products (Sourece:https://sanbao-steel.com/products)

Environmental stewardship remains central to Sanbao's operations. The company maintains 98.9% air quality days annually and has earned recognition as a national-level Green Factory. Key environmental initiatives include comprehensive flue gas desulfurization, ultra-low particulate emissions, full raw material yard enclosure, and 100% industrial wastewater recycling. In 2024, Sanbao Group reported a production output value of 592 billion RMB. Its current investment of 1.8 billion RMB in a specialty hot-rolled steel plant is projected to generate an additional 250 billion RMB in future output.

V. Multidimensional Path Analysis

In digital transformation of Fujian's manufacturing sector, the transformation process is shaped by a complex interplay of technological, organizational, and policy dimensions. These three dimensions collectively influence how companies such as Zhangzhou Sanbao Group and ABB Xiamen Industrial Center navigate their digital transformation journeys. Each of these dimensions is integral in understanding the different pathways to digitalization and the challenges and opportunities they present.

5.1 Technological Dimension

The technological dimension forms the backbone of digital transformation, driving the adoption and integration of cutting-edge technologies within manufacturing processes. Digital technologies, such as artificial intelligence (AI), the Internet of Things (IoT), big data analytics, and automation, are critical to improving productivity, enhancing product quality, and enabling smarter decision-making. ABB Xiamen Industrial Center has made significant strides in integrating smart energy systems and automation technologies. The facility has implemented AI-driven predictive maintenance and digital twin technologies to optimize operations and reduce downtime, enhancing both cost efficiency and system reliability. The use of a large-scale photovoltaic array, coupled with AI-powered energy management systems, exemplifies

how technology can be leveraged to achieve sustainability goals while enhancing operational resilience. Furthermore, ABB Xiamen has embraced the use of IoT-enabled sensors for real-time data monitoring, which enables better tracking of manufacturing processes and further optimizes resource utilization.

Sanbao Group, on the other hand, has adopted advanced technologies like AI-operated hot rolling lines and smart control centers for real-time environmental monitoring. The implementation of these technologies not only improves production efficiency but also helps the company manage environmental impacts, particularly through ultra-low emission systems and integrated recycling mechanisms. Such technological advancements underscore the critical role of technology in driving sustainable practices while maintaining high operational standards.

These technological advancements reflect a growing recognition within Fujian's manufacturing sector of the importance of adopting new digital tools to remain competitive. However, challenges persist in the form of limited access to high-end technologies and the uneven pace of digital adoption across different industries.

5.2 Organizational Dimension

The organizational dimension involves the structural and cultural shifts necessary within companies to support digital transformation. This includes changes in leadership, workforce skills, organizational culture, and management practices that foster a conducive environment for the successful implementation of digital technologies. ABB Xiamen, for instance, demonstrates the importance of strong organizational leadership in driving digital transformation. As a global leader in automation, ABB's Xiamen facility has embraced a culture of innovation and continuous improvement. The integration of AI and automation technologies is not merely technical but also organizational, with a focus on upskilling employees and ensuring alignment between technological initiatives and business strategies. This organizational readiness has allowed ABB to lead in areas such as green supply chain management and the implementation of energy-efficient manufacturing processes.

Sanbao Group has made organizational changes to accommodate its digital transformation. The company has invested heavily in building a skilled workforce capable of managing AI-driven processes and smart manufacturing systems. Strategic partnerships with research institutions have also helped Sanbao foster a culture of innovation, supporting its long-term vision of intelligent manufacturing leadership. These organizational changes are integral to ensuring that the technological investments made by the company are effectively utilized and integrated into its operations.

5.3 Policy Dimension

Government policies and regulations at both the provincial and national levels provide the framework within which digital transformation can thrive. These policies address various aspects, including digital infrastructure development, financial incentives, and industry-specific support mechanisms, all of which are critical in enabling firms to adopt new technologies. China's Made in China 2025 initiative and the 14th Five-Year Plan has been pivotal in promoting the digitalization of manufacturing. These policies emphasize the need for increased investment in digital infrastructure, support for research and development, and the integration of digital technologies into traditional industries. Policies that promote the development of industrial parks and public-private partnerships have been instrumental in supporting firms in Fujian like Sanbao Group, which has benefited from these initiatives to build its smart control systems and digitalized management structures.

At the local level, Fujian's government has been proactive in creating favorable conditions for digital transformation by offering incentives for green technologies and digital infrastructure investments. Programs that support the integration of digital technologies into the manufacturing sector help reduce the financial burden on firms, especially small and medium-sized enterprises (SMEs) that may face challenges in adopting high-end technologies.

However, challenges remain in aligning local policies with the diverse needs of different sectors and ensuring that policy initiatives are flexible enough to accommodate the rapid pace of technological change. Additionally, there is a need for more targeted policies that address the specific challenges faced by SMEs, which form a significant portion of the manufacturing sector in Fujian.

VI. Key Findings

6.1 Path Dependencies and Breakthroughs

The digital transformation journeys of Fujian's manufacturing sector have been shaped by both path dependencies and breakthroughs. Path dependencies refer to the ways in which past decisions, historical practices, and existing organizational structures influence current transformation strategies. Zhangzhou Sanbao Group, with a long history in traditional manufacturing, is facing challenges in adopting cutting-edge technologies due to their existing infrastructure and workforce limitations. It relied heavily on incremental improvements, utilizing digital tools to optimize existing processes rather than adopting radical innovations. However, breakthroughs in digital transformation can be seen in the cases of ABB Xiamen Industrial Center and Sanbao Group. ABB has embraced a more radical approach by integrating advanced automation systems, AI-driven predictive maintenance, and digital twin technology. This transformative shift has allowed ABB to leapfrog traditional manufacturing processes, achieving high levels of efficiency and sustainability. The path towards breakthroughs in digital transformation often requires overcoming significant barriers such as financial constraints, resistance to change, and lack of expertise. These breakthroughs not only improve operational performance but also help companies redefine their business models to become more competitive in the global market.

6.2 Policy-Enterprise Synergy

The synergy between government policies and enterprise strategies plays a crucial role in accelerating digital transformation in Fujian. National and regional policies, such as the "Made in China 2025" initiative and Fujian's local support for digital infrastructure, provide a favorable environment for businesses to invest in digital technologies. For instance, the incentives for green technologies and smart manufacturing parks have been pivotal in helping firms like Sanbao Group upgrade their manufacturing systems. Policies that encourage public-private partnerships have fostered collaboration, leading to the successful implementation of digital initiatives and the establishment of innovation hubs.

At the enterprise level, companies have adapted and aligned their strategies with government priorities. ABB's commitment to energy-efficient and low-carbon technologies aligns with China's dual-carbon goals, while Sanbao Group's focus on AI-controlled hot-rolling technology complements Fujian's emphasis on green and intelligent manufacturing. The alignment of policies and enterprise strategies ensures that digital transformation efforts are not only financially viable but also contribute to the overall national agenda of fostering a sustainable and competitive industrial ecosystem.

6.3 Barriers and Enablers

Several barriers include the high costs associated with technology adoption, the complexity of integrating new digital tools into legacy systems, and the shortage of skilled labor capable of managing advanced technologies. SMEs struggle with limited access to high-end technologies, making it difficult to compete with larger firms that can afford substantial investments in digital infrastructure. On the other hand, enablers of digital transformation include the availability of government incentives, the growing adoption of cloud computing, and advancements in IoT, AI, and automation technologies. The support from innovation platforms and research institutions, as seen in the collaborations between Sanbao Group and leading research centers, has also facilitated knowledge transfer and technological upgrading. Additionally, the increasing availability of affordable digital solutions has made it easier for smaller firms to begin their digital transformation journey. The combination of these enablers and a supportive policy environment paves the way for sustained digital growth in Fujian's manufacturing sector.

The comparative analysis reveals divergent digital transformation pathways between ABB Xiamen and Sanbao Group, shaped by their distinct industrial contexts and strategic priorities. ABB Xiamen adopts radical innovation, leveraging IoT, robotics, and global sustainability standards (e.g., 50% solar integration) to pioneer smart energy systems and digital twins, aligning with its role as a multinational automation leader. In contrast, Sanbao Group prioritizes incremental upgrades, retrofitting legacy steelmaking processes with AI-controlled emission monitoring and short-process techniques to comply with national green mandates while minimizing operational disruption. These pathways reflect broader sectoral trends: ABB's advanced manufacturing model emphasizes global technological leadership, whereas Sanbao's traditional heavy industry focuses on pragmatic, policy-driven efficiency gains. Both firms, however, converge in using AI and sustainability as core levers for transformation.

Dimension	ABB Xiamen Industrial Center	Sanbao Group
Innovation Strategy	Radical (AI-driven predictive maintenance, digital twins)	Incremental (AI retrofits to legacy systems)
Policy Engagement	Aligns with global sustainability standards (e.g., net-zero)	Complies with national green manufacturing mandates
Technology Adoption	IoT, robotics, smart energy systems	AI-controlled hot rolling, emission monitoring
Sustainability Focus	Renewable energy integration (50% solar)	Short-process steelmaking (15–20% energy reduction)

Table1， Comparative Analysis of Digital Transformation Pathways: ABB Xiamen vs. Sanbao Group

VII. Implications and Recommendations

7.1 Implications for Policymakers

The synergy between government policies and enterprise strategies is critical for advancing digital transformation in manufacturing. The study highlights the importance of creating a favorable policy environment that supports both large corporations and small and medium-sized enterprises (SMEs). Policymakers should focus on providing targeted financial incentives, tax breaks, and grants to encourage SMEs to invest in digital technologies, as these firms often face greater challenges in adopting high-end solutions. Additionally, continued investment in digital infrastructure, particularly in rural and less-developed areas, can help bridge the digital divide and ensure that the benefits of digital transformation are distributed more equitably across regions. Initiatives such as the establishment of more digital innovation hubs, public-

private partnerships, and specialized training programs for the workforce are crucial. The success stories of enterprises like ABB and Sanbao Group demonstrate the potential benefits of aligning digital transformation strategies with national policy objectives, particularly in areas such as green energy, sustainability, and high-end manufacturing.

7.2 Implications for Enterprises

The case studies of ABB Xiamen Industrial Center and Sanbao Group underscore the importance of adopting a multi-dimensional approach to digital transformation. Companies should not only invest in advanced technologies but also ensure that organizational structures, leadership, and workforce skills are aligned with digital strategies. This includes fostering a culture of innovation and continuous improvement, which is essential for integrating new technologies and processes.

Moreover, enterprises should carefully evaluate the specific technological needs that will drive their transformation. For instance, adopting IoT, AI, and automation can significantly improve productivity and reduce costs, but these technologies need to be integrated thoughtfully into existing operations. Companies should also consider the potential benefits of digital twin models and predictive maintenance, which can enhance operational resilience and reduce downtime.

Firms should be proactive in exploring opportunities for collaboration with research institutions, universities, and other industry leaders. The development of partnerships that facilitate knowledge exchange, access to cutting-edge research, and the implementation of best practices can further accelerate digital transformation efforts.

7.3 Recommendations for Future Research

Future research should further explore the role of organizational culture and leadership in driving digital transformation in the manufacturing sector. While this study has highlighted the importance of these factors, more in-depth research is needed to understand how different leadership styles and organizational cultures influence the success of digital transformation initiatives across different sectors.

There is a need for more research into the specific barriers faced by SMEs in the digitalization process. Understanding the unique challenges and constraints faced by these firms, such as limited access to funding and skilled labor, can help inform policies and strategies to better support their digital transformation.

As digital transformation is an ongoing and evolving process, future studies should investigate the long-term impacts of digitalization on firm competitiveness, productivity, and sustainability. Research into how digital tools affect the environmental, social, and governance (ESG) aspects of manufacturing could provide valuable insights into how companies can create sustainable value through digital transformation.

VII. Conclusion

This study emphasizes the importance of a holistic approach to digital transformation in Fujian's manufacturing sector, where technological innovation, organizational transformation, and policy alignment must function together to drive progress. Understanding the interplay of these factors enables companies to navigate the challenges of integrating advanced technologies while overcoming the constraints of legacy systems. The research also highlights the significance of fostering collaboration between government, industry, and enterprises, ensuring that policies are tailored to support both large corporations and SMEs. Aligning digital strategies with a culture of innovation and investing in the right skills will be key to enhancing productivity, sustainability, and competitiveness in the evolving manufacturing landscape.

References

[1] Q. Wu and Y. Yao, "Digital Transformation and Supply Chain Configuration: Centralization or Diversification?" China Industrial Economy, no. 08, pp. 99–117, 2023.

[2] C. Liu, H. Pan, P. Li, and Y. Feng, "The Impact and Mechanism of Digital Transformation on Green Innovation Efficiency in Manufacturing Enterprises," China Soft Science, no. 04, pp. 121–129, 2023.

[3] H. Wang, Z. Yan, G. Guo, and J. Yin, "Digital Infrastructure Policy and Enterprise Digital Transformation: Empowerment or Burden?" Quantitative & Technological Economics Research, vol. 40, no. 05, pp. 5–23, 2023.

[4] F. Tao, X. Wang, Y. Xu, and P. Zhu, "Digital Transformation, Supply Chain Resilience, and Firm Productivity," China Industrial Economy, no. 05, pp. 118–136, 2023.

[5] Y. Liu, "Digital Economy Empowering High-Quality Development of Enterprises: Empirical Evidence Based on Total Factor Productivity," Reform, no. 9, pp. 35–53, 2022.

[6] C. Zhao, W. Wang, and X. Li, "How Does Digital Transformation Affect Total Factor Productivity of Enterprises," Finance & Trade Economics, vol. 42, no. 7, pp. 114–129, 2021.

[7] J. Yang, Q. Peng, and Z. Ge, "The Customer Contagion Effect of Digital Transformation—From the Perspective of Supplier Innovation," China Industrial Economy, no. 8, pp. 156–174, 2022.

[8] Q. Wu and Y. Yao, "Enterprise Digital Transformation and Supply Chain Configuration: Centralization or Diversification," China Industrial Economy, no. 8, pp. 99–117, 2023.

[9] F. Tao, X. Wang, Y. Xu, and P. Zhu, "Digital Transformation, Supply Chain Resilience, and Enterprise Productivity," China Industrial Economy, no. 5, pp. 118–136, 2023.

[10] H. Wang, Z. Yan, G. Guo, and J. Yin, "Digital Infrastructure Policies and Enterprise Digital Transformation: Empowerment or Burden," Quantitative & Technological Economics Research, vol. 40, no. 5, pp. 5–23, 2023.

[11] D. Yu, C. Wang, and L. Chen, "Government Subsidies, Industrial Chain Collaboration, and Enterprise Digitalization," Economic Management, vol. 44, no. 5, pp. 63–82, 2022.

[12] H. Wang, X. Xu, and Y. Liu, "How Does Digital Finance Empower Enterprise Digital Transformation? Empirical

Evidence from China," Finance & Economics Review, no. 10, pp. 3–13, 2022.
[13] W. Li, W. Pan, and K. Yuan, "Enterprise Digital Transformation and the Development of the Real Economy in China," Quantitative & Technological Economics Research, vol. 39, no. 9, pp. 5–25, 2022.
[14] F. Bai, D. Liu, and K. Dong, "How Digital Transformation Affects Financial Performance—A Structural Equation Model Analysis," East China Economic Management, vol. 36, no. 9, pp. 75–87, 2022.
[15] X. Yin, X. Zhan, and S. Tang, "Mechanism of Digital Transformation Impacting Manufacturing Firms' Financial Performance," China Business Economics, vol. 36, no. 7, pp. 96–106, 2022.
[16] J. Hu, Y. Han, and Y. Zhong, "How Digital Transformation Affects ESG Performance—Evidence from Chinese Listed Companies," Industrial Economy Review, no. 1, pp. 105–123, 2023.
[17] T. Xie, R. Sun, and W. Qi, "Can Digital Wings Boost High-Quality Development of Enterprises—Empirical Evidence from Innovation," Economic Management, vol. 44, no. 5, pp. 41–62, 2022.
[18] Y. Zhang, X. Sun, and Q. Qian, "Value Creation and Evolution in Traditional Manufacturing Digital Transformation—A Resource Orchestration Perspective," Economic Management, vol. 44, no. 4, pp. 116–133, 2022.