DOI: 10.53469/wjimt.2025.08(06).17

Research on the Transformation Paths of Traditional Enterprises in Jiujiang City in the Context of Intelligent Manufacturing

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Abstract: ***With the rapid development of new-generation information technologies, intelligent manufacturing has become a key direction for the transformation and upgrading of China's manufacturing sector. As a major industrial city in Jiangxi Province, Jiujiang's traditional enterprises face both policy opportunities and multifaceted challenges in terms of technology, talent, and management during their transformation. Against the backdrop of intelligent manufacturing, this paper reviews relevant theoretical foundations and existing research, analyzes the practical difficulties and developmental characteristics of traditional enterprises in Jiujiang, and constructs three typical transformation path models: "technology-driven," "management-optimization," and "collaborative-integration." On this basis, the study proposes promoting high-quality intelligent transformation of regional enterprises through three approaches: government policy guidance, internal capability enhancement, and industry-university-research collaboration. The research findings offer both theoretical insight and practical guidance for local government policymaking and enterprise decision-making regarding transformation paths.***

Keywords: Intelligent manufacturing; Traditional enterprises; Transformation paths; Jiujiang City; Digital transformation.

1. INTRODUCTION

In recent years, with the advancement of a new wave of scientific and technological revolution and industrial transformation, intelligent manufacturing has emerged as a vital force in driving the transformation and upgrading of the manufacturing sector. The 14th Five-Year Plan for the Development of Intelligent Manufacturing issued by the State Council explicitly emphasizes the need to accelerate the digital transformation, networked collaboration, and intelligent development of the manufacturing industry to modernize industrial chains. Within this context, how traditional enterprises can seize these opportunities and plan effective transformation paths has become a topic of growing interest among local governments, the business sector, and academia. For Jiujiang—an important regional city located in the middle reaches of the Yangtze River—facilitating the transformation of traditional enterprises toward intelligent manufacturing is not only essential for enhancing industrial competitiveness, but also key to achieving high-quality regional economic development.

Traditional enterprises generally struggle with overcapacity, low efficiency, and weak technological foundations. In the face of the intelligent manufacturing wave, their transformation pressures have become increasingly pronounced. On the one hand, some companies maintain only a superficial understanding of intelligent manufacturing, lacking systematic knowledge and top-level design; on the other hand, many enterprises are constrained by limited financial resources, technical capabilities, and talent. Therefore, it is imperative to analyze the current status and challenges of traditional enterprise transformation in Jiujiang City, taking into account regional characteristics, and to explore intelligent manufacturing pathways suited to the local context. This will help provide both theoretical support and strategic guidance for practical implementation.

At present, numerous scholars have investigated the relationship between intelligent manufacturing and enterprise transformation, focusing on areas such as system architecture [1], digital capability development [2], and transformation strategies [3][4]. However, most of this research concentrates on national-level or economically developed regions, with limited focus on central China's mid-sized cities and small-to-medium-sized traditional enterprises. This paper takes Jiujiang City as a case study to systematically identify the main challenges faced by traditional enterprises in the current intelligent manufacturing environment. It aims to analyze their typical transformation paths and selection mechanisms in order to provide replicable and scalable experiences for traditional manufacturing enterprises in similar regional contexts.

2. THEORETICAL BASIS AND LITERATURE REVIEW

As the core concept of the "new industrial revolution," intelligent manufacturing represents the deep integration of new-generation information technologies—such as artificial intelligence, the Internet of Things, big data, and cloud computing—with traditional manufacturing technologies. The goal is to achieve intelligent perception, decision-making, and execution within manufacturing systems. According to Germany's "Industry 4.0" strategy and China's Made in China 2025 initiative, intelligent manufacturing is not merely a technological upgrade but also a comprehensive restructuring of enterprise organization, business processes, management systems, and even business models [5]. As a result, enterprises undergoing transformation must confront not only technological substitutions but also fundamental shifts in their operational logic.

Research on enterprise transformation paths can generally be divided into two perspectives: (1) macro-level classifications of path types and strategic decision-making, and (2) micro-level capability building and organizational transformation. From the macro perspective, Porter's theory of competitive strategy suggests that enterprises can achieve competitive advantage through cost leadership, differentiation, or focus strategies [6]. Under the framework of intelligent manufacturing, these strategies evolve into various forms such as automation upgrades, product intelligence, and service transformation. Taherdoost (2024) further categorized enterprise digital transformation paths into three dominant types: technology-led, data-driven, and platform-based collaborative models [7]. From a micro-level perspective, Teece et al. proposed the theory of dynamic capabilities, arguing that firms must sense changes, integrate resources, and reconfigure internal processes in order to adapt to external environments—an approach that aligns closely with the essence of intelligent manufacturing [8].

In China, domestic scholars have conducted extensive multi-level research on enterprise intelligent transformation. For instance, Xing et al. (2023) emphasized that transformation success hinges not only on technology adoption but also on the alignment of organizational mechanisms and workforce competencies [9]. Liang (2024) highlighted that transformation paths must be tailored to regional industrial structures and resource conditions, cautioning against "one-size-fits-all" solutions [10]. Moreover, researchers such as Zhu & Ouyang (2025) have explored the role of local governments in facilitating enterprise transformation, asserting that public policies, financial subsidies, and industrial alliances significantly help mitigate risks during the transition [11].

In summary, existing research provides a strong theoretical foundation for understanding intelligent manufacturing and enterprise transformation. However, several gaps remain. First, there is a lack of in-depth analysis of traditional enterprises in central and third-tier cities in China. Second, most studies emphasize technological routes while neglecting the interplay of organizational, managerial, and policy factors. Third, little attention has been paid to the internal mechanisms that influence how firms select, adapt, and evolve their transformation paths. To address these gaps, this study integrates the regional and industrial characteristics of Jiujiang City and proposes a multidimensional framework for analyzing transformation paths in traditional enterprises. The goal is to offer actionable, context-specific guidance for enterprise practice under the broader theme of intelligent manufacturing.

3. CURRENT STATUS AND CHALLENGES OF TRADITIONAL ENTERPRISE TRANSFORMATION IN JIUJIANG CITY

As one of Jiangxi Province's key industrial cities, Jiujiang has a solid foundation in traditional industries such as equipment manufacturing, food processing, building materials, textiles, and pharmaceuticals. These sectors have long occupied a dominant position in the city's industrial structure and played a significant role in driving local economic development. However, with the rapid advancement of new technologies, traditional enterprises are facing growing pressure to transform. There is an urgent need to achieve industrial upgrading, managerial innovation, and efficiency improvements through the implementation of intelligent manufacturing.

On the one hand, from an overall development perspective, traditional enterprises in Jiujiang have already developed a certain degree of transformation awareness and a preliminary technological foundation. In recent years, the municipal government has introduced a series of policy initiatives to support digital transformation, such as the "Strong Industrial City" strategy, the "Digital Jiujiang" initiative, and the "Special Action Plan for Manufacturing Digitalization." These policies have created a favorable external environment for enterprise innovation. Many large-scale enterprises have begun adopting intelligent manufacturing technologies, including MES systems, automated production lines, and ERP platforms. Some leading enterprises have even launched pilot programs for smart workshops and digital factories, laying the groundwork for broader intelligent manufacturing deployment.

On the other hand, the actual implementation of these transformations reveals numerous challenges and bottlenecks. First, the technological foundation remains weak, and transformation pathways are often unclear. Most small and medium-sized enterprises (SMEs) are still in early stages of automation, lacking systematic digital thinking and comprehensive planning. As a result, the overall level of intelligentization remains low. Second, insufficient capital investment hinders transformation motivation. The high costs and long investment cycles associated with intelligent manufacturing technologies make many enterprises—particularly privately owned SMEs—reluctant to invest heavily, resulting in sluggish progress. Third, a severe shortage of skilled talent limits transformation capacity. There is a significant gap in the availability of professionals with expertise in intelligent manufacturing technologies and interdisciplinary management, and many enterprises lack dedicated teams to plan, implement, and maintain digital systems. Fourth, outdated management structures and weak organizational coordination further constrain transformation. Many companies continue to operate under traditional hierarchical management models that are ill-suited to the process reengineering and organizational restructuring required by intelligent manufacturing.

Furthermore, survey data show that different types of enterprises adopt markedly different transformation paths. Larger enterprises, often backed by group-level resources, tend to pursue holistic intelligentization—integrating intelligent systems across R&D, production, and supply chain operations. In contrast, most SMEs adopt modular transformation strategies due to resource constraints, prioritizing upgrades to critical equipment or information systems as a phased approach to digital transformation. These differences suggest that there is no one-size-fits-all solution to intelligent manufacturing; transformation pathways must be tailored to each enterprise’s operational reality and development stage.

In summary, traditional enterprises in Jiujiang have made initial progress toward intelligent manufacturing, but still face considerable structural and capability-related barriers. Critical challenges remain in the areas of pathway selection, resource integration, and capacity building, requiring systematic research and strategic guidance. Based on these issues, the following chapter develops a transformation path model aligned with regional characteristics, enterprise typologies, and influencing factors.

4. CONSTRUCTION AND ANALYSIS OF TRANSFORMATION PATH MODELS

Given the heterogeneity and complexity of transformation among traditional enterprises in Jiujiang, it is essential to construct a multi-dimensional, typology-based, and action-guiding transformation path model. Such a model enables enterprises to select intelligent manufacturing strategies that are both well-matched to their internal conditions and practically operable [12]. Drawing on the theory of dynamic capabilities [6] and the resource-based view [13], this study categorizes enterprise transformation paths into three archetypes: technology-driven, management-optimization, and collaborative-integration. Based on these categories, a three-dimensional analytical model of “enterprise characteristics – path selection – capability configuration” is proposed.

The technology-driven path is most suitable for medium to large enterprises with robust financial resources and strong technical foundations. These enterprises typically possess independent IT departments and have the capacity to develop or integrate automated and digital systems in-house. Their transformation prioritizes automation of production processes, integration of core systems, and intelligent decision-making capabilities. The key feature of this path is the rapid establishment of technological barriers that enhance operational efficiency and responsiveness. For instance, several equipment manufacturers in Jiujiang have successfully transitioned from manual processes to smart workshop operations, exemplifying the “technology-first, systems-integrated” model.

The management-optimization path is more appropriate for SMEs with limited resources but relatively mature management practices. This transformation path does not rely heavily on cutting-edge technologies but rather focuses on process refinement through ERP optimization, workflow standardization, and digital performance evaluation. Its core logic is “management-led transformation,” progressively enabling data-driven operations, information transparency, and managerial modernization. For SMEs in Jiujiang, this model offers a viable “low-cost, high-return” approach with lower technical risks and greater adaptability.

The collaborative-integration path is designed for enterprises situated at the core of the industrial value chain or those possessing strong capabilities in external resource coordination. These firms focus not only on internal digital upgrades but also emphasize upstream and downstream integration. By forming partnerships with suppliers, clients, and research institutions, they construct integrated ecosystems that blend platforms, data, and services. This path aims to achieve cross-organizational, system-wide intelligent collaboration. In Jiujiang, some large enterprise groups have begun to collaborate with local universities to establish joint laboratories for intelligent manufacturing, creating model cases of this transformation strategy.

During the model construction process, variables such as enterprise size, industry characteristics, technological maturity, managerial capabilities, human capital, and external resources significantly influence the selection and effectiveness of transformation paths. Therefore, this study advocates a “classified guidance, phased implementation” approach. Enterprises should formulate path strategies based on their specific conditions and transformation readiness to avoid applying uniform solutions to diverse challenges. Moreover, a dynamic feedback mechanism should be established to monitor and adjust the transformation process in real time, ensuring sustained progress and optimal outcomes.

In conclusion, by identifying three transformation archetypes and aligning them with enterprise characteristics, this path model offers a strategic framework for enhancing the feasibility and scientific rigor of intelligent manufacturing transformation in traditional enterprises in Jiujiang. The next chapter provides targeted policy and practical recommendations to support implementation, focusing on government action, enterprise engagement, and industry-university-research collaboration.

5. POLICY AND PRACTICAL RECOMMENDATIONS

Building upon the three transformation path models proposed earlier and in response to the current challenges faced by traditional enterprises in Jiujiang City, this chapter presents targeted and actionable recommendations across three levels: government policy guidance, internal enterprise initiatives, and industry–university–research collaboration. These recommendations aim to support the orderly and efficient advancement of intelligent manufacturing transformation across the city.

First, at the government level, efforts to strengthen policy direction and institutional support should be sustained. It is recommended to introduce specialized support policies for the digital transformation of small and medium-sized enterprises (SMEs) and to establish a dedicated Intelligent Manufacturing Development Fund to subsidize equipment acquisition, system upgrades, and technical consulting. Additionally, the formulation of local standards for intelligent manufacturing should be promoted to guide enterprises toward structured transformation and to prevent inefficient or redundant investment. A comprehensive assessment and diagnostic mechanism should also be developed, allowing expert teams to conduct “transformation health checks” for enterprises to identify gaps and clarify suitable strategic directions. Moreover, the government should create robust platforms to connect enterprises with universities and research institutes, facilitating knowledge exchange, accelerating technology transfer, and offering services such as policy interpretation, project guidance, and talent recruitment.

Second, at the enterprise level, companies must strengthen their ownership of the transformation process and improve internal adaptability. Enterprises should select transformation paths aligned with their development stages and resource conditions to avoid ill-informed or superficial transitions into intelligent manufacturing. It is advisable to provide digital transformation training to raise awareness among senior and mid-level managers and to enhance strategic planning capabilities. At the same time, enterprises should invest in building skilled teams—particularly in fields such as data analytics, intelligent operations, and systems integration. Internal organizational structures and workflows should also be optimized to enable seamless data integration and collaborative system operation. Establishing dedicated internal units such as “Digital Transformation Task Forces” or “Smart Manufacturing Offices” is encouraged to coordinate external partnerships and ensure cross-functional alignment.

Third, in terms of industry–university–research collaboration, a diversified and flexible cooperation framework should be developed to maximize resource synergy and complementary expertise. Universities and research institutes can leverage existing laboratories, innovation platforms, and training centers to provide enterprises with technical consulting, applied research, and workforce development services. Joint initiatives such as “Intelligent Manufacturing Laboratories” and “Enterprise Practice Training Bases” should be promoted to realize co-development of projects, joint talent cultivation, and shared outcomes. Additionally, a tripartite collaboration model involving government, universities, and enterprises should be explored to support high-impact research, co-develop industry standards, and construct regional think tanks. Through sustained cooperation mechanisms, scientific research can be effectively aligned with enterprise needs, thereby enhancing the technical and innovative capabilities necessary for successful transformation.

By coordinating efforts across policy, practice, and academic-industry engagement, Jiujiang City can gradually establish a comprehensive ecosystem for intelligent manufacturing transformation—one that is enterprise-led, government-supported, university-backed, and market-driven. This ecosystem will provide the structural conditions and momentum needed to help traditional enterprises achieve successful digital and intelligent upgrades.

6. CONCLUSION

In the context of intelligent manufacturing, traditional enterprises face both the practical pressures and strategic opportunities of deep structural transformation. Taking Jiujiang City as the focal region, this paper has systematically examined the status quo and challenges of traditional enterprise transformation and proposed three distinct transformation path models—technology-driven, management-optimization, and collaborative-integration. On this basis, the study offered a set of policy and practical recommendations tailored to regional needs.

The theoretical contribution of this research lies in the development of a multi-path transformation model grounded in regional characteristics. This approach addresses the gap in empirical studies on intelligent manufacturing transformation among small and medium-sized cities in central China. The practical value of the study is reflected in its guidance for local governments on policy formulation and for enterprises in developing transformation strategies that are both structured and actionable.

Nonetheless, due to time constraints and data limitations, the study has not yet incorporated extensive empirical surveys or in-depth case analyses of representative enterprises. Future research could further integrate large-scale survey data and real-world case studies to validate the effectiveness and adaptability of the proposed transformation paths. This would strengthen the model’s applicability and generalizability across different contexts. Additionally, the research scope could be extended to include themes such as supply chain coordination and regional innovation platform development. These expansions would contribute more systematic theoretical support and practical insights for the intelligent upgrading of traditional industries—not only in Jiujiang City but across Jiangxi Province and similar regions.

FUNDING

This research was supported by the Jiangxi University Humanities and Social Sciences Research Project (GL23133); Jiangxi Provincial Social Science Foundation Project (24GL65D); Jiangxi Polytechnic University Doctoral Research Grant (JZBK24-1-8); Jiujiang Social Science Foundation Project (25YB263); Jiujiang Social Science Foundation Project (25YB230).

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