Application Research of Low-code Technology in Intelligent Transformation of Wenzhou Manufacturing Enterprises

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Abstract

With the trend of digitalization and intelligence, Wenzhou manufacturing enterprises are actively undergoing intelligent transformation. Low-code technology is a rapid application development method with advantages of efficiency, low cost, and reduced difficulty in code writing, and has received wide attention and application. This article aims to explore the application of low-code technology in the intelligent transformation of Wenzhou manufacturing enterprises. By analyzing the characteristics, advantages, and development status of low-code technology and combining with the research on the intelligent transformation of Wenzhou manufacturing enterprises, this article focuses on discussing the application practices of low-code technology in production line automation, quality management, and equipment maintenance. Finally, it concludes that the application of low-code technology can improve the efficiency of enterprise digital transformation, reduce development costs, and promote innovative capabilities, providing reference and value for the intelligent transformation of Wenzhou manufacturing enterprises.

Keywords

Low-code technology,manufacturing industry, intelligent transformation.

1. Introduction

With the continuous development of technology, digitalization and intelligence have become important trends in today's enterprise development. Along with this trend, the transformation and upgrading of the manufacturing industry and the acceleration of intelligent transformation are becoming increasingly evident. As one of the major manufacturing centers, Wenzhou actively responds to national policies, promotes digital transformation and intelligent manufacturing. Nowadays, more and more Wenzhou manufacturing enterprises are introducing low-code technology to achieve intelligent transformation, improve production capacity and efficiency, and expand market share. Therefore, the research on the application of low-code technology in the intelligent transformation of Wenzhou manufacturing enterprises is particularly important.

2. Characteristics and Development Status of Low-code Technology

2.1. Characteristics of Low-code Technology

Low-code technology refers to a development method that utilizes visual modeling tools and automated programming methods, allowing non-professional programmers to create software applications using simple drag-and-drop and configuration methods[1]. Compared to traditional software development processes, low-code technology can significantly shorten the development time and cost of applications. It has the following characteristics.

Visual modeling tool: Typically, a graphical interface is used instead of handwritten code, allowing users to create applications with simple drag-and-drop and configuration methods.

High automation: Low-code platforms typically have template-based automatic publishing and deployment functions, reducing manual operations and increasing productivity.

Wide applicability: Low-code technology is not only suitable for the development of enterprise-level applications, but also for fields such as mobile application development.

Flexibility: Low-code platforms typically support multiple development languages and platforms, which can adapt to different development needs and scenarios.

Low requirements for developer skills: Low-code technology allows personnel without advanced programming skills to easily build applications, reducing resource costs and labor inputs.

2.2.   Advantages of Low-code Technology Application

Improve development efficiency: Low-code technology allows developers to build applications faster, saving time and effort. Since there is no need to write a large amount of code, developers can focus on designing and implementing the application's features.

Increase enterprise flexibility: Low-code technology can facilitate faster application development and iteration, meaning that companies can respond more quickly to market demands and customer feedback, thereby increasing enterprise flexibility.

Reduce development costs: Since low-code technology reduces the amount of code writing required, the time and cost spent by developers will also decrease. Additionally, low-code technology can improve productivity and quality, thereby reducing potential errors and repetitive work.[2]

Improve application quality: Low-code technology provides a visual design and development platform, allowing developers to better understand the structure and functionality of the application, leading to higher quality applications.

Increase user engagement: Low-code technology enables non-professionals to easily create their own applications, which can increase user engagement and interactivity.

In summary, low-code technology can help companies develop and deploy applications faster and more flexibly, thereby increasing competitiveness and innovation capabilities.

2.3.   Current Status of Low-code Technology Development

Low-code development is an emerging software development model characterized by fast building, efficient collaboration, and lightweight scalability. Its main purpose is to improve software development efficiency, reduce development costs, and speed up project delivery. In recent years, low-code technology has been widely applied and is rapidly developing.

According to Gartner's prediction, the global low-code market will reach 43.6 billion US dollars by 2024, which is 23 times higher than in 2019. At the same time, more and more enterprises are paying attention to the application of low-code technology. About 60% of American companies have used or are using low-code development platforms. Similarly, more and more Chinese companies are trying to use low-code technology for development.[3]

In recent years, low-code technology has been widely applied and developed, mainly in the following aspects.

Continuous growth in market demand: As digital transformation deepens and application development costs continue to rise, the demand for low-code technology from enterprises continues to grow.

Gradual maturity of products: Numerous low-code platforms have been launched and verified in the market, with high maturity and stability, which can meet various needs of enterprise application development.

Continuous technological innovation: Low-code technology is continuously innovating, such as enhancing automation through AI/ML and natural language programming interfaces that are more accessible to developers. This will make low-code technology have a broader application prospect.

Rich practical cases: Low-code technology has been successfully applied in some fields, such as CRM systems, IoT applications, data processing and visualization, etc.

Change in developers' roles: Low-code technology can reduce the demand of enterprises for high-end development talents and allow developers to focus more on solving specific business problems, thereby accelerating the development and deployment of applications.

In addition, with the development of technologies such as artificial intelligence and machine learning, low-code platforms are continuously integrating these advanced technologies, making applications more intelligent, adaptive, and user-friendly. Therefore, its application fields are becoming broader, with a wider coverage and strong potential and prospects.

3. The Current Status of Intelligent Transformation in Domestic and Wenzhou Manufacturing Industry

Currently, the intelligent transformation of the manufacturing industry in China, including Wenzhou, is in a stage of advancement. With the progress of new industrialization, informatization, urbanization, and agricultural modernization, China's manufacturing industry is facing enormous market demand. The needs for new equipment in various industries, the emerging consumer demands of the people, the improvement of societal management and public service requirements, as well as the increasing security demands in national defense development, all require the manufacturing industry to rapidly enhance its capabilities and levels in terms of major technological equipment innovation, consumer product quality and safety, supply of public service facilities and equipment, and defense equipment safeguarding.

To stimulate the vitality and creativity of the manufacturing industry, China is comprehensively deepening reforms and further expanding its openness. This will help promote the transformation and upgrading of the manufacturing industry.

3.1. The Current Status of Intelligent Transformation in Domestic Manufacturing Industry

In recent years, provinces and cities across the country have effectively implemented the transformation and upgrading of intelligent manufacturing, achieving certain results. For example, in Jinjiang City, Fujian Province, nearly 100 million yuan is invested annually to support enterprises in introducing high-end equipment and technology, and implementing intelligent transformation and upgrading. Under the normal epidemic prevention and control measures, intelligent workshops in Jinjiang's manufacturing enterprises have greatly contributed to full-capacity production, significantly improving production efficiency.

In Daye City, Hubei Province, they adhere to a model of "intelligent diagnostic services + cultivation and promotion + creating benchmark demonstrations + rewards and publicity + promoting application". They organize technical teams in batches to provide intelligent diagnostic services for aluminum profiles enterprises throughout the city, issue reports on intelligent transformation diagnosis, and assist enterprises in implementing intelligent construction such as equipment replacement, production line transformation, and data cloudification to reduce production costs and enhance product quality. "Digital transformation and the transformation of intelligent factories are essential. Although there is a significant cost investment in the transformation, after completion, our production costs have decreased by 15% and efficiency has increased by 20%, truly achieving cost reduction and efficiency improvement for the enterprise!"

3.2. Current Status of Intelligent Transformation in Wenzhou's Manufacturing Industry

In recent years, with the increasing attention and support from the Wenzhou Municipal Party Committee and Government, the concept of intelligent manufacturing has become deeply rooted in people's minds. More and more "digital workshops" and "intelligent factories" have rapidly emerged and flourished in Wenzhou. They have not only profoundly changed the production, management, and operation models of traditional manufacturing industries but also become a powerful support for transforming and upgrading traditional industries, cultivating and expanding new driving forces, and promoting high-quality economic development in Wenzhou.

Data shows that through intelligent technological transformation, operating costs of enterprises in Wenzhou have generally decreased by 20%-30%, product defect rates have decreased by 20%-40%, energy consumption per unit has decreased by 10%-20%, the number of frontline workers has reduced by over 20%, and production capacity has increased by over 30%.

While moving towards the era of new intelligent manufacturing, "Wenzhou Manufacturing" has also embarked on a new journey of green transformation. With the goal of creating a "leading zone for green transformation of traditional manufacturing industries in the province", Wenzhou has comprehensively implemented the energy-saving transformation action plan for thousands of manufacturing enterprises. It focuses on four key areas: energy-saving on production lines, clean energy, energy storage applications, and supporting upgrades. By 2023, Wenzhou aims to achieve a 9% reduction in energy consumption per unit of added value in the industrial sector, realizing dual optimization of the energy structure and industrial structure in the industrial field.

4. The Current Application Status of Low-Code Technology in the Intelligent Transformation of Wenzhou's Manufacturing Industry

In recent years, with the increasing demand for intelligent transformation in Wenzhou's manufacturing industry, the application of low-code technology in this field has received wide attention and practice. Currently, some manufacturing companies in Wenzhou have begun adopting low-code platforms for development and have achieved significant results.

Firstly, in terms of production line automation, a manufacturing company in Wenzhou has built an intelligent production line using a low-code platform, achieving automation of the production process and reducing manual intervention. This has improved production efficiency and product quality.

Secondly, in quality management, a knitting company has developed a defect detection system based on artificial intelligence using a low-code platform. This system utilizes advanced technologies such as deep learning and image processing, successfully addressing issues such as high error rates and low efficiency in the original quality inspection process. It has improved product quality and production efficiency.

Furthermore, in equipment maintenance, some manufacturing companies have also developed intelligent maintenance systems using low-code platforms. These systems monitor equipment operation in real-time, provide early warning of faults, and automate repairs. As a result, they have reduced production line downtime and maintenance costs, improving equipment operating efficiency and enterprise profitability.

The application of low-code technology in the intelligent transformation of Wenzhou's manufacturing industry is rapidly advancing and has broad prospects and significance.

4.1. Application Practice of Low-Code Technology in the Intelligent Transformation of Wenzhou Manufacturing Enterprises

Based on the preliminary research conducted on manufacturing enterprises in Wenzhou, the application of low-code technology in the intelligent transformation of enterprises can be summarized as follows:

Application of Low-Code Technology in Production Line Automation

The application of low-code technology in production line automation is extensive. Through low-code platforms, enterprises can develop automation systems that meet their specific needs, transforming manual operations into automated processes. This improves production efficiency, product quality, while reducing costs and risks.

In the manufacturing industry, low-code technology can be used in various aspects such as automated material procurement, inventory management of components, assembly process control, and automated inspection. By utilizing low-code platforms, developers can quickly build material procurement automation systems that automate the entire process from demand, procurement, receipt to payment, significantly improving efficiency and accuracy.

Furthermore, low-code platforms can be used to develop automated factory process control systems for assembly operations. This system, built using low-code platforms, guides robots through the assembly process according to the defined production routes. It reduces human intervention, improves assembly efficiency, product quality, and reduces quality issues caused by human factors.

It is evident that the application prospects of low-code technology in production line automation are broad. It provides continuous innovation and optimization space, offering strong support for the digital transformation of production lines.

4.1.1. Application of Low-Code Technology in Quality Management

The application of low-code technology in quality management is crucial. Through low-code platforms, enterprises can rapidly develop quality management systems tailored to their specific needs. This enables the automation of the entire quality management process, resulting in improved product quality, reduced defect rates, and lower costs and risks.

In the manufacturing industry, low-code platforms can be utilized to develop quality inspection systems based on production routes. These systems guide robots to perform automated testing and inspection, reducing the influence of human factors and ensuring stable product quality. Additionally, low-code platforms can be used to quickly build quality analysis and data visualization tools, facilitating real-time monitoring of product quality by the production department and management team. This enables timely adjustments to production processes and parameters, enhancing product quality stability and reliability.[4]

In supply chain management, low-code technology can be applied to develop real-time monitoring systems. These systems integrate information from various stages of the supply chain, enabling tracking and monitoring of the entire supply chain. By leveraging low-code platforms, warning and risk investigation tools can be quickly developed to identify and resolve quality issues promptly. This ensures the stability and reliability of the supply chain.

To sum up, the application prospects of low-code technology in quality management are vast. It provides continuous innovation and optimization space, offering strong support for improving enterprise quality management and production efficiency.

4.1.2. Application of Low-Code Technology in Equipment Maintenance

The application of low-code technology in equipment maintenance is also crucial. Through low-code platforms, enterprises can quickly develop equipment maintenance systems tailored to their specific needs. This transforms existing manual operations into automated processes,

thereby improving equipment reliability and stability, reducing downtime, and lowering production costs.

In the manufacturing industry, with the help of low-code platforms, predictive maintenance systems based on equipment can be developed. These systems integrate equipment sensor data, maintenance plans, equipment repair records, and utilize technologies such as machine learning to monitor and predict equipment status. They promptly detect faults and propose solutions, reducing repair downtime while improving equipment reliability and stability.

Moreover, in terms of equipment inspection, low-code platforms can be used to develop automated inspection systems. Through mobile applications, equipment operators can quickly access equipment-related information and maintenance plans by scanning QR codes, enabling efficient equipment inspections and checks. During the inspection process, abnormal equipment conditions can be promptly recorded through photos and voice recordings, facilitating subsequent repair work.

Lastly, the application prospects of low-code technology in equipment maintenance are vast. It provides continuous innovation and optimization space, offering strong support for improving equipment reliability and stability within enterprises.[5]

5. The Future Development and Application Trends of Low-Code Technology

5.1. The Future Development Trends of Low-Code Technology

The future development trends of low-code technology include the following aspects:

1.Intelligence: With the rapid development and application of artificial intelligence technology, low-code platforms will become more intelligent in the future. For example, through natural language programming, image recognition, and other technologies, non-developers will find it easier to create applications.

2.Collaboration: Future low-code platforms will focus more on collaboration, allowing multiple developers to collaborate on the same project to improve development efficiency and quality.

3.No-code: In the future, low-code platforms will further promote the development of no-code solutions, enabling non-technical users to use low-code platforms to build and customize applications.[6]

4.Cloud-based: Cloud-based low-code platforms will become mainstream in the future. Using cloud services can provide better resource management and security, as well as enable automatic hosting and deployment of applications.

5.Industry-specific: Low-code platforms will introduce specialized products and services for different industries to meet various industry demands, such as finance, healthcare, manufacturing, etc.

In summary, the future of low-code technology will be more intelligent, collaborative, no-code oriented, cloud-based, and industry-specific. It will serve the development and customization of applications in different scenarios. Low-code technology will become an important tool for digital transformation in the future, further improving the efficiency and quality of enterprise application development.

5.2. The Future Application Trends of Low-Code Technology

The future application trends of low-code technology mainly include the following aspects:

1.AI-enhancement: With the continuous development of AI technology, low-code platforms will achieve more flexible and efficient development through more intelligent algorithms and models, providing a better programming experience and faster development speed.

2.No-code trend: A major trend in low-code technology is moving towards a "no-code" direction. Developers can quickly build applications through simple drag-and-drop and configuration methods without writing code, thus reducing cost and time.

3.API and integration: Integration with other applications and services through APIs will become more convenient and straightforward. Low-code platforms will enhance their ability to utilize APIs and expand the range of integrations, making application development more convenient.

4.Microservices architecture: In the future, low-code platforms may adopt a microservices architecture approach, achieving high modularity and componentization, greatly improving development efficiency and maintainability.[7]

5.Cloud-native trend: Cloud-centric development models will become a trend in low-code platforms. This model will enable developers to build, test, and deploy applications more easily, leading to faster development and time-to-market.

In conclusion, the future application trends of low-code technology are diverse, but overall, they aim to improve development efficiency, reduce development costs, and better serve user needs.

6. Conclusion

Based on the research in this article, it can be concluded that in recent years, the intelligent transformation of manufacturing companies in Wenzhou has become a trend. Low-code technology, as a fast application development approach, has been widely applied in the intelligent transformation of manufacturing companies in Wenzhou. Low-code technology can enhance the speed and efficiency of enterprise transformation, allowing companies to quickly build applications for digital transformation. It reduces the development costs during the digital transformation process and minimizes the workload of coding, helping companies make better use of resources. It also promotes the innovation capability of enterprises in digital transformation, making it easier for them to optimize and upgrade business processes. Lastly, the visual development mode of low-code technology makes it easier for employees to understand the structure and functionality of applications, thus addressing the talent shortage issue during digital transformation.

In summary, the application of low-code technology in the intelligent transformation of manufacturing companies in Wenzhou can help them achieve digital transformation goals more quickly and effectively, thereby improving their competitiveness and market share. In the future, low-code technology will continue to evolve, providing more feasible and innovative solutions for the digital transformation of manufacturing companies in Wenzhou.

Acknowledgements

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