

# A Study on Countermeasures for Climbing the Value Chain of Manufacturing Industry in Zhejiang Province Driven by Digital Technology

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**Abstract:** The digital technology revolution has brought about a new form of digital economy and accelerated the digital transformation of the manufacturing value chain. Digital technology drives the manufacturing value chain to achieve the goals of technological innovation, production cost reduction and sales service personalization, reshaping the division of labour and status of the value chain. Therefore, digital transformation is an inevitable choice for the manufacturing industry to achieve value chain climbing. The manufacturing industry in Zhejiang Province is large in scale and has a good development momentum. However, in the context of digital economy, the digital reform of manufacturing industry in Zhejiang Province is not strong, and the climbing of manufacturing value chain lacks effective assistance. Based on the analysis of the mechanism of digital technology-driven manufacturing value chain climbing, this paper discusses the current situation of manufacturing value chain development in Zhejiang Province and explores the problems of manufacturing digital reform, and puts forward suggestions for digital technology-enabled manufacturing value chain climbing in Zhejiang Province from four aspects: policy design, industrial change, facility construction and talent system.

## 1. Introduction

As the backbone and ballast of Zhejiang's economy, the manufacturing industry has always been the key focus of Zhejiang's economic work. In 2021, Zhejiang Province launched the implementation of a new round of manufacturing "cage for birds, phoenix nirvana" action to accelerate the construction of global advanced manufacturing base, and to achieve "five first breakthroughs". They are the first 50,000 industrial enterprises in the province, the first 2 trillion yuan of added value, the first 40 percent of new product output, the first 200 billion yuan of R&D expenditure, and the first 10 trillion yuan of industrial enterprise revenue. In September 2022, the People's Government of Zhejiang Province issued the "Guidance on High Quality Development and Construction of Global Advanced Manufacturing Base", specifying that by 2035, Zhejiang Province should become a global digital transformation innovation place, a global intelligent manufacturing leader, a national green manufacturing pioneer area, and basically a global advanced manufacturing base. Therefore, in the context of the Industry 4.0 era, how should Zhejiang Province make full use of digital, networked and intelligent information technology to promote the manufacturing industry to "overtake"; at the same time, how to get rid of the existing manufacturing value chain locking path. Ultimately, how to build a "global advanced manufacturing base" are very important issues.

## 2. Analysis of the Current Situation of the Value Chain of Manufacturing Industry in Zhejiang Province

### 2.1. Design R&D in the Manufacturing Value Chain in Zhejiang Province

As a strong manufacturing province, Zhejiang has a good foundation for manufacturing development. The R&D and design capability of the manufacturing industry in Zhejiang Province mainly comes from the high-tech enterprises in the manufacturing clusters and the local research

institutes, universities and high-end laboratories. Zhejiang Province has been making every effort to promote manufacturing enterprises to become more refined, bigger and stronger. In order to enhance the R&D and innovation capacity of the manufacturing industry, enterprises in the province invested RMB 215.77 billion in R&D expenses in 2021, an increase of 17.28% year-on-year. 7,179 new high-tech enterprises were identified in the province in 2021, and the technological R&D capacity of industrial enterprises has been continuously enhanced.

However, the number of national key experiments owned by Zhejiang Province is relatively small at present. As of 2022, a total of 254 national key laboratories have been established in China, which are the core components of China's science and innovation system. However, there are only nine national key laboratories established in Zhejiang. Secondly, as the main force of manufacturing research, universities are the source of driving local manufacturing innovation. At present, only Zhejiang University has a "985" and "211" background.

## **2.2. Manufacturing in the Manufacturing Value Chain in Zhejiang Province**

In 2022, the Zhejiang Provincial Government released the "14th Five-Year Plan for the Construction of Global Advanced Manufacturing Bases in Zhejiang Province", which focuses on creating a new "intelligent" manufacturing industry, accelerating the deep integration of digital technology with manufacturing technology, equipment and production processes, and speeding up the construction of projects such as "industrial brain" and "5G+future factory". By 2021, the province will cultivate 423 smart factories (digital workshops) and 61 "factories of the future". However, the industrial structure of the manufacturing industry in Zhejiang Province still shows the characteristics of "biased chemical industry (heavy industry) and garment industry (light industry)", and the proportion of daily-use industrial products in the advantageous industries is still high, with the output value of small household appliances and plastic parts rising year after year.

## **2.3. Marketing Services in the Manufacturing Value Chain in Zhejiang Province**

There is no shortage of high-profile enterprises in Zhejiang's manufacturing sector, such as Chint, Wanxiang, Geely, Gongniu and Fantasia. In 2021, the number of new trademark applications in Zhejiang reached 750,000, but there were only 646 national well-known trademarks. 41 of the top 500 most valuable brands in China were listed in 2022: 23 in Hangzhou, 8 in Ningbo, 3 in Jiaxing, 2 in Shaoxing, 2 in Huzhou, 2 in Wenzhou and 1 in Taizhou. In addition to the lack of support from well-known brands, the manufacturing industry in Zhejiang Province, from R&D to production and then to sales, still follows the traditional manufacturing value chain model of vertical information transfer from the R&D end to the sales end due to the lack of support from digital technology platform services. It is still difficult to transfer information on customers' demand for products and feedback on their use to the R&D and design end of the product.

# **3. Problems in the Process of Optimizing the Manufacturing Value Chain in Zhejiang Province with the Help of Digital Technology**

## **3.1. Digital Technologies are not Deeply Integrated into the Manufacturing Value Chain**

In 2021, the value added of the digital economy in Zhejiang Province will be RMB 3.57 trillion, ranking fourth in China, but the proportion of the core industries of the digital economy in manufacturing and service industries in the province is about 4:6, which shows that the development of digital technology in Zhejiang Province is still dominated by service industries. From the analysis of the mechanism of climbing up the manufacturing value chain, it can be seen that the climbing up of the value chain requires the R&D and design, production and processing and sales and service links to work in tandem, and digital technology must be deeply integrated with the three links in the manufacturing value chain<sup>[1]</sup>. As the traditional strength of the manufacturing industry in Zhejiang Province lies in the cultivation of a large number of small and precise industrial enterprises, it is difficult for digital technology to spread deeply in areas with low industrial clustering. There is already a consensus in the academic community that digital technology can accelerate the

optimisation of the manufacturing value chain, and the extent to which digital technology is integrated into the manufacturing value chain in Zhejiang Province directly affects the degree of value chain optimisation.

#### **4. Digital Technology Contributes to Weak Incentives for Manufacturing Value Chain Optimization**

Zhejiang Province's traditional manufacturing industry digital infrastructure is weak, industrial Internet of Things, industrial Internet development is not sufficient, industrial enterprises and industrial enterprises, manufacturing industry between the "data island" has not been opened. Zhejiang Province lacks manufacturing "chain master" enterprises, and the proportion of small and medium-sized manufacturing enterprises is very high. Due to the constraints of capital and manpower, small and medium-sized industrial enterprises are not sufficiently motivated to transform digitally, and the transformation of "intelligent factories" and "5G+future factories" is slow, making it difficult for digital technology to be effective<sup>[2]</sup>. Secondly, in order to meet the close combination of digital technology and manufacturing value chain, a large number of digital technology service applications and digital technology service platforms are also needed<sup>[3]</sup>, and Zhejiang Province is still lacking a large number of digital technology platform developers and service providers for manufacturing services, and the construction of virtual industrial park is also at the initial stage.

##### **4.1. Poor Digitisation of the Manufacturing Value Chain Ecosystem**

The degree of digitalisation of the manufacturing value chain ecosystem in Zhejiang Province is relatively low, and digital technology is more often only integrated with industrial enterprises in the production and processing chain, while less digital construction is deployed that can run through the entire ecology of the manufacturing value chain. At present, more than 80% of digital applications are limited to the intermediate links of the value chain, while less help is given to the value optimization of R&D, design, product sales and product services. The digital ecosystem of manufacturing value chain based on 5G network and cloud platform has not yet been built. The digital ecosystem of the manufacturing value chain in Zhejiang Province has not yet formed a scale, which will inevitably have a greater impact on the optimization of the manufacturing value chain in Zhejiang Province.

##### **4.2. Lack of Awareness of Digital Technologies in the Manufacturing Value Chain**

At present, the order of product creation in the manufacturing industry in Zhejiang Province is still a traditional vertical system, from the R&D and design end to the manufacturing end and then to the sales and service end. With the Internet penetrating deeply into people's daily lives, consumers' demands for products have become more diversified and personalized<sup>[4, 5]</sup>. However, the marketing model of the manufacturing industry in Zhejiang Province has not yet matched the current shift in consumer demand, making it difficult to better optimise the value of the sales and service link of the manufacturing industry in Zhejiang Province, and a lot of data reflecting product demand and usage feedback cannot be reverse-conducted to the R&D and design link enterprises.

#### **5. Suggestions for Digital Technology to Empower Zhejiang Province to Climb the Manufacturing Value Chain**

##### **5.1. Improve the top-level Design of Industrial Digitization and Accelerate the Construction of a New Pattern of Dual Domestic and International Development**

The use of digital technology to enhance the technological innovation capacity of the manufacturing value chain in Zhejiang Province is the key to achieving a rise in the value chain. A large number of industrial enterprises in Zhejiang's manufacturing industries are still in the middle and lower part of the "smile curve". Therefore, it is important to enhance the innovation capacity of the manufacturing industry with the help of digital technology. First, strengthen policy support<sup>[6]</sup>. In recent years, Zhejiang Province has released the "Implementation Opinions on Creating an Upgraded

Version of the "No.1 Project" of Digital Economy" and "Implementation Opinions on Accelerating the Development of Smart Supply Industry" and other related documents, making the digital transformation of manufacturing industry the primary task of manufacturing development. Therefore, with the help of digital technology, the manufacturing industry in Zhejiang Province has accelerated the implementation of the digital transformation mechanism of "large and excellent enterprises", list of key core technologies for manufacturing industry attack plan is created, and implemented the "unveiling of the list". Second, accelerate the digital reform of the research system. Zhejiang Province has accelerated the construction of major innovation platforms such as national key laboratories, and based on the innovation platforms, digital technology has been used to accelerate the pace of innovation cultivation in manufacturing enterprises, and digital technology has been used to reduce manufacturing R&D costs and improve R&D efficiency. Third, strengthen cooperation with domestic and international digital industries. Zhejiang Province's manufacturing value chain cannot climb without industrial digitalisation, and to achieve industrial digitalisation, it needs the assistance of digital industries. The development of Zhejiang's digital industry cannot be achieved without in-depth exchanges and cooperation with domestic and international digital industries. Therefore, Zhejiang Province should strengthen the deployment of key areas and key core technologies in the digital industry, establish cooperation mechanisms with domestic and international advanced sectors of the digital industry, accelerate the innovation and development of the digital industry in Zhejiang Province, strengthen the digital industry to achieve the rise of the manufacturing value chain and enhance the international competitiveness of the manufacturing industry.

## **5.2. Strengthen the Digital Technology Empowerment Effect and Actively Participate in the National Strategy for the Integrated Development of the Yangtze River Delta**

In the era of digital economy, digital transformation of the manufacturing industry is an important way to climb up the value chain. The essence of digitalization in the manufacturing industry is to fully network the traditional manufacturing industry and to help the three major segments of the manufacturing industry, namely research and development, innovation, production and processing and sales and service, to achieve improved efficiency and further synergy through digital technology<sup>[7]</sup>. At the manufacturing level, the industrial base of the manufacturing industry will be further enhanced through industrial digitisation, thus realising the purpose of climbing up the value chain. At present, there are two main paths to promote the digitalisation of the manufacturing industry in Zhejiang Province. The first one is to take the "chain master enterprises" and high-tech enterprises in the manufacturing industry of Zhejiang Province as the leaders, and to realize the digital transformation of each link within the manufacturing industry by building a "5G+Industrial Internet" platform. By building "intelligent factories" and "factories of the future" to improve the digital level of traditional manufacturing production links, the development of industrial software, industrial data sharing platforms and industrial data models will be increased, and the linkage between the three major links in the value chain will be strengthened by relying on the industrial internet to realize various types of data. In addition, it will also rely on the Industrial Internet to strengthen the links between the three major links in the value chain, realise the collaboration of various types of information and resources, and reduce the cost and pressure of digital transformation for SMEs in the digital ecosystem of the manufacturing value chain. The second type is to make use of digital platform enterprises, using the data service capability and algorithm capability of digital platform enterprises to achieve the digital transformation of manufacturing enterprises in Zhejiang Province, and to transform the R&D and design, production and processing and sales service links of manufacturing enterprises into a deep intelligent network, and rely on big data to achieve synergy effects and enhance the flexible and intelligent manufacturing capability based on personalised product customisation. Over the past 40 years of reform and opening up, the manufacturing industry in Zhejiang Province has been actively participating in the national and international industrial division of labour. Only by accelerating the digitisation process, actively participating in the national strategy for the integrated development of the Yangtze River Delta, and integrating more deeply into the national and even global manufacturing industry division of labour system can Zhejiang's manufacturing industry gain

fuller momentum to climb up the value chain.

### **5.3. Accelerate the Construction of digital Infrastructure and Accelerate the Consolidation of the Underlying Foundation of Digital Technology-enabled Value Chain Upgrading**

The use of digital technology to fuel the climbing of the manufacturing value chain requires a large amount of digital infrastructure as support. In the process of digital industry development, it has been found that traditional infrastructure is an important foundation to support the development of the digital economy, while a series of digital infrastructure supporting the development of digital industry also needs to be built. Therefore, Zhejiang Province should speed up the investment and construction of digital industry infrastructure projects and coordinate local finance to create a "new infrastructure" that can match the digital transformation of modern manufacturing industries, such as 5G base stations, data element centres, digital industry parks, supporting power grid facilities and other facilities. Secondly, the government should set up a digital industry development fund to support local digital industry enterprises to accelerate the pace of digital technology innovation and research, and encourage them to go out and cooperate with advanced digital industry research and development institutions through cross-regional and cross-border cooperation, so as to expand more space for digital industry and manufacturing industry digitization<sup>[8]</sup>. At the same time, financial institutions are encouraged to increase their investment in the digital industry. The government is guiding financial institutions through industrial development policies to give full play to financial market resource allocation and accelerate the cultivation of new digital industries and information technology enterprises.

### **5.4. Create a Digital Talent Cultivation System and Strive to Explore New Paths for Cultivating Cutting-edge Digital Technology Talents**

Due to the short development time of digital technology, the talent training system in related fields is not yet sound, and there is a lack of digital industry talents, the digital reform process of manufacturing industry in Zhejiang Province will be greatly affected. Firstly, the government of Zhejiang Province needs to introduce special policies to increase the introduction of specialised talents in the digital industry, and make good guarantees related to the landing of talents<sup>[9]</sup>. Secondly, local universities should also pay attention to the training of digital industry talents, especially the integration of digital technology training elements in the training system of manufacturing talents. Universities are encouraged to promote the teaching reform of integrating professional knowledge with industrial digital technology in traditional manufacturing-related majors. At the same time, through tripartite cooperation between schools, enterprises and institutes, relying on the university talent training system and integrating the research and innovation capabilities of local digital technology research institutes, special technical talents suitable for upgrading the manufacturing value chain in Zhejiang Province will be created through practical application in the process of digital transformation of manufacturing enterprises. From the manufacturing enterprise level, enterprises should pay attention to the talent transformation guidance work and provide assistance to the existing manufacturing talents for digital transformation, such as enterprises providing training opportunities for digital reform of manufacturing industry. The incentive policy related to the salary of enterprise employees should also be adjusted to encourage employees to speed up the pace of their own digital technology application ability improvement<sup>[10]</sup>. At the individual level, manufacturing workers should keep pace with industrial change, have a deep understanding of the inevitable trend of digital transformation in manufacturing, improve their digital technology application capabilities through their own educational investments and other means, and strive to adapt to the transformation of the workforce structure in the manufacturing value chain.

## **6. Conclusions**

The upgrading of the manufacturing value chain in Zhejiang Province necessarily requires the support of digital technology. In the paper, an in-depth analysis of the current situation of the digital development of the manufacturing industry in Zhejiang Province reveals that there are problems such

as a large number of small and medium-sized enterprises hindering digital transformation and a small number of digital platform-based enterprises. Therefore, this paper suggests four aspects: policy support, industrial reform, digital infrastructure construction and talent training to explore the path of deep integration of digital technology and manufacturing development in Zhejiang Province. The research in this paper is not comprehensive enough for the digital transformation of the manufacturing industry in Zhejiang Province, and the subsequent research will provide more practical suggestions for the digital transformation of the manufacturing industry in Zhejiang Province by obtaining more data through visits and research on the existing basis.

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