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The Impact of Innovation Evaluation Factors on Enterprise Digitalization

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Abstract

The digital economy is the future development direction of the world and an important driving force for world economic development. During the "Thirteenth Five-Year Plan" period, our country has deeply implemented the digital economic development strategy, continuously improved digital infrastructure, accelerated the cultivation of new business forms and new models, and achieved positive results in promoting digital industrialization and industrial digitization. In 2020, the added value of my country's core industries of the digital economy accounted for 7.8% of the gross domestic product (GDP). The digital economy has provided a strong driving force for the sustained and healthy development of the economy and society. Therefore, in the ever-changing market environment, only by establishing a standardized digital transformation capability evaluation system can manufacturing companies fundamentally understand the content of digital transformation capability construction, help them re-examine the status quo of their own digital transformation capabilities, and thus promote their The digital transformation process makes it invincible in the competition. Based on the above research background, this article believes that establishing an effective digital maturity evaluation tool for manufacturing enterprises, conducting evaluation and research on the digitalization level of Chinese manufacturing enterprises, and conducting research on the impact mechanism of digitalization on enterprise transformation capabilities are both satisfying and satisfying. The urgent demand of Chinese manufacturing enterprises to improve their digitalization level can also help the government better understand the current status of enterprises' digitalization level and improve the efficiency of government guidance and support for enterprise development.

Keywords

Digital economy; Digital transformation; Manufacturing enterprise digital maturity; maturity evaluation; Publishing ethics.

1. RESEARCH BACKGROUND AND MEANING

Based on the new era, the State Council's Notice on the Issuance of the "14th Five-Year Plan for Digital Economy Development Plan" pointed out that by 2025, the digital economy will enter a period of comprehensive expansion, and the added value of the core industries of the digital economy will account for 10% of GDP. . The interpretation of the "14th Five-Year Plan for the Deep Integration of Informatization and Industrialization Development Plan" is reflected in the overall goal. By 2025, informatization and industrialization will achieve integrated development on a broader, deeper, and higher level. A new generation of Information technology has accelerated its penetration into various fields of the manufacturing industry,

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with the scope significantly expanded, the degree continued to deepen, and the quality significantly improved. The pace of digital transformation in the manufacturing industry has accelerated significantly.

However, although the scale of my country's digital economy maintains rapid growth, and a large number of manufacturing companies regard the construction of digital transformation capabilities as the direction of their optimization and upgrading, only a small number of companies' digital investment has turned into benefits. The number of "transformation leaders" accounts for Less than 11%, there are still a large number of enterprises facing the confusion of "do not want to transfer, dare not transfer, cannot transfer". On the one hand, many manufacturing companies have been unable to make up their minds to promote digital transformation due to path dependence problems, rigid organizational structures and management models, lack of crisis awareness from top to bottom, and insufficient understanding of their own digital status quo and competitiveness levels. . On the other hand, although some manufacturing companies are aware of the importance of digital transformation, they lack a deep understanding of digital transformation and blindly copy only a few successful experiences, practices and cases in the industry, without fundamentally changing the logic of their own value creation. , The effect of digital transformation is not very ideal, which restricts the enthusiasm and initiative of transformation. Therefore, in the ever-changing market environment, only by establishing a standardized digital transformation capability evaluation system can manufacturing companies fundamentally understand the content of digital transformation capability construction, help them re-examine the status quo of their own digital transformation capabilities, and thus promote their The digital transformation process makes it invincible in the competition.

2. ANALYSIS OF THE COMPONENTS OF MANUFACTURING ENTERPRISES' DIGITAL TRANSFORMATION CAPABILITIES

2.1. The significance of digital transformation for manufacturing enterprises

[1] The meaning of digitalization

All Digital transformation was first proposed in the 1940s and 1950s. At that time, electronic digital computers represented by ENIAC and EDVAC entered the stage of history and became popular. People began to use digital technology to convert information from analog format to digital format. The process is called digital transformation. As digital technology applications began to be integrated into business processes and help enterprises (organizations) achieve management optimization, the concept of digitalization also appeared in 1959, but at the beginning it was not deliberately differentiated from digital transformation in meaning. [1] Yuan Leifeng, Huafeng et al. [2] believe that digitalization can help enterprises optimize their corporate management models, eliminate corporate information management problems, and promote high-quality development of enterprises. Through the application of digital technology, corporate managers can scientifically and accurately complete business activities. Optimize layout, optimize enterprise resource allocation based on business data, and improve resource utilization efficiency. At the same time, in the current increasingly complex market competition environment, the digital transformation of the supply chain can significantly improve the risk management capabilities of enterprises and help maintain security and stability. Li Yuanzhi and Guo Zhiquan [3] believe that: digital transformation accelerates the promotion of new industrialization in my country and builds a The domestic macrocycle provides the basic guarantee for the new development pattern in which the main body and the domestic and international dual cycles promote each other. It provides a basic guarantee for my country to accelerate the promotion of new industrialization and build a new development pattern with the domestic cycle as the main body and the domestic and international dual cycles reinforcing

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each other. Liang Dong[4] believes that digital transformation can optimize the industrial structure and is an important driving force for the upgrading of manufacturing companies. Digital transformation can also improve the risk resistance of manufacturing companies, facilitate the gathering and integration of resources such as talents, funds, land and markets, develop technology-intensive innovative technologies, and promote the deep integration of basic research, applied research, experimental development and industrial innovation. Finally, digital transformation improves the level of enterprise management decision-making. Digital transformation can help enterprises achieve intelligent professional work, automate business processes, and refine management work, reduce a large amount of time-consuming and useless work, and improve operating efficiency. Qi Ke and Tian Ying [5] believe that the digital transformation of manufacturing enterprises has significantly promoted the improvement of innovation efficiency. Digital transformation has a more significant promoting effect on enterprise innovation efficiency in both state-owned enterprises and enterprises in non-central cities.

[2] The connotation of digital transformation

In existing research, domestic scholars usually use concepts such as "Internet transformation", "Internet-based transformation" or "'Internet+' transformation". Guo Gaojing and Zhu Feng [6] proposed that the concept of digital transformation lies in dynamic capabilities for the government. Ma Chao and Song Chen [7] focused on the connotation and denotation of standard digitalization and proposed the standard query process, digitization, and writing process for the connotation of the concept of power digitalization. There are three levels of digitization and application process digitization. Xu Rujun [8] believes that the concept of digital connotation can be summarized in three aspects: first, enterprise digital transformation is the use of modern information technology to reshape enterprise business activities. Second, the core of enterprise digital transformation is to achieve value co-creation; third, the goal of enterprise digital transformation is to improve the ecological level of the industrial structure. Zhang Yawei, Yan Zhizhong, etc. [9] divided digital interconnection into three aspects of coordinated operation: perception, transmission, and supplementation, and then proposed three concepts of multi-subject dynamic collaboration, multi-team dynamic collaboration, and team dynamic collaboration.

[3] Enterprise understanding of digital transformation

Google believes that digital transformation is the use of modern digital technology. By analyzing big data and using advanced data analysis tools, companies can better understand the market, user behavior and trends, and thus make more informed decisions. They believe that AI and ML technologies can improve business processes, provide personalized user experiences, and enhance decision support.

Microsoft believes that digital transformation is a comprehensive strategic change process that involves the use of digital technologies to redesign business models, business processes, and organizational structures to improve efficiency, innovation capabilities, and customer experience, thereby achieving sustainable competitive advantage and growth. . Digital transformation is not just about the application of technology, but also about culture, organizational change and strategy development.

Walmart believes that digital transformation is a comprehensive strategic change process aimed at making full use of digital technology, data and innovation to improve business operations, enhance customer experience and achieve sustainable growth.

IDC believes that the use of digital technologies (cloud computing, mobility, big data/analysis, social and Internet of Things) to drive organizational business model innovation and reconstruction of business ecosystems is a way and method, the core of which is to promote business growth. and innovation.

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Huawei believes that through the in-depth application of the new generation of digital technology, we can build a fully aware, fully connected, full scenario, and fully intelligent digital world, thereby optimizing and recreating the business of the physical world, and innovating traditional management models, business models, and business models. and reinvention for business success.

Alibaba believes that "all businesses are digitized and all data is digitized," and that digitization "is a process from business to data, and then back to data." Alibaba believes that the key to enterprise digital transformation lies in three points: unified IT architecture, Internet-based business center, and online intelligent data.

2.2. Basic characteristics of manufacturing enterprises' digital transformation capabilities

It can be seen from the definition of digital transformation capabilities of manufacturing enterprises that the digital transformation of manufacturing enterprises is a comprehensive change involving organization, process, and management. The key to transformation is to build a capability system that is compatible with the transformation goals. my country's manufacturing industry has great advantages in organization, process and management, which are mainly reflected in the following three points:

[1] There are rich application scenarios and a diversified industrial ecology is taking shape.

Our country has a large population and a complete range of industries. The application scenarios of digital transformation are very rich. The market demand for digital transformation is also relatively stable, which facilitates the development of digital applications and industrial ecological construction. In 2021, there were 1.032 billion people using the Internet in my country, and the Internet penetration rate was 73.0%. The huge scale of Internet users has become the foundation for the development of online consumption and sharing economy. From the perspective of enterprise demand, according to the data of "China's Integrated Development Data Map of Informatization and Informatization (2018)", in 2018, the proportion of enterprises in the initial stage of digital transformation of my country's manufacturing enterprises was 27.4%, and the proportion of enterprises in single coverage was 50.2%. The digital transformation of most enterprises, especially small and medium-sized enterprises, has just begun, and the demand for digital software and hardware is considerable. Our country has a complete range of industrial categories, which helps form ecosystems of different types and industries, such as the industrial Internet, Internet of Vehicles, etc., which are diversified industrial ecosystems formed by different types of industries.

[2] The diversification and scale of data types have become my country's new industrial advantages.

According to statistics from the China Academy of Information and Communications Technology, the scale of my country's cloud computing market will reach 209.1 billion yuan in 2020. As the demand for digital transformation of enterprises increases, the data generated using cloud services and edge computing will continue to expand, which will also form more unmet needs. Mined production data. In addition to the enterprise level, personal itinerary data, medical data, traffic data, etc. have become important resources to support the construction of smart cities in our country. Our country has also stepped up the construction of digital centers. In 2022, it will begin to implement the "Eastern Data and Western Computing" strategy to guide the government and enterprises to tilt data centers and computing power towards hub cities, which will help our country form a more competitive data industry. .

[3] Moderately advanced infrastructure layout allows my country to seize development opportunities in the digital economy era.

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In terms of 5G network construction, my country already has 1.43 million 5G base stations in 2021, which can cover all prefecture-level cities and urban areas. In the "Three-Year Action Plan for the Development of New Data Centers (2021-2023)" newly released by the Ministry of Industry and Information Technology, my country proposes to build ultra-large data centers, new data centers in various provinces and overseas, and advanced digital infrastructure construction has become the key to my country's digital transformation. important support.

3. CONSTRUCTION OF MANUFACTURING ENTERPRISE DIGITAL TRANSFORMATION MATURITY EVALUATION MODEL

3.1. Introduction to interval analytic hierarchy process

The Analytical Hierarchy Process, referred to as AHP, was first developed by T.L. Saaty, an operations researcher at the University of Pittsburgh, in the early 1970s when he was studying "electricity allocation based on the contribution of various industrial sectors to national welfare" for the U.S. Department of Defense. topic was raised. The analytic hierarchy process is a multi-objective decision-making analysis method that combines qualitative and quantitative analysis methods. The main idea of this method is to make a comparative judgment on the importance of two indicators by decomposing complex problems into several levels and factors, and establish a judgment matrix. By calculating the maximum eigenvalue of the judgment matrix and the corresponding eigenvector, we can obtain The weights of the importance of different solutions provide a basis for selecting the best solution.

Based on the research of scholars over the years, the AHP has been derived from improved AHP, fuzzy AHP, extension fuzzy AHP and gray AHP after years of development and improvement, etc., as economic planning and management, energy The preferred method for research related to policy and distribution, behavioral science, military command, transportation, agriculture, education, talent, medical and environment. This paper takes advantage of the advantages of combining qualitative and quantitative methods with the Analytical Hierarchy Process to identify the main influencing factors affecting the digital transformation of traditional manufacturing enterprises in a complex situation, and develops a set of models suitable for the digital transformation of the manufacturing industry to assist Physical manufacturing companies quickly completed digital transformation.

3.2. Determination of digital transformation capability maturity evaluation factors and construction of indicator factors

The Development Research Center of the State Council of China, together with the famous German industrial company Bosch, released a research report on "Learning from German Industry 4.0 to Promote the Transformation and Upgrading of China's Manufacturing Industry" on March 17, 2017, stating that China's manufacturing industry as a whole is still in the transition from Industry 2.0 to Industry 3.0. stage, and a large proportion of enterprises have only reached the level of Industry 2.0 and Industry 3.0. As a result, there are huge differences in the degree of automation and informatization capabilities between different industries, regions and enterprises, and the development levels are uneven. This also makes Chinese manufacturing enterprises have diversified needs in the process of transforming to intelligent manufacturing. [10]

The evaluation model needs to have the function of evaluating and guiding enterprises at different stages. Therefore, how to effectively evaluate and guide enterprises at the level of Industry 2.0 and Industry 3.0 is the starting point of this study for model optimization, in order to promote enterprises to move towards intelligence based on their own actual conditions. Provide reference for manufacturing development.

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According to the basic understanding and reference framework of digital transformation issued by the State-owned Assets Supervision and Administration Commission of the State Council, the following four aspects should be systematically grasped to carry out digital transformation: First, digital transformation is a systemic change caused by information technology. Second, the fundamental task of digital transformation is to optimize, innovate and reconstruct the value system. Third, the core path of digital transformation is the construction of new capabilities. Fourth, the key driver of digital transformation is data.

According to the Central Economic Work Conference "Transforming and Upgrading Traditional Industries and Cultivating and Strengthening Emerging Industries - Accelerating the Construction of a Modern Industrial System", the status and competitiveness of traditional industries in the global industrial division of labor will be enhanced. Fu Baozong believes that to enhance the status and competitiveness of traditional industries in the global industrial division of labor, we need to actively explore new paths for high-end, intelligent, and green development. According to the "Enterprise Digital Transformation in the Manufacturing Industry (2021 Edition)", it is proposed that digital transformation can mainly focus on the five levels of "technological innovation, industrial ecology, cluster development, service integration, and digital operations". Six points of view are put forward accordingly: 1. Clarify the enterprise development strategy and propose digital transformation propositions; 2. Enhance the enterprise's new capabilities to support digital transformation and upgrading; 3. Create a data governance system to provide digital transformation guarantee; 4. Build system solutions to promote comprehensive Digital transformation; fifth, promote business optimization and innovation, and give birth to new business formats and new models; sixth, attach importance to the cultivation of digital talents and build an integrated talent team. Based on the above policy guidelines, industry guidance and the combination of different elements based on the three major areas of digital transformation, this article uses business transformation, technology transformation and organizational transformation as first-level indicators in the smart manufacturing capability maturity model of small and medium-sized enterprises to analyze the three major areas of digital transformation. The basic elements and focuses of each stage were analyzed to extend 12 second-level indicators, and on this basis, 25 third-level indicators were screened out.

Table 1. Evaluation indicators for the maturity of intelligent manufacturing capabilities of small and medium-sized enterprises

First-level indicators	Second-level indicators	Third-level indicators
Business transformation	Degree of business digitalization	Degree of product/service digitalization and intelligent online integration
		Degree of R&D and design digitalization and intelligent online integration
		Degree of digitization of production control and intelligent online integration
		Degree of digitization of operation management and intelligent online integration
		The degree of market service digitalization and intelligent online integration
	Degree of business digital integration	Integration of operation management and on-site production operation control
		Supply chain or industrial chain integration
		Product life cycle integration
	Degree of innovation in business digital model	Degree of innovation in intelligent operation and production process optimization models
		Innovation level of platform technology network and partnership network collaboration model for online operation of key businesses

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		Degree of data integration and sharing, data asset-based operation and full-scenario service innovation
		The degree of innovation in models such as Internet platforms to quickly and accurately meet users' dynamic changing needs
	Digital business cultivation	Digital resource services
		Digital knowledge services
		Digital capability services
Technological transformation	Improve equipment level	Through technologies such as digital system control and artificial intelligence, equipment can operate dynamically and autonomously perform task execution and decision-making.
		Through data analysis and mining, digital equipment can obtain information about equipment performance, fault prediction, optimization suggestions, etc.
		Real-time data transmission and collaboration, data sharing, and improvement of the overall efficiency and productivity of the production line can be achieved between equipment.
		Digital technology equipment simulation and testing capabilities enable problems to be discovered in advance, optimized and improved, saving time, reducing costs and increasing efficiency.
	Promote green development	Improve industrial energy efficiency, cleaner production, comprehensive utilization of resources and other technological transformations
		Industrial product green design R&D system to improve energy resource utilization efficiency
	Integration of informatization and marketization	Application of information technology in all aspects of R&D, design, and manufacturing
		Application of information technology in after-sales service
	Safety production management	Application of digital monitoring and early warning system and process safety production management technology
		Emergency handling system enterprise security technology application
Organizational transformation	Digitalization of organizational management improves coordination efficiency	Utilize new technologies such as big data and artificial intelligence to establish an efficient and agile management system and reduce operating costs.
		Use data platforms to break down communication barriers between levels and establish an efficient collaborative office system
	Digitizing organizational processes improves operational efficiency	Deep embedding of digital technologies such as artificial intelligence to upgrade production processes
		Big data, cloud computing, improve supply chain flexibility and efficiency
	Digital platforms promote cross-border circulation of resources	Through the digital platform and effective linkage with various element data, it can drive the level of technology flow, capital flow, talent flow, and information flow.
		Achieve the optimal allocation of resources across departments, enterprises, and industries
	Digital platform promotes products and services	In the product and service link, enterprises achieve full coverage of digital product and service scenarios.
		In order to meet the needs of users, product services can provide ready-made tools and solutions to enable enterprises and individuals to operate more efficiently.

Design survey questionnaires and conduct data collection based on the analytic hierarchy process:

The Delphi method, also known as the expert survey method, was created by the Rand Corporation in the United States in 1946. The Delphi method is essentially a feedback

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anonymous correspondence method. The general process is: after soliciting the opinions of experts on the issues to be predicted, sorting, summarizing, and counting, then anonymously feedback to the experts, soliciting opinions again, concentrating again, and feedback again until a consensus of opinions is obtained. This article selected 7 digital enterprise business decision-making managers based on the Delphi method research process. Experts rated their importance "back-to-back". After three rounds of research, we obtained consistent scoring results. The summarized research results are as follows:

Table 2. Determining the importance of enterprise digital transformation maturity assessment factors

Elements	Business transformation	Technological transformation	Organizational transformation
Business transformation	1	3	3
Technological transformation	1/3	1	2
Organizational transformation	1/3	1/2	1

We asked experts to conduct a pairwise comparison of the sub-criteria layers from the levels of business digitalization, business digital integration and integration, business digital model innovation, and digital business cultivation. The results are shown in Table 3:

Table 3. Determining the importance of enterprise digital transformation maturity assessment elements (sub-criteria level)

Elements	Degree of business digitalization	Degree of business digital integration	Degree of innovation in business digital model	Digital business cultivation
Degree of business digitalization	1	3	5	6
Degree of business digital integration	1/3	1	3	3
Degree of innovation in business digital model	1/5	1/3	1	2
Digital business cultivation	1/6	1/3	1/2	1

From the perspective of digitizing organizational management to improve coordination efficiency, digitizing organizational processes to improve operational efficiency, digital platforms to promote cross-border circulation of resources, and digital platforms to promote product and service levels, we conducted a pairwise comparison of sub-criteria levels and invited experts to conduct research and evaluation. The scoring results are shown in Table 4:

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Table 4. Determining the importance of enterprise digital transformation maturity assessment elements (sub-criteria level)

Elements	Improve equipment level	Promote green development	Integration of informatization and marketization	Safety production management
Improve equipment level	1	2	3	5
Promote green development	1/2	1	3	3
Integration of informatization and marketization	1/3	1/3	1	2
Safety production management	1/5	1/3	1/2	1

From the perspective of digitizing organizational management to improve coordination efficiency, digitizing organizational processes to improve operational efficiency, digital platforms to promote cross-border circulation of resources, and digital platforms to promote product and service levels, we conducted pairwise comparisons at the sub-criteria level and invited experts to conduct research and evaluations. The evaluation results are shown in Table 5:

Table 5. Determining the importance of enterprise digital transformation maturity assessment elements (sub-criteria level)

Elements	Digitalization of organizational management improves coordination efficiency	Digitizing organizational processes improves operational efficiency	Digital platforms promote cross-border circulation of resources	Digital platform promotes products and services
Digitalization of organizational management improves coordination efficiency	1	3	5	4
Digitizing organizational processes improves operational efficiency	1/3	1	2	3
Digital platforms promote cross-border circulation of resources	1/5	1/2	1	2
Digital platform promotes products and services	1/4	1/3	1/2	1

According to Saaty's random consistency index RI results are as follows:

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Table 6. Value list of consistency index R.I.

n	1	2	3	4	5	6	7	8
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41

According to the analytic hierarchy process and Saaty's random consistency index RI value table, the consistency test results are shown in Table 7：

Table 7. Criterion level AHP hierarchical analysis results

Index	Feature vector	Weights	Maximum eigenvalue	CI value	RI value	CR value	Consistency test results
Business transformation	1.767	0.589	3.054	0.027	0.58	0.046	pass
Technological transformation	0.756	0.252					
Organizational transformation	0.478	0.159					

Table 8. Sub-criteria level AHP hierarchical analysis results

Index	Feature vector	Weights	Maximum eigenvalue	CI value	RI value	CR value	Consistency test results
Degree of business digitalization	2.257	0.564	4.0796	0.027	0.58	0.04577	pass
Degree of business digital integration	0.976	0.244					
Degree of innovation in business digital model	0.461	0.115					
Digital business cultivation degree	0.305	0.076					
Improve equipment level	1.892	0.473	4.0651	0.022	0.58	0.03740	pass
Promote green development	1.191	0.298					
Integration of informatization and marketization	0.570	0.142					
Safety production management	0.347	0.087					
Digitalization of organizational management improves coordination efficiency	2.170	0.542	4.1029	0.034	0.58	0.05915	pass
Digitizing organizational processes improves operational efficiency	0.929	0.232					
Digital platforms promote cross-border circulation of resources	0.533	0.133					
Digital platform promotes products and services	0.368	0.092					

This section determines the evaluation index factors according to the stages and processes of digital transformation of manufacturing enterprises, and obtains the evaluation weights

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through expert research and the Analytical Hierarchy Process (AHP). The classification of the indicator layer uses the characteristics of the evolution stage to directly score. This classification method is more Suitable for internal self-assessment of traditional manufacturing enterprises.

3.3. Digital transformation capability maturity assessment data collection

In terms of data collection, the specific scoring rules are as follows: the scoring of indicators uses a score assignment between 100 points (accurate to 1 decimal place), corresponding to the four major stages of enterprise digital transformation; a survey format as shown in Table 9 is used The questionnaire was surveyed among 406 company leaders, functional departments, and business department employees of Company A. 406 survey questionnaires were collected, and 406 valid questionnaires were collected. The index scores were averaged, and the specific scoring results are shown in Table 9:

Table 9. A Enterprise Digital Transformation Maturity Survey Score Table

Criterion layer	Sub-criteria layer	Indicator layer	Score
Business transformation	Degree of business digitalization	Degree of product/service digitalization and intelligent online integration	90
		Degree of R&D and design digitalization and intelligent online integration	80
		Degree of digitization of production control and intelligent online integration	75
		Degree of digitization of operation management and intelligent online integration	60
		The degree of market service digitalization and intelligent online integration	82
	Degree of business digital integration	Integration of operation management and on-site production operation control	95
		Supply chain or industrial chain integration	70
		Product life cycle integration	73
	Degree of innovation in business digital model	Degree of innovation in intelligent operation and production process optimization models	60
		Innovation level of platform technology network and partnership network collaboration model for online operation of key businesses	65
		Degree of data integration and sharing, data asset-based operation and full-scenario service innovation	70
		The degree of innovation in models such as Internet platforms to quickly and accurately meet users' dynamic changing needs	75
	Digital business cultivation	Digital resource services	80
		Digital knowledge services	85
		Digital capability services	90
Technological transformation	Improve equipment level	Through technologies such as digital system control and artificial intelligence, equipment can operate dynamically and autonomously perform task execution and decision-making.	75
		Through data analysis and mining, digital equipment can obtain information about equipment performance, fault prediction, optimization suggestions, etc.	70
		Real-time data transmission and collaboration, data sharing, and improvement of the overall efficiency and productivity of the production line can be achieved between equipment.	76

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		Digital technology equipment simulation and testing capabilities enable problems to be discovered in advance, optimized and improved, saving time, reducing costs and increasing efficiency.	80
	Promote green development	Improve industrial energy efficiency, cleaner production, comprehensive utilization of resources and other technological transformations	70
		Industrial product green design R&D system to improve energy resource utilization efficiency	75
	Integration of informatization and marketization	Application of information technology in all aspects of R&D, design, and manufacturing	80
		Application of information technology in after-sales service	85
	Safety production management	Application of digital monitoring and early warning system and process safety production management technology	90
		Emergency handling system enterprise security technology application	86
Organizational transformation	Digitalization of organizational management improves coordination efficiency	Utilize new technologies such as big data and artificial intelligence to establish an efficient and agile management system and reduce operating costs.	92
		Use data platforms to break down communication barriers between levels and establish an efficient collaborative office system	95
	Digitizing organizational processes improves operational efficiency	Deep embedding of digital technologies such as artificial intelligence to upgrade production processes	90
		Big data, cloud computing, improve supply chain flexibility and efficiency	80
	Digital platforms promote cross-border circulation of resources	Through the digital platform and effective linkage with various element data, it can drive the level of technology flow, capital flow, talent flow, and information flow.	95
		Achieve the optimal allocation of resources across departments, enterprises, and industries	90
	Digital platform promotes products and services	In the product and service link, enterprises achieve full coverage of digital product and service scenarios.	60
		In order to meet the needs of users, product services can provide ready-made tools and solutions to enable enterprises and individuals to operate more efficiently.	70

3.4. Digital transformation capability maturity data analysis

Since the development of each stage of intelligent manufacturing is complementary to each other, there is a step-by-step development between different stages. For example, the development of lean is inseparable from automation and digitization. In order to achieve a higher level of lean capabilities, it is necessary to rely on automation and information. technologies such as automation and intelligence; at the same time, a higher degree of leanness can promote the development of automation and digitalization, so the starting points of intelligent manufacturing capability levels at different stages are different.

According to the "Notice of the General Office of the Ministry of Industry and Information Technology on releasing the evaluation indicators for the digitalization level of small and medium-sized enterprises (2022 version)" (Industry and Information Technology Department Enterprise [2022] No. 32): "Evaluation Indicators" are based on Industry characteristics are divided into manufacturing digitalization level evaluation tables, which comprehensively

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evaluate the digital development level of small and medium-sized enterprises from the four dimensions of digital foundation, operation, management, and effectiveness. Based on the enterprise evaluation scores, the digitalization level is divided into four levels:

Level 1 (20-40 points): Carry out basic business process sorting and data standardization management, and carry out simple application of information technology.

Level 2 (40-60 points): Use information technology means or management tools to achieve digital management of a single business.

Level 3 (60-80 points): Apply information systems and digital technologies for data analysis to achieve digital management and control of all main businesses.

Level 4 (above 80 points): Utilize data integration analysis across the entire business chain to achieve data-driven business collaboration and intelligent decision-making.

Through the calculation of the average value of digital transformation, further in accordance with the above-mentioned digital transformation determined through research and analytic hierarchy process.

Based on the maturity weight, it can be concluded that the overall maturity of digital transformation of enterprise A is 78.949, the maturity of business transformation is 77.311, the maturity of technology transformation is 76.570, and the maturity of organizational transformation is 88.771. It can be seen that the weakest link in the current digital transformation of enterprises It's a technological transformation. Corresponding to the maturity stage model corresponding to the maturity score proposed above, it can be concluded that the overall level of digital transformation is at the third level, that is, the application of information systems and digital technology for data analysis has been completed, and it is at the fourth level of digitalization from informatization At the boundary of transition, efforts still need to be made to realize the fourth stage of digitalization.

Table 10. A Enterprise Digital Transformation Maturity Survey Data Analysis Table

Criterion layer	Weights	project	Weights	average value	Metric maturity	Maturity assessment	overall maturity
Business transformation	0.5889	Degree of business digitalization	0.564	77.400	43.681	77.311	78.949
		Degree of business digital integration	0.244	79.333	19.360		
		Degree of innovation in business digital model	0.115	67.500	7.779		
		Digital business cultivation level	0.076	85.000	6.490		
Technological transformation	0.2519	Improve equipment level	0.473	75.250	35.590	76.570	
		Promote green development	0.298	72.500	21.593		
		Integration of informatization and marketization	0.142	82.500	11.756		
		Safety production management	0.087	88.000	7.631		
Organizational transformation	0.1593	Digitalization of organizational management improves coordination efficiency	0.542	93.500	50.716	88.771	
		Digitizing organizational processes improves operational efficiency	0.232	85.000	19.744		
		Digital platforms promote cross-border circulation of resources	0.133	92.500	12.331		
		Digital platform promotes products and services	0.092	65.000	5.980		

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4. SUMMARIZE

By studying the traditional digital maturity assessment field, digital business transformation, organizational transformation and technological transformation are crucial to the development of enterprises. They are important topics in the current business environment and are of great significance to the development and competitiveness of enterprises. These transformation processes involve integrating traditional business and organizational models with emerging technologies to achieve innovative, efficient and sustainable business operations, helping enterprises to thrive in the new era. This article innovatively uses the digital cycle as an overall analysis of evaluation factors, aiming to help companies cope with the increasingly complex and changing business environment and achieve innovative, efficient and sustainable development through factor analysis of all stages. Through in-depth study of the processes and effects of these transformations, strategic guidance and best practices can be provided for enterprises to promote their success and competitive advantage in the digital era.

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