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The Impact of Digital Transformation on the Resilience of Manufacturing Firms

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Abstract. In the context of the turbulent international economic situation, digital transformation promotes the deep integration of digital technology and production development, and provides new tools for enterprises to cope with increasingly frequent external shocks. This paper empirically examines the role of digital transformation in relation to the resilience of manufacturing firms based on microdata from 3,670 A-share listed manufacturing firms from 2013 to 2022. The outcomes reveal that by making firms more agile and responsive, digital transformation improves corporate resilience; however, heterogeneity analysis illustrates that digital transformation serves a more substantial part in boosting the resilience of state-owned enterprises (SOEs). The aforementioned results offer small-scale proof that enterprise resilience has been enhanced by digital transformation.

Keywords: Digital Transformation, Resilience, Agility Responsiveness

1. Introduction

At present, the frequent occurrence of 'black swan' events has led to a complex and volatile macroeconomic environment. In the volatile, uncertain, complex and ambiguous (VUCA) market environment [1], how to identify risks and turn 'crisis' into 'opportunity' to achieve long-term development has become the focus of academic and practical circles [2]. Enterprise resilience, as a key indicator of enterprise crisis response capability, directly determines whether enterprises can survive external shocks and achieve transformation and upgrading [3].

The Party's '14th Five-Year Plan' for the development of the digital economy clearly defines the strategic positioning of digital transformation and stresses the importance of improving the digital capabilities of enterprises. The state has persisted in enacting laws in recent years to encourage the merging of the digital and physical economies and hasten businesses' digital transformations [4]. Due to the external effects of global diseases and trade friction, digital transformation has emerged as a crucial strategy for businesses looking to weather the crisis.

As digital transformation becomes more and more common, a large number of scholars have begun to focus on this practical practice and systematically explore the impact of digital transformation on enterprises. It mainly focuses on the following two aspects: on the one hand, some scholars have explored the enabling role of digitalisation on enterprise resilience from the instrumental attributes of digital technology. The promotion of green innovation and total factor productivity, for instance, can increase enterprise resilience [5], as can the allocation of enterprise

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resources [6]. The main ways that digital transformation improves company resilience are via increasing human capital, improving innovation capacity, reducing budgetary restrictions, and fortifying internal control [7]. Digital transformation has a facilitating influence on business performance, according to the dual innovation mediating effect [8]. However, other academics note that because of the disruptive nature of digital technology, digitalization may have a detrimental effect on company resilience. This kind of study is founded on the disruptive innovation hypothesis, which contends that digital technology, as a disruptive component, undermines an organization's initial development trajectory and value creation model, potentially weakening organizational resilience. For example, digitalisation, as a technological and strategic change, is highly uncertain and brings certain technological, operational and derivative risks to organisations, resulting in a 'digital negative energy' effect [9].

In summary, The outcomes of the current body of research on the connection between enterprise resilience and digital transformation have been mixed and contradictory. One significant process influencing the connection between enterprise resilience and digital transformation is that agile responsiveness has not been given enough attention in existing studies. To address the above theoretical gaps, this paper takes A-share listed companies in the manufacturing industry as the research object and explores the path of digital transformation to enhance enterprise resilience based on the perspective of agile responsiveness. The following are some potential contributions this paper might make: First, it expands the study on the elements that influence enterprise toughness and discusses how digital transformation promotes enterprise toughness from the standpoint of agile responsiveness. Second, it clarifies the enterprise variability of the efficacy of digital transformation in boosting enterprise resilience by using the variations in enterprise property attributes to do the heterogeneity analysis. It also offers empirical evidence for pertinent decision-making.

2. Theoretical analyses and research hypotheses

2.1. Digital transformation and resilience

Enterprise resilience is a kind of ability embodied in the process of prevention, adaptation, recovery and renewal of enterprises in response to internal and external sudden destructive events [10]. Dynamic capability theory suggests that enterprises can integrate, construct and reconfigure internal and external resource elements to enhance their ability to cope with external crises and adapt to complex environments, and help them gain sustainable competitive advantages [11]. Enterprise resilience, as a special organisational capability, is the ability of an enterprise to predict, avoid and respond to internal and external environmental damage [12]. The process of employing digital technologies to enhance corporate operations, increase productivity, and change the way value is generated is known as digital transformation [13]. Enterprise dynamic capabilities rely on technological upgrades and market demand information to continuously adjust the existing model, which can enhance the enterprise's risk prevention and risk resolution capabilities, improve the enterprise's environmental adaptability, emergency response capabilities and performance rebound capabilities, thus enhancing enterprise resilience [14]. Based on this, this paper will explain the mechanism of digital transformation affecting enterprise resilience from the three aspects of perceiving crisis, acquiring resources, and integrating and reconstructing.

When faced with adversity, companies' responses and adjustments rely on crisis awareness, which can be enhanced by digital transformation to improve risk defence [15,16]. For the manufacturing industry, digitalisation can help it to quickly grasp key information both internally and externally: internally, through production line sensors to collect real-time data on equipment

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operation, and catch abnormalities in time to deal with internal crises; externally, it can break through the limitations of traditional data collection, and with the help of supply chain management software docked on third-party platforms to monitor suppliers' operating conditions, changes in market demand, etc., for example, it can avoid supply cuts and stoppages caused by suppliers' financial chain risks in advance. For example, it can avoid in advance the supply suspension caused by the risk of suppliers' financial chain. Therefore, digital transformation significantly improves the ability of enterprises to sense crises, and thus enhances their resilience.

Rich resource reserve is the foundation for enterprises to resist impact and achieve adaptive adjustment, while insufficient resources will reduce enterprise resilience [17]. Digital transformation optimizes resource reserves in three ways: first, change the human resources acquisition mode, break through the geographical and organizational boundaries, and improve the precision of personnel matching through the semantic parsing and competency modelling technology of the intelligent recruitment platform to alleviate the shortage of high-end talents; second, improve the transparency of financing, enterprises achieve standardized sharing of operational data through financial digitization and supply chain platforms, and combine with blockchain technology to build dynamic credit file, reducing the information asymmetry between banks and enterprises, and promoting the transformation of financing to data-driven decision-making; third, deepening customer demand insight, establishing an omni-channel data collection and analysis system, realising 'production based on demand', shortening the demand response cycle, and reducing the risk of inventory. To sum up, digitalisation broadens the access to resources and helps enterprises to resist crisis and restore renewal.

Based on the dual innovation perspective [18], enterprise digital transformation promotes dual innovation through collaborative and substitution mechanisms [19]: collaborative mechanisms accelerate the integration of resource and information flows in the value chain by digitally embedding existing resource capabilities, and shorten the product lifecycle to promote utilisation-based innovation; substitution mechanisms replace physical product services with digital product services, and lead to changes in the production process and business model to promote exploratory innovation. Innovation. At the same time, the deep optimisation and reconstruction of business processes by digitalisation makes it easier for enterprises to adapt to market changes, improve efficiency and reduce risks. Therefore, digital transformation significantly improves enterprise resilience by integrating resources, acquiring new knowledge and optimising processes [20].

Based on the above analyses and the dynamic capability theory, it is found that digital transformation improves the resilience capability embodied in the prevention, adaptation, recovery and renewal, i.e., coping with crises, by enhancing the capability of enterprises in the three aspects of perceiving crisis, acquiring resources, and integrating and reconfiguring. Therefore, this paper proposes the following research hypothesis:

H1: Digital transformation can improve business resilience.

2.2. The mediating role of agility responsiveness

Agility responsiveness is the ability of an enterprise to respond to and meet customer needs in a timely manner after perceiving and identifying changes in the external environment. First of all, digital transformation with the help of advanced digital technology to obtain internal and external effective information in a timely manner, improve the speed of information processing, help enterprises to explore the value of information, strengthen the ability to perceive market information, accurately predict customer demand, optimise product design, and respond to external changes in a timely manner, which improves the agility and responsiveness of the enterprise.

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Secondly, digital transformation helps to break the information barriers between enterprises, reduce the cost of information exchange between enterprises, and improve the agility response of enterprises based on the industrial end [21]. Agile responsiveness is closely related to the survival, growth and development of enterprises in crisis situations, and is an important influence on enterprise resilience [22]. In essence, the enterprise as an organic whole, the internal links have a close interdependence, and any interruption of the function of any link may trigger systemic risk. In the complex situation where multiple external shocks are superimposed, agility responsiveness can empower enterprises to quickly identify opportunities and threats in the environment, shorten the reaction cycle, accelerate the response to disruptions, and promote enterprises to adjust their strategic planning and carry out adaptive actions in a timely manner, so as to effectively reduce the negative impacts of external shocks and realise the recovery of operations. Therefore, this paper proposes the following research hypotheses:

H2: Digital transformation improves business resilience by increasing business agility and responsiveness.

3. Model construction

3.1. Sample selection and data sources

In this paper, A-share manufacturing listed companies are selected as the initial sample from 2013-2022, and the sample screening is carried out according to the following steps: firstly, this paper excludes the samples that are specially treated (ST, *ST) from 2013-2022; secondly, this paper excludes the samples with incomplete data of key variables; finally, this paper Finally, this paper obtains 15781 firm-year observations from 3698 A-share manufacturing listed companies, and truncates the key continuous variables at 1% and 99% levels to eliminate the effect of data extremes. As for the data sources, the above financial data and basic information related to A-share listed manufacturing companies are all from the Cathay Pacific database (CSMAR), in addition, the empirical analyses of this paper are all completed by Stata18.0.

3.2. Definition and measurement of variables

3.2.1. Explained variables

The explanatory variable of this paper is corporate resilience. The measurement of enterprise toughness mainly includes the following three methods: first, using the scale method of recovery time and recovery level when facing shocks, respectively, to assess the enterprise toughness recovery time is short and rebound level of the enterprise, the toughness of the enterprise is stronger [23] with the enterprise's financial indicators, from the enterprise on the degree of change in the specific external shocks to measure the enterprise toughness [24]; the third is to pay attention to the market performance of the enterprise, the method focuses on the volatility of stock prices, the level of recovery and recovery time of listed companies when facing shocks [25]. In this paper, we use the ratio of stock market capitalisation to total assets of listed companies, i.e. Tobin's Q, to measure corporate resilience [25].

3.2.2. Explanatory variables

The explanatory variable of this paper is digital transformation. In this paper, keywords are extracted from artificial intelligence, big data, blockchain, and cloud computing through text analysis method

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to derive the frequency of keyword appearances, and the digital transformation index is calculated based on the digital indicators to measure the degree of digital transformation of enterprises [26].

3.2.3. Intermediate variables

The mediating variable in this paper is agile responsiveness. Agile responsiveness is a firm's ability to cope with changing market conditions and achieve firm growth through rapid and innovative responses [27]. Board meetings explore and analyse key issues and make high-quality decisions, which is a good indicator of a firm's response to external shocks [28,29]. In view of this, this paper uses the number of board meetings in the current period to measure the agility responsiveness of the firm, and the higher the number, the faster the firm's response to external changes.

Drawing on existing relevant literature, we control for other factors that may have an impact on firm resilience, including firm size, firm age, gearing, return on net assets, board size, equity concentration, and two jobs. Key variables are defined in Table 1.

Table 1. Variable definition and measurement

Variable Type	Variable Name	Variable Symbol	Measurement Methods
Explained Variable	Corporate Resilience	res_tobq	Total Market Capitalisation of Enterprises / Average Total Assets
Explanatory Variable	Digital Transformation	DCG	Logarithmic Number of Digitising Related Word Frequencies
Intermediary Variable	Agility Responsiveness	agility	Logarithmic Number of Board Meetings
Control Variable	Enterprise Size	size	Logarithmic Number of Total Assets
	Enterprise Age	age	Logarithmic Number of Year of Reporting Period Minus Year of Inception
	Asset-Liability Ratio	liability	Total Liabilities/Total Assets
	Return on Equity	ROE	Net Profit/Average Total Net Assets
	Board Size	board	Logarithmic Number of Board Meetings
	Shareholding Concentration	top10	Shareholding Ratio of Top 10 Shareholders of the Enterprise
	Combine Two Positions	position	Whether the Chairman and General manager are the same person The same person takes 1, otherwise 0

3.3. Model construction

This study builds the following model to examine how digital transformation affects manufacturing organizations' resilience:

$$\text{res}\_tobq_{it} = \alpha_0 + \alpha_1 DCG_{\text{it}} + \alpha_2 \text{Controls}_{\text{it}} + \text{industry}_i + \text{year}_t + \varepsilon_{\text{it}} \quad (1)$$

Where $\text{res\_tobq}_{\text{it}}$ is the explanatory variable in the regression model, indicating the resilience value in industry i in year t; DCG_{it} is the core explanatory variable, indicating the degree of digital transformation in industry i in year t; $\text{Controls}_{\text{it}}$ is the control variable mentioned above; in order to

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rule out the influence of differences in firms' industry and year characteristics on corporate resilience, this paper also controls for industry ($industry_i$) and year ($year_t$) fixed effects in the regression model; ε_{it} denotes the random disturbance term.

$$agility_{it} = \beta_0 + \beta_1 DCG_{it} + \beta_2 Controls_{it} + industry_i + year_t + \varepsilon_{it} \quad (2)$$

$$res\_tobq_{it} = \gamma_0 + \gamma_1 DCG_{it} + \gamma_2 agility_{it} + \gamma_3 Controls_{it} + industry_i + year_t + \varepsilon_{it} \quad (3)$$

Model (2) is used to test the impact of enterprise digital transformation on agile responsiveness, if the coefficient β_1 is significantly positive, indicating that enterprise digital transformation can improve the enterprise's agile responsiveness. Model (3) is used to test the impact of agile responsiveness and digital transformation on the resilience of manufacturing enterprises, if the coefficients γ_1 and γ_2 are significant, then it is a partial mediation effect; if γ_2 is significant but γ_1 is not significant then it is a complete mediation effect, otherwise the mediation effect does not hold.

4. Empirical analyses

4.1. Descriptive statistics

In this paper, the main variables in the econometric model test are analysed by descriptive statistics, and the results are shown in Table 2. The results show that the maximum value of enterprise toughness (Res_tobq) is 8.220, the minimum value is 0.880, the mean value is 2.100, and the standard deviation is 1.270, indicating that there is a big difference in the level of toughness of China's manufacturing listed companies, and on the whole, China's manufacturing listed companies have a higher level of toughness and stronger ability to cope with risks. The maximum value of digital transformation (Digital) is 4.760, and the minimum value is 0, indicating that there is a significant difference in the level of digital transformation among listed companies in China's manufacturing industry, and some companies have not yet begun to carry out digital transformation.

Table 2. Descriptive statistics of the main variables

Variable	N	Mean	SD	Min	p50	Max
Res_tobq	15780	2.100	1.270	0.880	1.690	8.220
DCG	15780	1.460	1.290	0	1.390	4.760
age	15780	2.880	0.330	1.950	2.940	3.530
size	15780	22.17	1.170	20	22.03	25.76
liability	15780	0.390	0.190	0.060	0.390	0.890
ROE	15780	0.060	0.130	-0.690	0.070	0.360
board	15780	2.100	0.190	1.610	2.200	2.560
top10	15780	0.590	0.150	0.230	0.600	0.900
position	15780	0.350	0.480	0	0	1

4.2. Benchmark regression

The effect of digital transformation on the resilience of manufacturing firms is tested using model (1) and the regression results are shown in Table 3, where all control variables are added and

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industry fixed effects and year fixed effects are controlled. The regression results show that the regression coefficient of digital transformation on the resilience of manufacturing firms is 0.0376 and is significant at the 1% level. This indicates that digital transformation has a positive effect on the resilience of manufacturing enterprises and hypothesis H1 is verified. To ensure the robustness of the empirical results, this paper lags the sample intervals of the explanatory variables by two periods for the robustness test. At the 1% level, the regression coefficient of digital transformation on enterprise resilience is significantly positive, according to the regression results in column (2), and the regression results are consistent with those of the benchmark regression, which further validates hypothesis H1.

Table 3. Benchmark regression and robustness test results

	(1)	(2)
	res_tobq	res_tobq
DCG	0.0376***	0.0245***
	(0.0139)	(0.00920)
age	0.223***	0.118***
	(0.0509)	(0.0346)
size	-0.385***	-0.290***
	(0.0159)	(0.0106)
liability	0.0874	-0.346***
	(0.0961)	(0.0647)
ROE	1.868***	1.492***
	(0.121)	(0.0792)
board	-0.234***	-0.193***
	(0.0832)	(0.0553)
top10	-0.763***	-0.488***
	(0.107)	(0.0717)
position	0.0778**	0.0116
	(0.0322)	(0.0215)
year	Yes	Yes
ind	Yes	Yes
_cons	14.16***	12.28***
	(0.678)	(0.468)
N	15780	13623
R^2	0.135	0.230
adj. R^2	0.131	0.226

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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4.3. Tests for intermediate effects

Benchmark regression results show that digital transformation can significantly improve the resilience level of manufacturing enterprises in response to external shocks. Combined with the discussion in the theoretical analysis section, this paper further explores and validates the mechanism of digital transformation affecting the resilience of manufacturing enterprises based on the agile responsiveness perspective. The results of the mediation effect test are shown in Table 4. Table 4 presents the regression results of agile responsiveness mechanism identification. The regression results in column (1) show that the regression coefficient of digital transformation (DCG) is 0.0269, which is significant at the 1% level, indicating that digital transformation of enterprises can improve enterprise agility responsiveness. Column (2) shows that the regression coefficient of agility is 0.0998, which is significant at 1% level, indicating that the increase of agility helps to increase the level of enterprise resilience. Meanwhile, the regression coefficient of digital transformation is slightly smaller than the coefficient in the baseline regression (0.0327<0.0376), indicating that enterprise agility responsiveness exhibits partial mediation effect in the process of digital transformation to enhance enterprise resilience, and the mediation effect accounts for 7.14%. Thus, hypothesis H2 is verified.

Table 4. Mechanism of action regression results

	(1)	(2)
	agility	res_tobq
DCG	0.0269***	0.0327***
	(0.00258)	(0.00846)
agility		0.0998***
		(0.0260)
age	-0.0473***	0.120***
	(0.00943)	(0.0308)
size	0.0565***	-0.305***
	(0.00295)	(0.00975)
liability	0.359***	-0.314***
	(0.0178)	(0.0588)
ROE	-0.0511**	1.530***
	(0.0224)	(0.0730)
board	-0.0732***	-0.196***
	(0.0154)	(0.0503)
top10	-0.0942***	-0.499***
	(0.0198)	(0.0646)
position	0.00664	-0.00148
	(0.00597)	(0.0195)
year	Yes	Yes
ind	Yes	Yes
_cons	1.199***	11.26***
	(0.126)	(0.411)

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Table 4. (continued)

N	15780	15780
R^2	0.140	0.237
adj. R^2	0.136	0.233

4.4. Heterogeneity analysis

In fact, the different nature of enterprise property rights may lead to differences in the impact of digital transformation on enterprise resilience. Thus, based on the type of enterprise property rights, this paper separates the research sample into state-owned and non-state-owned businesses. The heterogeneous impact of digital transformation on enterprise resilience under different property rights nature is further analysed. From Table 5, it can be seen that digital transformation has a significant positive effect on the resilience of state-owned enterprises and is significant at the 1% level. However, for non-state-owned enterprises, the effect of digital transformation on the toughness of state-owned enterprises is not significant. The possible reasons for this difference are as follows:

First, state-owned enterprises have certain financial advantages and data accumulation, which make it easier to quickly carry out digital transformation and increase their enterprise resilience, while non-state-owned enterprises cannot effectively apply digital technology due to the limitations of financial and human resources and other factors, resulting in a slightly weaker effect of digital transformation in comparison. Second, state-owned businesses have advantages over non-state-owned businesses in terms of operational capital and resource use, among other things. State-owned enterprises can make strategic planning in advance to help them respond quickly to the uncertainty brought about by environmental changes, which provides a guarantee for improving enterprise resilience. Finally, SOEs have invested much more in digital technology and digital product R&D and innovation than non-SOEs, and their overall R&D and innovation capacity is relatively high.

Table 5. Regression results of heterogeneity in the nature of firms' property rights

	(1) State Owned Enterprises	(2) Non State Owned Enterprise
	res_tobq	res_tobq
DCG	0.0812***	0.0222
	(0.0171)	(0.0169)
age	0.0780	0.261***
	(0.0698)	(0.0612)
size	-0.366***	-0.395***
	(0.0178)	(0.0210)
liability	-0.574***	0.327***
	(0.107)	(0.120)
ROE	1.355***	1.966***
	(0.129)	(0.152)
board	-0.0510	-0.296***
	(0.102)	(0.101)

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Table 5. (continued)

top10	0.244*	-0.975***
	(0.131)	(0.132)
position	-0.0616	0.104***
	(0.0553)	(0.0375)
year	Yes	Yes
ind	Yes	Yes
cons	12.39***	13.78***
	(0.509)	(0.663)
N	3506	12274
R^2	0.359	0.121
adj. R^2	0.349	0.116

5. Conclusion

Facing the complexity and unpredictability of the environment and the future, building and enhancing the resilience of manufacturing enterprises to cope with external shocks has become a necessary condition for their survival and development. Digital transformation, as the main trend of the current industry development, can help manufacturing enterprises to perceive and identify changes in the market environment and respond to them instantly, thus improving their resilience. Based on the micro enterprise perspective, this paper explores the intrinsic relationship between digital transformation, agile responsiveness and manufacturing enterprise resilience through theoretical analysis and empirical testing. The main conclusions are as follows: first, digital transformation can effectively improve manufacturing enterprise toughness, and this conclusion still holds after the robustness test. Second, the results of the mechanism test indicate that digital transformation enhances enterprise resilience by responding to changes occurring externally in a timely manner, breaking down the information barriers between enterprises, and improving enterprise agility responsiveness. Third, the results of heterogeneity analysis show that the effect of digital transformation on enterprise resilience enhancement is more obvious in SOEs. Based on the above findings, this paper puts forward the following policy insights:

First, the government should systematically strengthen the construction of digital transformation infrastructure and ecosystem, and build a whole-chain support barrier for enterprise resilience enhancement. On the one hand, more new digital infrastructure should be built by the government: focusing on promoting the extension of coverage of 5G base stations, industrial Internet, and arithmetic centres to manufacturing clusters, providing a low-threshold and highly reliable technical base for enterprise digital transformation by optimizing network bandwidth and reducing the cost of use; and synchronously promoting the construction of a digital technology standard system, standardizing the management of the whole process of data collection, storage, and sharing, and safeguarding the safe and orderly circulation of data elements. safe and orderly circulation. On the other hand, the government, industry, academia, research and application of digital transformation ecosystem should be constructed: supporting universities, research institutes and enterprises to jointly carry out digital technology research and accelerating the scenario of AI, blockchain and other cutting-edge technologies in the manufacturing industry; encouraging industry associations and third-party organisations to set up a platform for transformation exchanges, and facilitating the sharing and dissemination of transformation experience and technical achievements. Encourage

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industry associations and third-party organisations to set up transformation exchange platforms to promote the sharing and dissemination of transformation experience and technical achievements, and form a digital ecological pattern guided by the government, led by the market, and participated by many parties to create a high-quality external environment for enterprises to enhance their resilience through transformation.

Second, enterprises should focus on the intermediary transmission value of agile responsiveness, and strengthen the agile response mechanism through digital transformation to build the foundation of resilience. On the one hand, relying on digital technology to build an all-link real-time sensing and response system, agile responsiveness has become a key link to the resilience empowered by digital transformation. Enterprises can use big data analysis and artificial intelligence algorithms to capture and dynamically warn of external signals such as market demand fluctuations, supply chain risks, and changes in the policy environment in real time, and through the construction of a digital intelligence monitoring platform covering production, procurement, sales, and other aspects of the integration and analysis of dispersed market information and operational data, accurately identifying potential impacts and quickly generating response solutions, so that the technological advantages of digital transformation can be transformed instantly through agile response, and efficiently delivered to the market. The technological advantages of digital transformation are instantly transformed into the resilience of the enterprise to withstand risks through agile response. On the other hand, digital transformation promotes the flexible restructuring of the organisation's response process, and consolidates the intermediary transmission efficiency of agile response. By breaking down traditional departmental barriers and establishing cross-departmental agile response teams based on digital platforms to achieve instantaneous interoperability of demand information, resource scheduling, and decision-making commands, and at the same time, using industrial Internet technology to disassemble the production process into modular units that can be quickly reorganised, enabling enterprises to flexibly adjust production plans and optimise supply chain configuration according to external changes, so that process optimisation brought about by digital transformation can be efficiently implemented through the agile response, and continuously strengthen the dynamic enterprise response capability. Efficient implementation, continue to strengthen the adaptability and resilience of enterprises in the dynamic environment, so as to fully release the agile responsiveness in the digital transformation and resilience enhancement of the intermediary bridge role.

Third, the government and enterprises should collaborate to implement differentiated digital transformation strategies to accurately release the resilient growth momentum of enterprises of different ownership systems. On the one hand, state-owned enterprises need to be based on resource endowment and transformation foundation, play a leading role in digital transformation demonstration, through increasing investment in digital technology research and development, building a digital system covering the entire chain of production and manufacturing, operation and management, and market services, and deepening the depth of integration of digital technology and the real economy, to transform the advantages of digital transformation into resilience enhancement performance more efficiently, and to provide replicable practice models for industry transformation. On the other hand, the government needs to focus on the pain points and difficulties in the digital transformation of private enterprises, and formulate targeted support policies: for example, to accurately reduce the transformation costs of small and medium-sized private enterprises through gradient transformation subsidies, to provide customised solutions relying on public service digital technology service platforms, and to help private enterprises steadily push forward the transformation of private enterprises in combination with their own scale and business

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characteristics, so as to ensure that all types of enterprises of all types of ownership can strengthen the resilience to external shocks through digital transformation. Ensuring that enterprises of all types of ownership can strengthen their resilience to external shocks through digital transformation.

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