Proceedings of Business and Economic Studies, 2025, Volume 8, Issue 4
http://ojs.bbwpublisher.com/index.php/PBES
Online ISSN: 2209-265X
Print ISSN: 2209-2641

The Origin, Measurement, and Influencing Factors of Enterprise Resilience

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Abstract: In the dual context of VUCA era and digital transformation, enterprise resilience, as the core ability of organizations to resist shocks, adapt to changes, and achieve sustainable development, has increasingly highlighted its theoretical connotation and practical value. This article systematically explores the interdisciplinary theoretical origins, multidimensional dynamic measurement methods, and complex influencing factors of enterprise resilience. Research has shown that: (1) the concept of resilience originates from ecology, engineering, and physics, and extends to the field of complex adaptive systems, forming a micro capability integration framework of "pre crisis prevention crisis response crisis recovery", as well as macro strategic attributes that support high-quality development of the national economy; (2) Resilience measurement needs to integrate subjective and objective dynamic indicators: at the subjective level, Likert scale is used to evaluate organizational capability traits, and at the objective level, financial performance fluctuations, market performance, and crisis learning behavior are combined; (3) Resilience is driven by the synergy of multiple levels of factors: internal dependence on organizational capability foundation, digital empowerment, external resource linkage, policy environment, and sustainable governance. Its interaction mechanism accelerates capability updates through digital iteration, policy activates resource networks, and ultimately constructs an organizational resilience system of "survival adaptation evolution". This article provides a unified analytical framework for the study of enterprise resilience, and provides theoretical guidance and practical paths for organizations in the digital age to cultivate risk resistance capabilities and achieve resilience evolution.

Keywords: Enterprise resilience; Digital empowerment; Influencing factors; Sustainable governance

Online publication: September 9, 2025

1. Introduction

In the context of VUCA (volatility, uncertainty, complexity, and ambiguity) era, macroeconomic fluctuations and micro enterprise survival environment are facing unprecedented challenges. Enterprise Resilience, as the core ability of organizations to resist shocks, adapt to changes, and achieve sustainable development, has become a focus of attention for both academia and practice. Although this concept originated from ecology[1]and engineering[2] and is manifested in physics as the "toughness" characteristic of fracture resistance[3], its theoretical connotation has extended to interdisciplinary fields of complex systems, becoming an inherent property of enterprises, infrastructure

and other systems to cope with disturbances[4,5]. Although Meyer (1982) was the first to introduce resilience into business management research, there is still disagreement in academia regarding its definition: at the micro level, it focuses on the integration of dynamic capabilities before, during, and after a crisis[6-8], while at the macro level, it emphasizes its strategic value for the high-quality development and sustainability of the national economy[9]. Especially in the global wave of digital transformation, enterprise resilience has been endowed with new connotations - the ability to use digital technology to identify environmental changes, prevent crises, respond efficiently, and achieve long-term development adaptability[10]. However, existing research has not yet systematically addressed three key issues: firstly, the lack of integration of interdisciplinary theoretical origins weakens the essential understanding of resilience as a dynamic capability; Secondly, the measurement methods are fragmented, and the isolated use of subjective scales, market indicators, and financial performance makes it difficult to capture the multidimensional dynamic characteristics of resilience[11]; Thirdly, research on influencing factors is scattered across dimensions such as organizational capacity, digitization, external resources, and sustainable governance, lacking a systematic deconstruction of their interaction mechanisms. Therefore, based on the background of the digital age, this article clarifies the theoretical origins of resilience, constructs a measurement system of "subjective and objective combination+dynamic process", and reveals the synergistic mechanism of organizational capability foundation, external resource network, and policy environment. The aim is to provide a unified analytical framework for enterprise resilience research and provide theoretical guidance for the practice of cultivating risk resistance and achieving sustainable evolution.

2. Research on enterprise resilience

2.1. The origin and definition of resilience

In the era of VUCA, the importance of resilience in macroeconomic operations and micro enterprise development is increasingly prominent, receiving widespread attention from the academic community. As shown in **Table 1**, Resilience "originated in the field of ecology and refers to the ability of ecosystems to absorb and respond to disturbances[1]. In addition to its widespread application in ecology, the concept of resilience is becoming increasingly important for engineering systems as it is a method of solving their increasingly complex problems and designing systems that can sustain unexpected failures without catastrophic losses. For engineering systems, resilience is defined as the ability of the system to withstand disturbances and recover while undergoing changes and maintaining the same functionality [2]. From a physics perspective, the stronger the toughness, the less likely brittle fracture occurs [3]. Resilience, as a key concept, also appears in interdisciplinary fields related to complex systems, such as enterprises, critical infrastructure systems, and ecosystems [4,13]. From these perspectives, resilience is referred to as an inherent property of complex systems [1,13,5]. The perspectives defined by different disciplines are different, but a certain consensus has also been reached.

Table 1. The origin and definition of resilience

Discipline	Definition
Ecology	The ability of an ecosystem to absorb and respond to disturbances.
Engineering	The capacity of a system to withstand disturbances and recover while maintaining its original functions after experiencing changes.
Physics	The ability of a material to absorb energy during plastic deformation and fracture. Higher toughness reduces the likelihood of brittle fracture.
Interdisciplinary	Resilience constitutes a response to unexpected changes and disturbances, reflecting the ability to adapt to and cope with such disruptions. It is an inherent property of complex systems.

2.2. Main viewpoints on enterprise resilience

Professor Meyer (1982) was the first to bring resilience research into the field of enterprise management[6], thus opening the curtain on the study of enterprise management resilience. However, so far, there is no consensus on the main theoretical content of research on enterprise resilience in the field of enterprise management. But overall, it can be defined from two perspectives: micro and macro. As shown in **Table 2,** macroscopically, it is a global and complete concept; At the micro level, it can be divided into three stages: pre event, in event, and post even. From a pre employment perspective, resilience is a potential capability foundation for enterprises, helping them predict external shocks, adjust and respond in a timely manner, and avoid further losses. It is an essential characteristic for enterprises to cope with crises or overcome difficulties[7,14]. This viewpoint tends to view corporate resilience as inherent resilience, that is, the ability under normal circumstances[13]. The mid-term stage focuses on highlighting the current response of the enterprise, that is, the enterprise continues to operate even when encountering significant disruptions, which can measure whether the enterprise has the ability to respond to crises[15,11,16]. The post event view suggests that even after a destructive crisis occurs, companies can still restructure and maintain their organizational status[8], restoring inventory, production capacity, service efficiency, and other aspects to normal levels[17].

In summary, at the micro level, enterprise resilience refers to the ability of a company to identify and scan internal and external environmental changes, prepare and take preventive measures to integrate internal and external resources, respond promptly and effectively to emergencies, achieve recovery, and possess the ability for long-term prosperity[18]. From a macro perspective, economic resilience is the key to measuring the high-quality development of a country's economy, which can ensure the sustainable development of the economy. Enterprise resilience has the same value [19].

In summary, combined with the digital background, this article defines enterprise resilience as the adaptability of enterprises for long-term development, specifically manifested as the ability to use digital technology to respond to and overcome various crises in the development process. The ability of enterprises to identify external changes, fully prevent and prepare in advance, effectively respond and recover afterwards, and achieve long-term development.

Table 2. Main viewpoints on enterprise resilience

Perspective	Phase	Core view
Micro-level	Pre-disruption	The potential capability of enterprises to predict, avoid, and adjust to external shocks – an essential attribute for overcoming crises.
	During-disruption	The ability of enterprises to maintain continuous operations when facing major disruptions.
	Post-disruption	The capacity to reconfigure resources and sustain organizational functions after a crisis.
	Comprehensive	The integrated capability to identify external changes, proactively prepare, respond effectively, recover, and achieve long-term development.
Macro-level	Holistic	A key metric for high-quality national economic development and a safeguard for sustainable growth.

3. Measurement of enterprise resilience

Enterprise resilience is an important indicator for measuring the performance of enterprise development, and the measurement methods mainly include the following three methods, which is shown in **Table 3:** first, survey scale measurement. Lu *et al.*(2021) subjectively and objectively measured enterprise resilience, and the subjective measurement drew on the Likert scale to construct an indicator system; Objective measurement mainly measures

the recovery level and recovery time of enterprises after being subjected to destructive shocks[20]. It is believed that the shorter the recovery time and the higher the recovery level, the stronger the resilience of enterprise; The second is to focus on the market performance of enterprises, which focuses on examining the volatility, recovery level, and recovery time of stock prices of listed companies after being impacted. It is usually measured by the growth rate of stock returns, emphasizing that the recovery level of stock prices and their returns should not be lower than the level before the impact[11]; The third is to use the financial performance indicators of the enterprise to measure its resilience, including profitability, growth ability, debt paying ability, etc., such as return on equity, return on assets [12], sales net profit margin, and the ability of operating income to recover growth after an impac, as well as indicators such as the growth rate of operating income from the perspective of enterprise performance[21].

Table 3. Methods for measuring enterprise resilience

Approach	Medium	Perspective	Specific method
Direct	Scale-based	Capability	Anticipatory, responsive, and adaptive capabilities
	Scale-based	Process	Monitoring, response, prediction, and learning
		Traits	Stability, sensitivity, and synergy
Indirect	Financial Metrics	Comprehensive Performance	Financial volatility, sales growth rate, survival rate
			Long-term growth and financial fluctuations
			Risk resistance, adaptive adjustment, and recovery capabilities
			Risk resistance, recovery adaptability, and innovation transformation capabilities
			Standard deviation of long-term ROE relative to industry peers
			Total sales revenue relative to industry average development level
	Market Metrics	Impact of External Shocks	Magnitude of stock price decline, duration of decline, and recovery extent
			Post-crisis stock price recovery extent
			Stock price volatility

4. Factors influencing enterprise resilience

As shown in **Table 4**, the formation and development of enterprise resilience are influenced by multi-level complex factors, and its core is rooted in the internal capability foundation of the organization. Dynamic capabilities enable enterprises to quickly restructure resources and adjust strategies to respond to crises. The heterogeneity of the executive team, CEO openness, and internal social capital further strengthen this adaptability by enhancing decision-making diversity and internal collaboration efficiency[22]. Closely linked to this is digital empowerment, where digital transformation significantly enhances resilience by restructuring business processes and optimizing data-driven decision-making. The application of artificial intelligence deepens risk warning mechanisms, while digital supply chain management strengthens the responsiveness of the supply chain. However, caution should be taken against the efficiency inflection points that may arise from excessive digitization[23-25].

The external resource linkage mechanism provides key support for enterprises to cope with external shocks, strategic alliance cooperation expands the boundaries of resource acquisition, state-owned capital participation enhances the stability of the industrial chain by fixing and supplementing the chain, while the agglomeration of productive service industries and the coordination of supply chain networks rely on specialized division of

labor to build elastic buffer spaces [36-38]. These synergies are amplified under the catalysis of policies and market environments: the construction of a unified national market reduces institutional transaction costs, innovative policies and new infrastructure provide technology and resource supply channels, and government assistance becomes a guarantee to resist extreme sanctions[29-31].

Sustainable governance constitutes the long-term cornerstone of resilient development, ESG rating enhancement strengthens resilience by optimizing corporate reputation and risk management, and social responsibility fulfillment consolidates stakeholder support in most contexts, but resource constraints may weaken its positive effects; Carbon neutrality practices promote structural adaptation in green transformation, while patient capital provides stable long-term financial support for strategic adjustments[32-34].

The above factors shape resilience through dynamic interaction: digital empowerment accelerates organizational capability iteration [35], policy environment activates external resource networks[36], and sustainable governance runs through the entire process of building internal and external resilience systems, ultimately forming the vitality of organizational survival, adaptation, and evolution [37].

Table 4. Factors influencing enterprise resilience

Dimension	Influence factor	Influence direction
Fundamentals of organizational capability	dynamic capability	+
	Heterogeneity of senior management team	+
	CEO openness	+
	Risk-taking willingness	+
	Social capital within the organization	+
	Innovation resilience	+
Digital empowerment	Digital transformation	+/Inverted N-type
	Data element input	+
	Artificial intelligence application	+
	Digital supply chain management	+
External resource linkage	Strategic alliance cooperation	+
	State-owned capital equity participation	+
	Agglomeration of productive service industries	+
	Supply chain network collaboration	+
Policy and market environment	Construction of a unified national market	+
	Innovation policy support	+
	New infrastructure	+
	Government assistance	+
Sustainable governance	ESG rating improvement	+
	Fulfillment of social responsibility	+/-
	Carbon neutrality practice	+
	Patient capital investment	+

5. Conclusion and future prospects

This study systematically explores the complex and critical organizational capability of enterprise resilience, delving into its theoretical origins, scientific measurement methods, and multidimensional influencing factors. The conclusion indicates that the concept of enterprise resilience is rooted in multiple disciplinary fields, particularly ecology, complex adaptive system theory, and crisis management theory. This provides a solid theoretical foundation for understanding its essence as an organization's dynamic ability to absorb shocks, adapt to changes, and achieve recovery or even transcendence in turbulent environments. At the measurement level, research has revealed that enterprise resilience cannot be summarized in a single dimension. Effective measurement requires a combination of objective financial indicators and subjective perception indicator, as well as attention to the learning and change behaviors exhibited by organizations during crises, to construct a multidimensional and dynamic evaluation system. Regarding the influencing factors, research has found that corporate resilience is influenced by a complex interplay of multiple internal and external factors. Among the internal factors, robust organizational capita, deep social capita, and key psychological capital constitute the core pillars of resilience; In terms of external factors, the stability of the stakeholder network, the characteristics of the industrial environment, and the support of the macro institutional environment jointly shape the buffer zone and resource pool for enterprises to cope with external shocks. These factors do not exist in isolation, but interact and work together to determine the vulnerability and resilience of enterprises in the face of crises. Ultimately, this study confirms that enterprise resilience is a core capability for organizations to survive and develop in uncertain times, and its cultivation is a systematic project involving strategic foresight, structural optimization, cultural shaping, and relationship management.

Although this study has deepened our understanding of corporate resilience, there is still vast room for exploration in this field. Future research should focus on overcoming the limitations of existing measurement methods and developing resilience dynamic assessment tools that are more timely, forward-looking, and industry applicable, such as using big data and artificial intelligence technologies to track organizations' real-time response patterns and recovery trajectories in crises, and exploring methods for identifying resilience thresholds. At the same time, theoretical construction requires further integration of emerging perspectives, in-depth exploration of the micro psychological mechanisms underlying resilience formatio, dynamic process models of resilience evolution, and the interrelationships and transformation conditions between different resilience type. In terms of influencing factors, future work urgently needs to focus on resilience differences in specific contexts, such as in-depth analysis of the heterogeneity and prioritization of key resilience driving factors in different industries, different sized enterprise, and facing different types of shock. In addition, the revolutionary impact of digital technologies such as artificial intelligence, blockchain, and the Internet of Things on building enterprise resilience, particularly in enhancing situational awareness, optimizing decision-making speed, reshaping supply chain resilience, and innovating business models, is a highly relevant research frontier. Exploring effective intervention strategies and practical paths for cultivating resilience, such as how to design resilience oriented leadership development projects, build a learning oriented organizational culture, optimize crisis plans and exercise mechanisms, and how to create an external ecosystem that is more conducive to enterprise resilience growth through policy design, will be a key bridge connecting theory and practice in the future. Ultimately, the ultimate goal of research should be to help businesses not only "survive" in crises, but also achieve "evolution", transforming resilience into a source of sustainable competitive advantage, and contributing wisdom to building a more risk resistant business ecosystem and economic system.

Funding

2025 Nanjing University of Science and Technology Zijin College Campus level Scientific Research; Research on the Mechanism, Path, and Policy of Generative AI Cracking the Bottom Logic of Organizational Resilience (Project No.: 2025ZXSK0401004)

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