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A Study on the Impact of Digital Transformation, Innovation Capability on Innovation Performance of China's High-Tech Listed Companies

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Abstract:
In today's soaring digital economy, companies are experiencing increasingly fierce competition and a growing need for innovation performance. This paper examines the influence of digital transformation and innovation capability on the innovation performance of China's high-tech listed companies. It develops a theoretical model that includes dynamic capability as a mediator variable. The study categorizes digital transformation into three dimensions: digital technology, digital product, and digital platform. Similarly, innovation capability is divided into technology capability, market capability, and integration capability. Dynamic capability is further divided into perception capability, absorption capability, and integration capability. Lastly, innovation performance is measured in terms of product innovation performance and process innovation performance. This paper examines the current situation and motivation influencing the innovation capability of high-tech companies in China that are listed on the stock market, taking the context of digital transformation into account. Based on this analysis, it proposes feasible realization path from the dimension level according to the proposed theoretical mechanism model, and gives four innovative strategies: establishing an agile product development mechanism, building a unified digital collaboration platform, implementing a comprehensive market research mechanism, and implementing a cross-functional product development mechanism. Ultimately, this report offers pertinent recommendations for companies, governments, and investors. The findings have significant implications for China's high-tech companies that aim to enhance their innovation performance through digital transformation and innovation capability.

Keywords:
high-tech listed companies; digital transformation; innovation capability; dynamic capability; innovation performance

1. Introduction

Due to the fast advancement of digital technology, digital economy has emerged as the most dynamic and innovative economic model, surpassing the agricultural and industrial economies in terms of its vast reach.

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Digital economy has rapidly developed, encompassing a broad range of activities and exerting a significant impact. It has not only transformed production, daily life, and governance methods, but also driven the worldwide restructuring of resources, economic structure, and competition patterns. In China, the magnitude of digital economy has been progressively growing each year, and its proportion of the Gross Domestic Product (GDP) has been consistently rising. The quick growth of the digital economy can be linked to the swift advancements in science and technological innovation. This tendency also can be seen in the continuous improvement of the innovation index throughout the years.

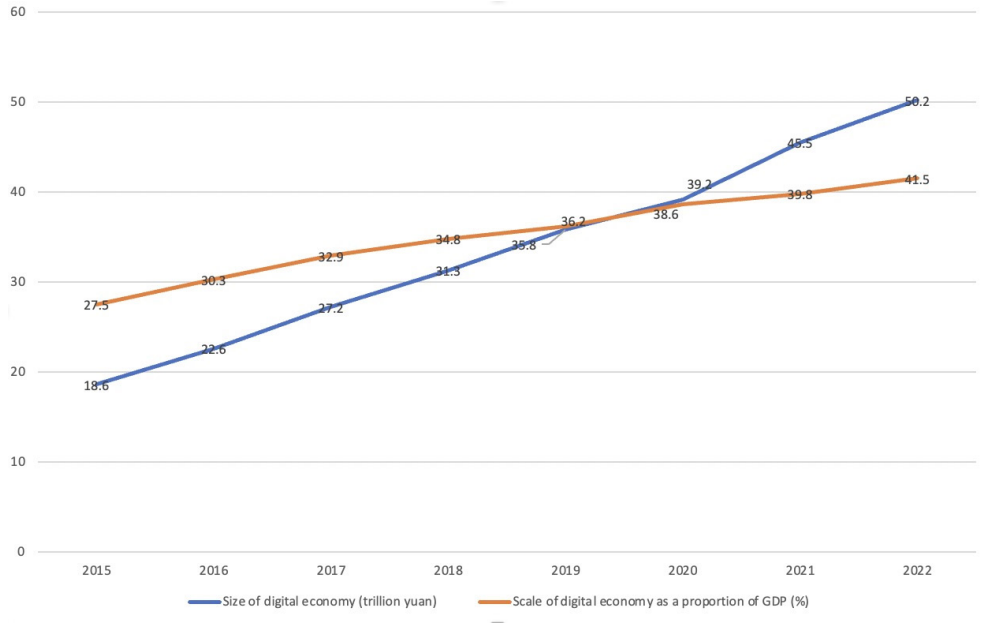


Figure 1 China's digital economy size and its share of GDP 2015-2022

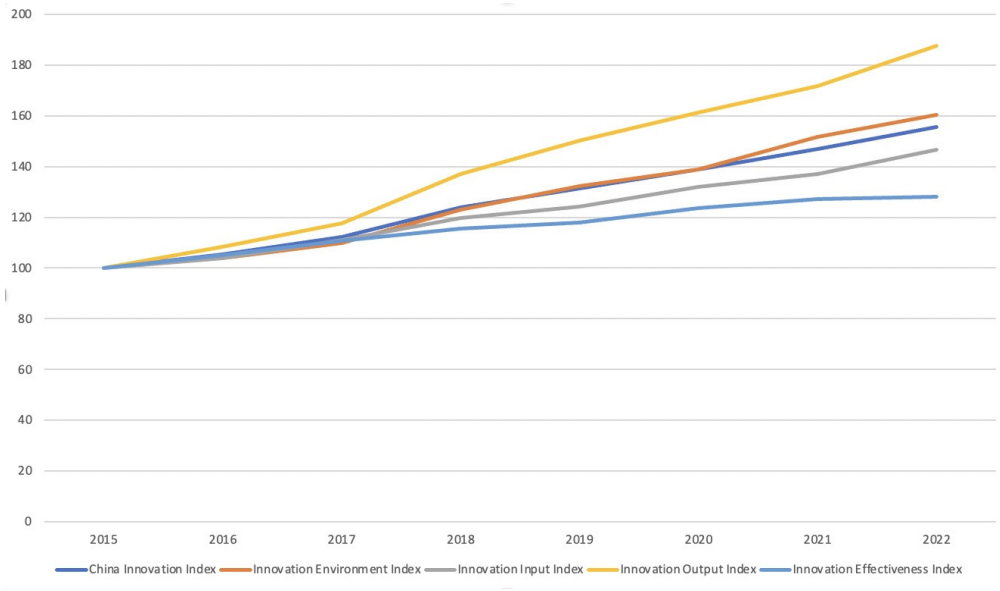


Figure 2 China Innovation Index and Segment Indices 2015-2022

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Currently, China's firms are confronted with the predicament of being unwilling, hesitant, or unable to undergo digital transformation. The digital transformation rate in China's firms is around half of the developed countries in Europe and America. The primary cause is the inadequate foundation of the company, the high cost of digital transformation, the elevated threshold for comprehensive implementation, the lengthy time frame, the limited scope of the program, and the lack of synergy between the industry chain and its upstream and downstream components. Over 50% of companies in China have yet to finish the superficial, equipment-focused digital transformation, much less to undertake a comprehensive digital transformation that utilizes digital tools to decrease costs, enhance efficiency, and boost innovation. The position of listed companies in high-tech industries is more strongly associated with digital transformation compared with other industries. These companies have better accumulation, and their successful digital transformation serves as a valuable reference for China's SMEs. This will aid China in overcoming the national-scale transformation dilemma. This paper introduces dynamic capability as the mediator variable to examine how digital transformation and innovation capability of high-tech listed companies affect innovation performance. It explores this relationship from a theoretical perspective and proposes innovation strategies to enhance the innovation performance of enterprises.

2. Theory Review and Prospect

2.1 Innovation performance

Ever since Schumpeter introduced the concept of "innovation," the matter of innovation performance has garnered the interest of scholars both domestically and internationally. The field of academic research on corporate innovation performance has a long history. Scholars primarily describe company innovation performance from three perspectives: the process perspective, the result perspective, and the comprehensive perspective, as illustrated in Table 3. In terms of the process, innovation performance encompasses the entire cycle from generating new ideas to developing new technologies, products, and services, and finally introducing them to the market. Therefore, it is necessary to measure innovation performance throughout the entire process. In terms of results, innovation performance can be narrowly assessed by quantifying the number of patents, new products, and other tangible innovation achievements. In a broader sense, innovation performance encompasses the economic advantages that a company gains from its innovative efforts. From a comprehensive perspective, scholars have examined both the process and results of innovation to define innovation performance.

Table 3 Definition of innovation performance

Research Perspectives	Representative Studies	Definition of Innovation Performance
Process Perspective	Meeus and Oerlemans (2000)	Innovation performance is the process by which firms introduce developed new technologies and products into the market, and it is the economic performance of firms through technological innovation
	Hagedoorn and Cloodt (2003)	Innovation performance is the entire process of a firm from coming up with new ideas, to developing new technologies, to creating new products and services.

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Result Perspective	Ahuja and Katila (2001)	Innovation performance refers to the results achieved by firms in terms of technology, inventions and innovations in the processes of new idea generation, technology development, product production, and commercialization.
	Prajogo and Ahmed (2006)	Innovation performance refers to the outcome of product innovation, categorized into the type of product innovation, cost and speed of change
Comprehensive Perspective	Janssen and Van Yperen (2004)	Innovation performance is the combination of innovation processes and innovation outcomes, from the willingness to innovate to the actions to innovate to the resulting innovation outcomes
	Chen Jin and Chen Yufen (2006)	Innovation performance is categorized into innovation process performance and innovation output performance, innovation output performance is categorized into economic and technological benefits, and innovation process performance refers to the level of management and potential performance of technological innovation activities

After examining the division of innovation performance dimensions by scholars both domestically and internationally, this study identifies several categories that innovation performance can be classified into. These categories include the degree of innovation, all types of enterprises, cooperation, content, technology, region, green initiatives, individual efforts, team organization, and other miscellaneous categories. Scholars often categorize organizations' innovation performance into two aspects, as illustrated in Table 4.

Table 4 Classification of companies' innovation performance dimensions

Representative Studies	*Dimensions*
Lee and Ryu (2014)	*Product innovation performance, process innovation performance*
Hong et al. (2019)	*Product innovation performance, management innovation performance*
Wang and Lam (2019)	*Technological innovation performance, management innovation performance*
Ma Hedan and Zhang Wan Yue (2022)	*High-tech innovation performance, non-high-tech innovation performance*
Patwary et al. (2024)	*Management innovation, technological innovation*

The definition of innovation performance varies depending on different views, with the primary perspectives being the process perspective, result perspective, and comprehensive perspective. In terms of the dimensional division of innovation performance, researchers focus on various objects and types of research subjects, resulting in a broad range of dimensional divisions. This paper, however, will specifically examine China's high-tech listed companies as the research object. It will investigate innovation performance-related issues from the perspectives of product innovation performance and process innovation performance. This paper concludes that there is a lack of research by both domestic and foreign scholars on the relationship between digital transformation, innovation capability, and enterprise innovation performance. Therefore, this study aims to provide a theoretical framework for future research on improving enterprise innovation perfor-

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mance by examining the mediating role of dynamic capability.

2.2 Digital transformation

Within the digital economy, the definitions of digital transformation have become more comprehensive, and research on this topic has increasingly focused on corporate strategy rather than only digital technology. This movement is outlined in Table 5. Digital transformation refers to the process of utilizing digital technology to innovate and adapt to the changing digital market environment. This involves transforming the company's strategy, organizational structure, business processes, and related capabilities (Gurbaxani Vijay & Dunkle Debora, 2019). In addition, Vial (2019) developed a comprehensive procedural framework for digital transformation based on Grounded Theory.

Table 5 Definition of digital transformation

Realm	Representative Studies	Definition of Digital Transformation
Digital Technology	Westerman et al. (2011)	Digital transformation utilizes computer and Internet technologies with the goal of creating economic value more efficiently, improving business performance
	Li et al. (2018)	Digital transformation is an information technology-enabled transformation that can have a planned digital impact on normal systems
Corporate Strategy	Xiao, X. and Qi, I. (2019). Xiao Jinghua (2020)	Digital transformation utilizes a new generation of digital technology to realize business reconstruction and upgrading, integrating it with the real economy, and then improving production efficiency and management innovation level
	Wei Ying and Zong Xiaoyun (2021)	Digital transformation focuses on improving operational efficiency and organizational performance by facilitating innovation in products, services, processes and business models

The majority of studies indicate that digital transformation enhances innovation performance. However, alternative research suggests that there could also exist an inverted U-shaped, negative correlation, as well as a U-shaped link, between digital transformation and innovation performance. Conversely, some studies argue that there is no discernible relationship between the two. In their empirical investigation, Yu feifei et al. (2022) discovered that when firms invest excessively in digital transformation, it results in negative returns and hampers innovation performance. This relationship is characterized by an inverted U-shaped curve. In their empirical study, Ma Jun et al. (2023) discovered that corporate digital transformation goes through a painful stage and that there is a U-shaped curve association between digital transformation and innovation performance. According to Usai et al. (2021), innovation is the outcome of both creativity and ongoing research and development efforts. They assert that commonly employed digital technologies have a minimal influence on an enterprise's innovation performance, and excessive reliance on these technologies may even harm the long-term innovation capacity of an enterprise.

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Regarding the dimensions of digital transformation, Nambisan (2017) examined the factors that contribute to the success of digital transformation in businesses, specifically focusing on three dimensions: digital components, digital infrastructure, and digital platforms. Wang Molin et al. (2021) classified the information technologies that drive digital transformation into three distinct categories: digital artifacts, digital platforms, and digital infrastructure. Zeng Delin et al. (2021) proposed that digital technology, products, and platforms facilitate the process of digital transformation.

The connotation of digital transformation remains fragmented, primarily centered around four key themes: technological innovation, organizational change, business model, and synergistic development. Furthermore, the research focus has shifted from the realm of digital technology to that of enterprise strategy. At present, there is no consensus on the extent of digital transformation, and there is a dearth of theoretical studies on how it affects the innovative performance of companies. In order to improve the universality of theoretical research outcomes, it is necessary to develop a comprehensive theoretical framework for this topic in the future. This paper will examine the issues pertaining to digital transformation by focusing on three dimensions: digital technology, digital product, and digital platform, based on the aforementioned research and the research target of this paper.

2.3 Innovation capability

Enterprise innovation capability refers to the utilization of enterprise capability theory in the realm of innovation management. The concept of enterprise innovation capability is widely discussed in several sectors, and researchers primarily define its meaning based on the corporate innovation process and the variables that contribute to enterprise innovation. Enterprise innovation capability refers to the ability of enterprises to effectively utilize and generate knowledge in the process of innovation. It involves the mobilization, integration, and creation of knowledge within the organization (Wang Hui et al., 2023). Additionally, enterprise innovation capability encompasses the utilization of both internal and external resources to carry out innovation activities, even in the face of uncertain external conditions. This includes non-technical factors such as employee quality, human resource management, organizational structure, and cultural atmosphere. Enterprise innovation capability refers to the ability of businesses to effectively utilize internal and external resources for innovation, even in uncertain external environments. This includes non-technical factors such as employee quality, human resource management, organizational structure, and cultural atmosphere (Wang Yanlin and Wang Li, 2023).

In contemporary times, the majority of scholars categorize the dimensions of enterprise innovation capability into input and output perspectives, such as innovation input and innovation output. These divisions, as presented in Table 6, facilitate the establishment of multi-level measurement indexes and enable quantitative analysis of enterprise innovation capability. However, this paper follows the qualitative research approach of examining the relationship between "innovation capability - dynamic capability - innovation performance". It also draws on the work of Yang Yan et al. (2007) which analyzes and traces the development of China's enterprise innovation capability. Based on this, the paper categorizes enterprise innovation capability into three components: technology capability, market capability, and integration capability.

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Table 6 Classification of innovation capability dimensions

Representative Studies	Dimensions
Yang Yan et al. (2007)	Technical capability, market capability
Zhao Bo et al. (2023)	R&D inputs, innovation inputs, innovation outputs
Tang, Chunyong et al. (2023)	Number of innovations, quality of innovations
Chen Rui, Wang Hongwei (2023)	Innovation inputs, innovation outputs, innovation efficiency
Li Xiaomei, Zhang Ziwei (2024)	Innovation inputs, innovation outputs, innovation quality

In the digital economy era, corporate innovation capability extends beyond technological innovation to encompass a range of market capability, including product definition, marketing, and internal and external integration capabilities that bridge technology and the market. Scholars mostly concentrate on empirically analyzing the innovation capability of enterprises. However, there is a shortage of qualitative study of the multi-dimensional aspects of innovation capability. The division of dimensions tends to be more bent towards aiding the empirical analysis by establishing measurement indexes. Subsequent studies might further elucidate the parameters of enterprise innovation capabilities mostly at a theoretical level. This research examines the relationship between enterprise innovation capability and innovation performance at the dimension level, with dynamic capability serving as the mediating variable.

2.4 Dynamic capability

The idea of dynamic capability offers a suitable framework for examining the significant correlation between digital transformation, the ability to innovate, and the performance of innovation. There are three primary viewpoints for comprehending dynamic capability domestically and internationally. The first viewpoint is the capability view perspective, and Teece et al. (1997) initially defined dynamic capability as an organization's capacity to adjust to the ever-changing external environment by effectively combining, constructing, and organizing both internal and external resources and abilities. The resource-based perspective defines dynamic capabilities as the accumulation of experience, refinement of knowledge, and cognition of knowledge (Zollo & Winter, 2002). The strategic viewpoint, as defined by Eisenhard and Martin (2000), characterizes dynamic capabilities as the whole set of competencies required for a company to develop and execute a strategy.

Various organizational environments impose distinct demands on business dynamic capabilities, making it challenging for scholars to establish a unified dimensional categorization of such capabilities, as illustrated in Table 7. This research, after conducting a thorough review of literature, has identified that the majority of scholars have identified perception capability and integration capability as two characteristics of dynamic capabilities. Thus, this study uses the term "absorption capability" to collectively refer to the capability components that come after the perception capability process and before the integration capability process. Additionally, it categorizes dynamic capability into three components: perception capability, absorption capability, and integration capability.

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Table 7 Classification of dynamic capability dimensions

Number of Dimensions	Representative Studies	Dimensions
Three Dimensions	Teece (2007)	Ability to sense, ability to capture opportunities, ability to reconfigure
	Jian Zhaoquan et al. (2015)	Perception, integration, absorption
	Jiao Hao (2021)	Opportunity Sensing Capability, Opportunity Control Capability, Change Reconfiguration Capability
Four Dimensions	Luo Min and Liu Yongjun (2009)	Perceptual, relational, integrative, absorptive skills
Five Dimensions	Ge Baoshan and Dong Baobao (2009)	Resource integration capacity, learning capacity, innovation capacity, adaptive capacity, resource reallocation capacity

This work aims to provide a precise definition of dynamic capability from a capability perspective. Specifically, dynamic capability is conceptualized as comprising three distinct dimensions: perception, absorption, and integration skills. Research in the topic of enterprise dynamic capability has made some progress, but overall, it is still insufficient, particularly in its function in mediating corporate digital transformation and innovation capability on enterprise innovation performance. The research primarily concentrates on conventional sectors, highlighting the crucial role of dynamic capability in mediating the relationship between digital transformation, innovation capabilities, and innovation performance of high-tech corporations listed in the digital economy age.

2.5 Research review

This work categorizes the pertinent theoretical models and dimensions, acknowledges the deficiencies of the current literature, and reinstates the mechanism model by integrating the research subject of China's high-tech listed companies. Indirectly, digital transformation and innovation capability influence innovation performance. Existing research has established that the dynamic capability of organizations has a favorable influence on their innovation performance. This article asserts that the impact of digital transformation on dynamic capability directly influences innovation performance. Innovation capabilities have an impact on innovation performance by affecting dynamic capability.

Considering the study conducted by previous researchers, it is important to examine the connections between digital transformation, innovation capability, and innovation performance within various organizational contexts. China's high-tech listed companies experience a substantial positive impact on their innovation performance through digital transformation. Additionally, innovation capability also has a significant positive impact on innovation performance. Furthermore, digital transformation contributes significantly to dynamic capability, and innovation capability also plays a crucial role in dynamic capability. Lastly, dynamic capability has a significant positive impact on innovation performance.

To summarize, this work presents a model of the mechanism, which is illustrated in Figure 8.

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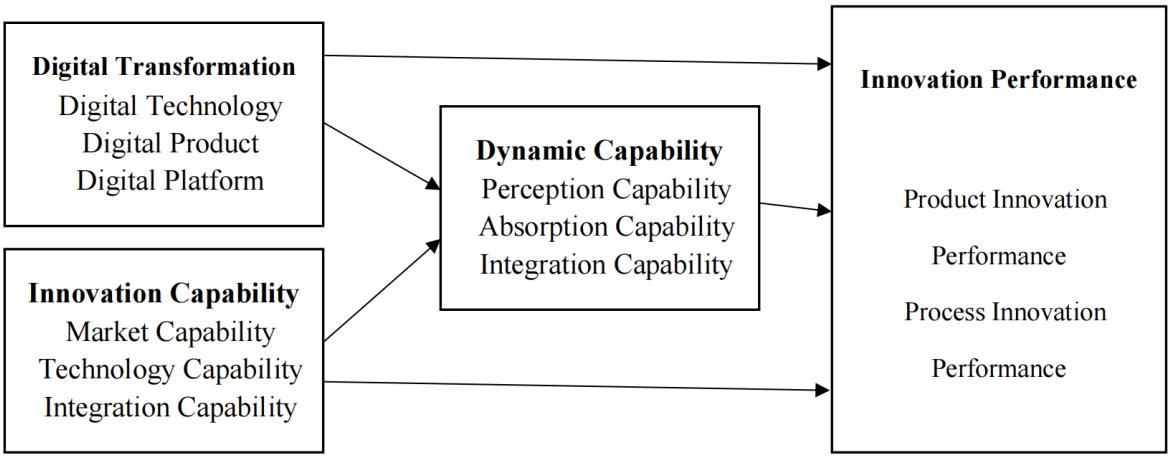


Figure 8 Mechanism of action model

In the model of action mechanism, this paper examines the dimension of digital transformation. It defines digital technology as a fusion of information, computing, communication, and connectivity technologies. Digital product is defined as products that can be distributed through a digital network like the Internet. Digital platform is described as a collection of digital resources, comprising of companies that offer complementary products, technologies, and services. These platforms are capable of interacting with external producers and consumers to create value. In terms of innovation capability, this paper defines market capability as the capacity to develop product definitions that meet user needs in a specific market, as well as the ability to carry out product marketing activities such as pricing, advertising, and promotion, and to execute sales activities including sales, distribution, and service. Technology capability refers to the capacity encompassed by technological research and development, product design, and manufacturing. Integration capability, on the other hand, pertains to the ability of a firm to combine market capability, technological capability, and other relevant capabilities. This paper defines the dimension of dynamic capability as follows: perception capability refers to the ability to understand emerging market opportunities and customer needs; absorption capability refers to the ability to incorporate new knowledge and information with existing knowledge and facilitate the restructuring of the enterprise; and integration capability refers to the ability to combine knowledge and information from various domains and apply them to the innovation activities of the enterprise. This paper examines two dimensions of innovation performance: product innovation performance, which measures an organization's effectiveness in developing and launching new products or enhancing existing ones, and process innovation performance, which measures an organization's effectiveness in improving and optimizing its internal business, production, or service processes.

3. Analysis of the Current Situation and Motivation of Innovation Capability of China’s High-Tech Listed Companies in the Context of Digital Transformation

This paper focuses on China’s high-tech listed companies and examines their innovation capability in the context of digital transformation. The study specifically selects six industries, namely pharmaceutical manufacturing, aerospace vehicle and equipment manufacturing, electronics and communication equipment

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manufacturing, computer and office equipment manufacturing, medical instrumentation manufacturing, and information chemical manufacturing, based on the Classification of High-Tech Industries (2017).

3.1 Current situation of innovation capability of China's high-tech listed companies in the context of digital transformation

China's high-tech listed companies possess abundant cash, advanced technology, talented individuals, and other valuable resources. As a result, they are able to undergo digital transformation at a faster pace, in a more comprehensive manner, and with superior quality across numerous industries. The majority of companies are utilizing cloud computing to meet the fundamental criteria of digital transformation. Over 90% of the corporations listed on A-share companies are currently in the early stages of digital transformation, with a focus on investigating pilot projects. Only less than 10% of these enterprises have achieved a "relatively mature" and "fully completed" level of digital transformation. From an industry classification standpoint, the high-tech industry is at the forefront of the digital transformation of the entire industry. This suggests that China's high-tech firms have acknowledged the significance of digital transformation and have made gradual advancements. While the cumulative index scale of certain high-tech industries in 2022 may not be as significant as that of financial, e-commerce, sports, and entertainment industries, the communication, manufacturing, and energy sectors hold a favorable position in terms of index growth. The digitalization of China's high-tech listed enterprises is still in its early stages, but it holds a distinct advantage over other industries.

Diversification of digital transformation models and platforms. The digital transformation of China's high-tech listed companies incorporates cutting-edge technologies such as artificial intelligence, digital twins, Web 3.0, cloud-native, and edge computing. These technologies have given rise to innovative approaches to digital transformation, such as the "online office" and "smart manufacturing". High-tech firms are enhancing their digital transformation by acquiring cloud services from established digital transformation platforms like Alibaba Cloud and Tencent Cloud. This helps facilitate the transition of their company operations to cloud platforms. By incorporating data into the digital platform, businesses have achieved the ability to visualize information in real-time. This enables easier management and tracking, resulting in reduced operating costs and increased profitability. Additionally, it allows for quicker responses to market demands for better products and services, as well as improved efficiency and quality in decision-making processes. As the demand for digitalization continues to grow, there is a limitless range of digital transformation methods available. Digital platforms are utilized by organizations to successfully achieve digital transformation.

Enhanced policy assistance for the process of digital transformation. During the initial stages, the government's efforts to digitally transform China's high-tech listed enterprises were hindered by inadequate guidance in investment, training of digital talent, and creation of relevant infrastructure. Recently, the implementation of policies has decreased the reluctance of China's high-tech companies listed on the stock market to undergo digital transformation. A study conducted by Shi et al. (2021) discovered that these policies have enhanced the oversight of digitalization methods, the sharing of open data, the market for commercial data trading, and the collaboration of data between different sectors of the industry. Overall, the companies expressed mostly positive satisfaction with these policies. The Outline of the 14th Five-Year Plan and Long-Range Objectives Through the Year 2035 aims to expedite the utilization of data elements, foster the growth of the digital economy, and embrace the advent of the digital era. Additionally, the Outline underscores the importance of exten-

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sively employing digitization technology across various domains such as research, development, design, production, manufacturing, operation, and service. Furthermore, it highlights the establishment of the Industrial Internet Platform and Digital Transformation Promotion Center to meet international standards, particularly in high-technology industries. According to the National Bureau of Statistics of China, high-tech manufacturing expenses in 2022 was approximately 650.8 billion RMB. This reflects the China's government's robust backing of domestic enterprises in their pursuit of digital transformation. Additionally, it bolsters the confidence of high-tech listed companies as pioneers in digital transformation.

Consistently augment research and development (R&D) funding to foster and enhance innovation capabilities. In 2023, the listed businesses have invested 1.6 trillion RMB in research and development (R&D). According to data from the Shanghai Stock Exchange (SSE), high-tech industries like aviation equipment, electric power, and communications services are experiencing a growth rate of above 30% in their R&D expenditure. China's high-tech enterprises listed on the stock market prioritize investment in research and development (R&D) to foster new and high-quality productivity, boost their innovation capability, and expedite the development of future industries. The robust accumulation of capital by listed companies offers a firm financial assurance to bolster their innovation capability.

Globalization strategy and talent pool. Backed by government assistance, numerous advanced technology companies are actively venturing into foreign markets. They are setting up overseas science and technology innovation centers, offshore innovation and entrepreneurship centers, and other facilities. Meanwhile, some leading companies in the industry are spearheading the establishment of international social organizations and contributing to the development of global standards. China's demographic dividend is transitioning into a talent dividend, as its talent reserves continue to grow. The government has augmented its investment in fostering high-tech talents and facilitated the repatriation of skilled individuals from abroad. Numerous prestigious universities and scientific research institutions have supplied enterprises with a substantial pool of exceptional engineers and scientists, thereby furnishing intellectual backing for enterprise innovation. Simultaneously, high-tech industry and listed firms serve as the optimal future prospects for talented individuals, thereby augmenting the innovation capability of high-tech listed firms.

Innovation ecosystem and industry synergy. The innovation ecosystem in China is growing more mature, owing to growing backing from the government and capital market. As of the end of 2020, there were a total of 169 national high-tech zones and 21 national innovation demonstration zones. The government offered tax incentives and policy support to encourage innovation among enterprises, providing high-tech listed companies with new institutional mechanisms and development methods. Enterprises have enhanced their ability to collaborate on innovation, working together to drive technical advancement and industrial upgrading through strategic collaboration and industry partnerships. Currently, there are widespread collaborations between businesses in fields such as cloud computing and artificial intelligence.

Despite the incremental progress made by China's high-tech listed companies in terms of their innovation capability within the framework of digital transformation, they continue to confront significant obstacles that should not be overlooked:

1. Insufficient supply of digital talent

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In the era of digital economy, there is a growing need for skilled digital professionals. Though Chinese scholars have produced a significant number of influential papers in the field of digital transformation, providing a strong theoretical basis for the digital transformation of China's high-tech listed companies, the rate at which the number of skilled professionals is increasing is still not keeping up with the demand. By 2022, China's digital talent pool amounts to approximately 5 million individuals. The concentration of digital skills in coastal developed areas is a growing trend. However, this exacerbates the significant gap of around 27.5 million digital talents in China by 2023. Therefore, it is crucial to promptly address the pressing issue of the digital talent gap. In comparison to the globally advanced standard, the digital talent training system is inadequate, with a usually low level of digital literacy. There is a scarcity of individuals who possess both advanced digital skills and practical business expertise. The issue of composite talents is evident in the significant age disparity between China's digital IT research and development personnel and the average age of employed personnel. The average age of China's digital IT research and development personnel is approximately 30 years old, which is nearly 10 years younger than the average age of 40 years old for employed personnel. The rejuvenation of research and development personnel may result in increaseing challenges in the utilization of digital products, as it raises the threshold for their use.

2. Digital transformation industry differences

While high-tech listed companies are at the forefront of digital transformation in their respective industries, the extent of transformation may vary depending on the industrial category. When considering the 2022 indicators of the integration of informatization and industrialization, industries closely linked to the digital economy, such as electronic information manufacturing, that require significant capital, technology, and talent, have a higher degree of digital transformation. On the other hand, resource-intensive industries like metallurgy have a lower level of digital transformation. Information sector and manufacturing industries have a stronger connection to digital technology compared with other future industries. It is challenging to bridge the gaps between different industries, but firms can cater to solutions by collaborating across industries. Governments can also build pilot demonstration projects to amass successful experiences and use them as guidance.

3. Core technology bottlenecks

China's high-tech companies often face a common obstacle where cutting-edge core technologies are reliant on foreign countries, creating a bottleneck. Currently, there are ongoing debates surrounding semiconductor chips, high-end manufacturing equipment, and some essential minerals. These fields still face technical obstacles and rely heavily on imports. The volatility in these areas has a negative impact on the long-term innovation of businesses. While there is a lack of appropriate technology accumulation and R&D expenditure in certain cutting-edge domains, the scarcity of high-end talents and technical impediments pose challenges in achieving breakthroughs in core technologies. Enterprises should persist in allocating resources to pertinent research and recruiting top-tier professionals, while the government can establish dedicated funding and foster collaboration between industries, universities, and research institutes to expedite autonomous innovation in essential technologies.

4. Discrepancy between inputs and returns

Enterprises with higher innovation indexes sometimes have bad market performance. This indicates that

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while China's listed companies have been consistently increasing their investment in corporate innovation capability, they still face the challenge of a lengthy return cycle. The underwhelming short-term market performance will impose immediate financial strain on firms and undermine investor confidence. Enterprises can decrease their dependence on immediate financial performance by broadening their sources of funding, such as through the inclusion of venture capital and government subsidies. Enterprises should enhance their communication with investors and provide transparency in their innovation investments and expected returns. This would not only contribute to the overall environment of industrial innovation but also facilitate the industry's sustainable development.

3.2 Analysis of the motivation of innovation capability of China's high-tech listed companies in the context of digital transformation

1. Expanding market reach and responding to customer needs

Enterprises must adapt to the digital transformation and broaden their market reach by gaining a deeper understanding of their target customers' demands. Enterprises can gain a deep understanding of their target customers' requirements by utilizing specific digital technologies. Additionally, companies can expand their customer engagement channels by creating e-commerce platforms and developing mobile applications. By utilizing digital marketing tactics in conjunction with big data, AI, and other digital technologies, organizations are able to precisely focus on specific client segments and effectively align essential resources such as talent, capital, technology, production capacity, and channels. This not only facilitates the development of new market segments for enterprises, but also satisfies client demands and enhances the conversion rate of potential customers.

2. Upgrading product or service and improving decision-making efficiency

With the advancement of digital transformation, companies can utilize their extensive understanding of the basic information of their clients to consistently enhance and improve their offerings. These services have the ability to fulfill a wide range of client needs, while also increasing customer loyalty and trust in the brand, and bolstering the brand's influence. During the digital transformation, creating a digital platform serves as a center for sharing information and making management decisions within a company. All stakeholders involved in the platform, including employees, suppliers, distributors, and customers, have the right to access important information that is used to make decisions. Enhanced openness allows firms to promptly evaluate and reconcile the interests of all stakeholders, facilitating management decisions that are accurate and diversified, so enhancing the efficiency of decision-making.

3. Reducing costs and improving profitability

Digital transformation encompasses more than just a technical revolution, it also drives companies to implement lean operations. Companies can enhance their operational efficiency by constructing a comprehensive digital platform, which enables them to streamline internal management procedures and allocate resources more effectively. Companies can reduce labor expenses dramatically by implementing resource planning systems and automated production equipment. These technologies eliminate unnecessary steps in the process and enable the automation of production and management, reducing the need for human labor. The optimiza-

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tion of cost-effectiveness is directly manifested in the operational expenses of the organization, resulting in reducing costs and increasing profit margins for business operations.

4. Responding to market competition and maintaining a leading position

In the era of digital economy, the rapid iteration of technology and intensified market competition make it imperative for high-tech listed companies to innovate continuously to maintain their market leadership. Companies that possess the capacity for innovation are able to swiftly adapt to shifts in customer demands and successfully create and introduce desired products or services. By consistently implementing technical advancements, a company can capitalize on the initial chance in the market and provide revolutionary items, thereby distinguishing itself from numerous rivals and significantly boosting its market presence and brand impact. Within the high-tech industry, listed companies possess the ability to both set the industry's direction through ongoing technological advancements and sustain their competitive edge in a rapidly evolving market, thereby securing long-term industry dominance.

5. Pursuing sustainable development and enhancing resilience to risk

In the dynamic realm of business, innovation is the pivotal factor for achieving long-term and viable corporate expansion. Innovation enables firms to decrease expenses and raise productivity, thereby reinforcing their capacity to manage market uncertainties. For listed companies in the high-tech industry, possessing a strong innovation capability is a valuable asset for overcoming market saturation and technological obsolescence. This enables companies to create new business models and discover fresh avenues for profit, ensuring their continuous and stable growth. This innovation capability not only creates new possibilities for market expansion, but also offers the essential flexibility and adaptability required to navigate market fluctuations and uncertainty. It enables organizations to accurately predict and tackle potential risks, ensuring the continuity and stability of their business operations.

4. Paths to Realization and Innovative Strategies

This paper suggests that digital transformation can be categorized into three dimensions: digital technology, digital product, and digital platform. Similarly, innovation capability can be divided into three dimensions: market capability, technology capability, and integration capability. These dimensions have an impact on the mediating variable dynamic capability, which is further divided into dimensions of perception capability, absorption capability, and integration capability. Ultimately, this influences innovation performance in terms of both product innovation performance and process innovation performance. Please refer to Figure 8 for a visual representation of this mechanism model. This paper will utilize this model that incorporates research on the current situation of innovation capability in high-tech listed companies within the context of digital transformation and the analysis of motivation. The model will be used to identify and propose feasible paths to achieve innovation performance at a dimensional level, while also providing corresponding innovative strategies.

First, establish an agile product development mechanism. In theory, the digital transformation involves leveraging digital technology to boost the perception capability inside a company's dynamic capability, ultimately leading to improved product innovation performance. Enterprises benefit from detailed data and pow-

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erful analytical skills through the use of digital technologies such as big data analytics, artificial intelligence, and the Internet of Things (IOT). From a perceptual standpoint, digital technologies enable organizations to gain real-time insights into shifts in market demand and prevailing technology trends, thereby boosting their perception capability. By promptly understanding the market, consumers, and other factors, companies can more effectively recognize market opportunities and develop innovative products to capitalize on these opportunities. This approach enhances the speed and success rate of new product development by quickly responding to market demand and launching innovative products to capture market share, ultimately improving the product innovation performance. China's high-tech listed companies ought to construct an agile product development mechanism. Digital technology enables the collection of market information, including consumer demand, purchasing preferences, and market dynamics. It also helps enterprises gain insights into industry development trends and technological frontiers. Additionally, it allows for the prediction of future demand for products and services, and enables agile responses to market changes. Enterprises can employ text mining, user profiling, and other techniques to effectively capture the nuanced shifts in client demand, thereby achieving a responsive understanding of market dynamics. Furthermore, numerous high-tech industry companies incorporate programming boards into their daily production processes. Continuous integration (CI) and continuous deployment (CD) play a crucial role in the current agile development. CI/CD facilitates the frequent and reliable integration, testing, and deployment of code to production environments. This, in turn, reduces complexity, enhances efficiency, streamlines workflow, and accelerates the pace of product iteration. To summarize, using an agile product development mechanism can effectively enhance an organization's product innovation performance, facilitate the exploration of new market niches to broaden market penetration, and enable the business to promptly address consumer requirements in an agile manner.

Second, build a unified digital collaboration platform. The theory is to create a digital platform for digital transformation in order to strengthen the integration capability of the enterprise's dynamic capability and ultimately enhance the process innovation performance. The digital platform is a highly effective tool for seamlessly integrating internal and external resources. Enterprises either develop their own digital platforms or acquire digital platform services. Internally, this allows for standardization and automation of business processes, optimizing production and management processes. This enhances information sharing and collaboration among departments and employees. Externally, this initiative integrates the supply chain and sales channels, thereby improving the overall industrial chain. From the standpoint of dynamic capability, this process enhances the enterprise's ability to integrate various functions, enables timely identification and resolution of process-related issues, enhances operational adaptability, and ultimately drives improvements in process innovation performance. China's high-tech listed companies ought to establish a cohesive digital collaboration platform. The advanced digital platform integrates diverse data from various sources, creating a communication and collaboration environment for employees within the enterprise. This facilitates information exchange and knowledge transfer at any time. The "barrier-free" communication mechanism enhances the enterprise's ability to integrate information, enabling cross-departmental and cross-functional information sharing and business collaboration. This facilitates the integration and exchange of information between different departments and functions inside organizations, promoting collaboration and cooperation in business operations. Furthermore, the platform fosters the digital control and enhancement of crucial business procedures, such as standardized procurement, manufacturing, and sales. By utilizing layered separation and standardized inter-

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face design, the digital platform acts as a central hub, streamlining the integration of technical elements from different entities, resulting in increased flexibility and significantly reduced costs associated with constructing intricate solutions. Ultimately, the platform consolidates the resources of the organization and external collaborators, fostering stronger connections between the enterprise and its suppliers, distributors, and other partners. This enables the timely monitoring of orders, inventories, and other pertinent information. Currently, platform-based solutions have become a popular trend in various industries. Many large enterprises are leveraging their accumulated experience and expertise in digital transformation to build digital platforms as the foundation for platform-based solutions. These programs have been successfully implemented in numerous high-profile enterprise projects. A unified digital collaboration platform is a comprehensive tool that enhances enterprise integration capability, maintains business processes, enables real-time monitoring, and plays a crucial role in improving enterprise performance through process innovation. It helps enterprises carry out lean operations, reduce business operation costs, and increase profit margins.

Third, implement a comprehensive market research mechanism. In theory, enhancing the perception capability in the dynamic capability of the organization from the market capability dimension of innovation capability can ultimately increase the product innovation performance. The market capability serves as a strong basis for the enterprise's ability to perceive and understand. Market research and demand insights, assisted by market capability, enable organizations to gain a comprehensive understanding of the evolving demands of existing customers, enhance their understanding of the target market, and increase their awareness of external environmental changes and trends. This, in turn, allows them to identify and pursue new market possibilities. Hence, a robust market capability enhances the enterprise's perception capability, enabling it to outpace competitors in developing products and services demanded by client segments and enhancing the product innovation performance. China’s high-tech listed companies ought to build a comprehensive market research mechanism. Companies can establish a cross-functional team comprising market analysts, data scientists, industry experts, and marketing specialists. The team members should be trained to proficiently utilize cutting-edge market research tools and technologies, including SPSS, SAS, Tableau, and other data analysis software, as well as artificial intelligence and machine learning technologies. Furthermore, it is imperative for companies to maintain a current and comprehensive comprehension of the preferences of their target customer segments and the prevailing trends in their target market. This can be achieved by consistently conducting market research, gathering customer feedback, conducting focus interviews, and other similar activities. Additionally, companies should also possess a thorough understanding of their competitors' dynamic information and be able to promptly and precisely respond to it. Enterprises can collaborate with professional research firms and academic institutions to acquire specialized and comprehensive market research services. An effective market research mechanism can enhance enterprise’s ability to perceive and adapt to dynamic market conditions, leading to improved product innovation performance. It can also assist in upgrading the product services demanded by the market, enhancing decision-making efficiency, and gaining a competitive advantage in the current intense market competition.

Fourth, implement a cross-functional product development mechanisms. The integration capability component of innovation capability theoretically strengthens the integration capability inside an enterprise's dynamic capability, leading to improved process innovation performance. The integration capability necessary for innovation capability is founded on both technological and market dimensions, with a focus on the amal-

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gamation of these two aspects. However, it should be noted that this integration capability differs from the integration capability observed in the dynamic capability perspective. The resolution of a scientific quandary or the advancement of state-of-the-art technology may not directly contribute to the economic success of a company. However, the ability to integrate innovation connects research with product development, manufacturing, marketing, distribution, and service. This aligns with the integration capability aspect of dynamic capability and enhances the performance of process innovation. China's high-tech listed companies ought to construct interdisciplinary mechanisms for product development. The practice of dividing tasks across different departments is common in organizations, particularly in large ones. However, this division can lead to difficulties in comprehending and coordinating amongst departments, which is a significant challenge. A cross-functional product development mechanism necessitates the involvement of a diverse team of frontline professionals, such as product managers, engineers, designers, and marketing specialists. This ensures that essential departments collaborate closely during the product creation process. Furthermore, firms have the ability to incorporate essential procedures in order to achieve comprehensive process collaboration across many departments such as product development, research and development, manufacturing, marketing, distribution, and customer support. Simultaneously, it promotes the interchange of information and exchange of expertise among departments to enhance the overall operational adaptability. The cross-functional product development mechanism enhances the integration ability within the enterprise's dynamic capability, thereby improving the performance of enterprise process innovation. It allows the rapid transformation of technological innovation into corporate profits, enables the enterprise to seize market opportunities, and maintain a leading position in the industry.

5. Conclusions and Recommendations

5.1 Conclusions

This study develops a mechanistic model to examine the impact of digital transformation and innovation capability on the innovation performance of China's high-tech companies listed on the stock market, based on a theoretical review. The study reveals that China's high-tech listed companies' digital transformation and innovation capability have an indirect and beneficial impact on innovation performance. This impact is mediated through their influence on dynamic capability. The study also reveals that China's high-tech listed companies' digital transformation and innovation capability have a direct and beneficial impact on their innovation performance. The mechanism of action model categorizes digital transformation into three dimensions: digital technology, digital product, and digital platform. Similarly, innovation capability is divided into three dimensions: technology capability, market capability, and integration capability. Dynamic capability is further divided into three dimensions: perception capability, absorption capability, and integration capability. Lastly, innovation performance is categorized into two dimensions: product innovation performance and process innovation performance.

This study reveals that the digital transformation of China's high-tech listed companies is now progressing in stages, with the primary stage being the current situation. The emergence of various digital transformation models and platforms is experiencing rapid growth, and there has been an increase in the support provided by relevant legislation. Nevertheless, it continues to encounter issues such as a dearth of digital expertise and

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disparities in the digitalization across different industries. The driving force for companies undertaking digital transformation is the need to increase their market presence and meet client demands, upgrade their product offerings and optimize decision-making efficiency, as well as reduce costs and boost profitability. The current state of innovation capability among high-tech listed companies in China is characterized by their ongoing increase in R&D investment to foster innovation capability. These companies have also established strong internationalization layout, talent reserves, and well-developed innovation ecosystems and industrial synergies. However, they are currently grappling with challenges such as bottlenecks in core technologies and discrepancies between inputs and returns. Enterprises are motivated to expand their innovation capability primarily to effectively respond to market competition, sustain their current leading position, uphold sustainable development, and strengthen their ability to withstand risks in the highly competitive high-tech sector market.

This paper proposes four paths and assesses their feasibility at a theoretical level, based on the constructed mechanism model and analysis of the current situation and motives. Additionally, it suggests four innovation strategies: implementing an agile product development mechanism, constructing a unified digital collaboration platform, establishing a comprehensive market research mechanism, and implementing a cross-functional product development mechanism.

5.2 Innovative Points

This paper conducts a comprehensive review of relevant literature and integrates the research focus on China's high-tech listed companies. It proposes a mechanism model for digital transformation, innovation capability and innovation performance. Digital transformation and innovation capability directly influence innovation performance, and indirectly affect it through the intermediary variable of dynamic capability. This approach differs from the current mainstream empirical analysis and contributes to the development of theoretical frameworks, dimensional divisions, and function paths in this field.

This article analyzes the current state of innovation capability in China's high-tech companies listed on the stock exchange in the context of digital transformation. It identifies the progress made, highlights the issues faced, and conducts a corresponding study of the driving factors.

This research utilizes the mechanism model and analyzes the current circumstances and drivers to identify paths in the model. It then suggests innovative strategies for China's high-tech listed companies to enhance their innovation performance.

5.3 Recommendations

First, it is vital for enterprises to augment their comprehension of digital transformation and amplify their allocation of resources towards research and development and innovation. High-tech listed companies should have a well-defined digital transformation strategy that includes clear strategic objectives and a complete road plan. They should prioritize digitalization as the central focus of their enterprise's development. High-tech listed firms should augment their research and development expenditures and allocate additional resources to propel technological innovation and enhance product improvements.

Second, the government should enhance data governance, construct a regulatory system, and provided

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training for digital talent. At this stage, it is crucial for the government to enhance the oversight of big data security, build a comprehensive market system for commercial data trading, facilitate the market distribution of data components, support the digital transformation of businesses, and enable data to effectively benefit society. The government should also enhance the training and recruitment of highly skilled individuals in advanced technology fields. This should involve establishing a comprehensive system for training top-tier digital talent, improving the allocation of benefits related to human capital, such as technology shares and option incentives, to fully unleash the innovative potential of skilled individuals. Additionally, the government should collaborate with universities to establish relevant majors in the digital economy, thereby providing enterprises with a greater pool of talented individuals to support their digital transformation and innovation.

Third, investors should prioritize their attention on the enduring digital transformation and innovation capability initiatives of companies. Implementing digital transformation and fostering innovation necessitate substantial financial commitments, often accompanied by extended periods of time until the initial investment is recouped. However, these endeavors have the potential to yield significantly higher returns for investors over the long run. Investors should thoroughly evaluate a company's ability to innovate within the framework of digital transformation, considering factors such as the level of digital transformation, investment in research and development, availability of skilled personnel, and technological resources.

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