

Research on the Impact of Digital Technology Innovation on Enterprise Value

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Abstract. The report of the 20th National Congress of the Communist Party of China pointed out: "Accelerate the development of the digital economy and promote the deep integration of the real economy and the digital economy." Digital technology is the technical support for the digital economy. With the acceleration of the digitalization process of the entire society, more and more enterprises have begun to adopt emerging technologies such as artificial intelligence, big data, cloud computing, and blockchain. These technologies play an important role in improving the operational efficiency of enterprises, optimizing resource allocation, and enhancing customer experience. The continuous innovation of digital technology also has a significant impact on the market value of enterprises in the digital era. Therefore, this paper studies the relationship between digital technology innovation and enterprise market value of China's listed companies from 2013 to 2020, and draws the following conclusions: Digital technology innovation can significantly enhance the market value of enterprises, but the above improvement effect only holds true for small and medium-sized enterprises, private enterprises, highly competitive industries, and low-tech traditional industries. The research in this paper expands the scope of research on the effects of the digital economy at the micro level, providing useful references for the Chinese government to optimize digital economy policies and for enterprises to formulate digital innovation strategies.

Keywords: Digital technology innovation, digital economy, market value, digital transformation.

1. Introduction

The report of the 20th National Congress of the Communist Party of China proposed: "Building new growth engines such as next-generation information technology and artificial intelligence" and "Accelerating the development of the digital economy to promote deep integration between the digital economy and the real economy." Digital technology serves as the technological foundation for high-quality development in the digital economy. The rapid advancement and widespread application of digital technologies have profoundly impacted corporate operational models, competitive strategies, and market performance. With continuous progress in information technology, particularly the popularization of cutting-edge technologies like big data analytics, artificial intelligence, cloud computing, and the Internet of Things, enterprises now face unprecedented opportunities and challenges in transformation. Digitalization has become a crucial driving force for corporate innovation, not only reshaping competitive landscapes in traditional industries but also opening up new business models and market opportunities. In recent years, increasing research has focused on the impact of the digital economy on micro-level enterprise operations, yet most discussions emphasize the effects of digital transformation while paying insufficient attention to digital technological innovation. Digital technological innovation differs from digital transformation. The former highlights breakthroughs and changes in digital technologies themselves, while the latter emphasizes their application—using digital technologies to create new products, improve production processes, transform organizational models, and innovate business models. Therefore, digital technology serves as the technical foundation for digital transformation, with its innovation process playing a pivotal role in determining the effectiveness of digital transformation. Therefore, systematic research on the relationship between digital technology innovation and enterprise market value can not only help to make up for the research defects of this subject in academic circles, but also provide theoretical support and practical guidance for enterprises to make reasonable digital strategy.

2. Hypothesis development

Yoo et al. (2010) first defined digital technological innovation as an innovative process that combines digital and physical components to create new products, services, and business models. Subsequent studies have further refined and expanded the concept of digital technological innovation (Yoo et al., 2012; Nambisan et al., 2017; Yu Jiang et al., 2017; Daiyang et al., 2020), adopting a broader perspective, Digital technology innovation refers to the process of technological advancement through the integration of digital technologies such as information, computing, communication, and connectivity, focusing on multiple dimensions including new product development, production process optimization, organizational transformation, and business model innovation (Liu Yang et al., 2020). This definition highlights three key characteristics: First, combinatorial nature—the innovation process emphasizes the application of integrated technologies rather than isolated techniques. Second, self-sustaining growth—due to data homogeneity and reprogrammability inherent in digital technologies, innovation can continuously evolve and adapt (Yoo et al., 2012; Ciriello et al., 2018). Third, convergence—digital innovation transcends industrial, organizational, and product boundaries, blurring traditional demarcations (Nambisan et al., 2017; Liu Yang et al., 2020). Compared to other technologies, digital innovation is expected to exert deeper impacts on corporate development and significantly enhance market value. The following analysis examines its effects on corporate market value through three key dimensions.

First, digital innovation in new product development drives product iteration and cycles (Tee & Gaver, 2009), meeting the growing market demand for intelligent digital products (Yoo et al., 2010), thereby boosting corporate market value. Digital products refer to new products or services incorporating digital technologies, categorized into two types: those combining digital and physical components, and purely digital innovations (Boudreau, 2012). The rapid advancement of digital technologies and the growing prevalence of remote work scenarios have driven sustained market demand for digital products. Traditional innovation often faces prolonged cycles from R&D to market launch, resulting in products that fail to fully meet market needs and risk obsolescence in dynamic markets. Digital innovation, by integrating digital resources as a production factor, enables rapid iteration and upgrading of products/services through its self-evolving nature (Yoo et al., 2010).

Furthermore, digital innovations focused on production process optimization can refine corporate workflows, achieving more precise, flexible, and intelligent management that enhances market value (Huang Qunhui et al., 2019). Digital process innovation has transformed traditional workflows in product development, manufacturing, procurement, and sales (Lyytinen et al., 2016), not only boosting productivity but also better addressing personalized, diversified, and multi-tiered consumer demands in the digital era. The application of digital technologies allows enterprises to systematically and accurately capture production-related data, while data analytics helps break through path dependencies in traditional process management (Xiao Jinghua, 2020). Digital technology aggregates fragmented demand and supply information (Wei Lili & Hou Yuqi, 2022), reducing communication costs between enterprises, clients, and suppliers (Brynjalfsson et al., 2011). By dynamically adjusting production capacity in response to supply-side and market changes, companies can transition from traditional industrial models to refined, flexible, and intelligent supply chain management systems, thereby enhancing market value.

Finally, digital innovations in business model transformation break down organizational and industrial boundaries (Nambisan et al., 2017), expanding corporate value potential. Digital-driven business model innovation overcomes spatial, social, and technological constraints, revolutionizing value creation and capture mechanisms. Through knowledge sharing and effective utilization of digital components, such innovations improve connectivity among participants, resource efficiency, and process transparency, driving transformative changes in value acquisition. A prime example is Apple's digital mobile app distribution platform, which shifted its revenue model from pure hardware sales to an ecosystem-based approach integrating software and hardware. This strategic shift significantly accelerated Apple's market value growth. Additionally, Digital technology innovation can significantly break down industry barriers and create new business models, driving the digital

transformation of traditional industries. For instance, the deep integration of digital technology with traditional sectors like automotive and home furnishings can spark cross-industry innovations such as intelligent driving systems and smart home solutions. The increased output of cross-sector innovations better meets latent societal demands, thereby enhancing corporate market value. Based on this, this paper proposes the following research hypotheses:

H1: Digital technology innovation significantly enhances a company's market value

H2: The impact of digital technology innovation on a company's market value is heterogeneous, moderated by factors such as company size, ownership nature, industry competition level, and industry technological activity.

3. Trends of Digital Technology Innovation and Evolution of Listed Companies

From 2001 to 2020, the digital technology innovation of listed companies has experienced a significant evolutionary trend. This process can be roughly divided into several key stages, each accompanied by breakthroughs in technological innovation and the expansion of application scenarios.

3.1. Initial exploration phase (2001-2005)

During this phase, the internet infrastructure began to gradually improve, laying the groundwork for digital technology innovation. Enterprises started focusing on applying digital technologies, though their efforts were primarily concentrated on internal management and initial information system development. Meanwhile, with the widespread adoption of internet technology, e-commerce began to gain momentum, and some listed companies started exploring e-commerce platforms to expand their sales channels.

3.2. the rapid development stage (2006-2010)

With the rise of technologies like cloud computing and big data, listed companies are now integrating these innovations into their business processes to enhance operational efficiency and decision-making capabilities. As more enterprises recognize the importance of digital transformation, they are ramping up investments in digital technologies to drive the digitization of business workflows. Meanwhile, the widespread adoption of smartphones and the rapid growth of mobile internet have opened up new opportunities for innovation and diverse application scenarios for businesses.

3.3. Comprehensive deepening phase (2011-2015)

As big data technology matures, enterprises are increasingly leveraging it for market analysis and customer insights. Breakthroughs in artificial intelligence have introduced innovative intelligent solutions to businesses. Listed companies are adopting digital technologies for precision marketing and personalized services, enhancing customer experience and satisfaction. Meanwhile, the cross-industry integration of digital technologies has become a trend, giving rise to numerous emerging business models and innovative industries.

3.4. Innovation-driven phase (2016-2020)

Corporate digital transformation has entered a phase of comprehensive deepening, focusing not only on digitizing business processes but also on restructuring organizational frameworks and transforming corporate culture. Emerging technologies like blockchain, IoT, and 5G are being widely adopted, driving profound changes in business models, product forms, and service delivery. Listed companies are building digital ecosystems by integrating resources through platform-based and ecosystem-oriented approaches, thereby enhancing the competitiveness of the entire ecosystem.

In conclusion, the digital technology innovation of listed companies has experienced an evolution from initial exploration to comprehensive deepening from 2001 to 2020. In this process, enterprises

continuously integrate emerging technologies into their business operations, driving transformative innovations in both business models and commercial frameworks. Concurrently, they are building digital ecosystems to enhance the competitiveness of these systems. Looking ahead, as technological advancements and application scenarios continue to expand, listed companies will maintain rapid growth in digital technology innovation in Table 1.

Table 1. overall overview of digital technology innovation in Chinese listed companies from 2001 to 2020

Year	Number of Listed Companies Applying for Digital Invention Patents (companies)	Digital Invention Patent Applications by Listed Companies (units)	Average Number of Digital Invention Patent Applications per Company (units)
2001	28	62	2.214
2002	46	112	2.435
2003	57	506	8.877
2004	72	781	10.847
2005	100	1316	13.160
2006	121	2602	21.504
2007	196	4567	23.301
2008	273	5878	21.531
2009	403	8648	21.459
2010	543	9844	18.129
2011	736	11407	15.499
2012	910	12859	14.131
2013	1043	14719	14.112
2014	1289	17931	13.911
2015	1841	22449	12.194
2016	2751	30481	11.080
2017	3017	32065	10.628
2018	3281	36532	11.134
2019	3357	37213	11.085
2020	3117	33976	10.900

4. Data and empirical strategy

4.1. Data and sample selection

This study utilizes two primary datasets: patent records and listed company information. The patent data was sourced from a second-hand trading platform, while the listed company data was obtained from the Guotai An Database (CSMAR). The initial research sample comprised A-share listed companies in Shanghai and Shenzhen from 2013 to 2020. Following standard practices in prior literature, the data underwent the following processing: elimination of ST (Special Treatment) and delisting samples, correction of erroneous entries, exclusion of financial firms, and removal of companies with fewer than one digital technology patent application. To mitigate the impact of outliers, all micro-level continuous variables were subjected to 1% and 99% tail-trimming.

This study focuses on corporate market value as the dependent variable, a key indicator of a company's growth potential. Existing literature commonly employs metrics such as Tobin's Q and Cumulative Abnormal Return (CAR) for measurement. While CAR primarily uses event study methods to assess short-term impacts on corporate value, Tobin's Q integrates both current capital market valuations and reasonable expectations of future growth potential, aligning with the research focus. Tobin's Q is calculated as the ratio of market value to replacement cost, with replacement cost data being difficult to obtain, hence the formula "(market capitalization + total liabilities) / total

assets". In addition to the dependent variable, this study incorporates a series of control variables: company size (measured as the natural logarithm of total assets), intangible asset ratio (Intass) (the ratio of intangible assets to total assets), debt-to-asset ratio (Lev) (total liabilities to total assets), return on assets (Roa) (net profit to total assets), independent director ratio (Dirratio) (the proportion of independent directors to total directors), major shareholder ownership (OwnConl) (the proportion of shares held by the largest shareholder), and company age (Age) (the natural logarithm of the current year minus the company's founding year). Descriptive statistics for each variable are presented in Table 2.

Table 2. descriptive statistics of the variables

Variables	N	Mean	Std.dev	Min	Max
Tobin Q	5583	2.135	1.396	0.743	22.300
Digtech	5583	1.966	1.221	0.693	8.310
Size	5583	22.355	1.390	19.600	28.500
Intass	5583	0.041	0.041	0.000	0.822
Lev	5583	0.414	0.201	0.011	3.920
Roa	5583	0.040	0.102	-4.950	0.297
Dirratio	5583	0.378	0.056	0.231	0.800
OunConl	5583	33.820	15.349	3.000	88.500
Age	5583	2.862	0.302	1.610	3.710

4.2. Model specification

This paper mainly studies the impact of digital technology innovation on the market value of enterprises, so this paper constructs the following panel model:

$$\text{Tobin's } Q_{it} = \alpha_0 + \alpha_1 \text{Digtech}_{it} + \alpha_2 \text{Control}_{it} + \delta_i + \mu_t + \varepsilon_t \quad (1)$$

The Tobin's Q_{it} represents the market value of firm t in year i . The core explanatory variable Digtech_{it} measures digital innovation at the firm level. Control_{it} comprises a set of control variables, including firm size, intangible asset ratio, asset-liability ratio, return on assets, and independent director ratio. δ_i denotes individual fixed effects, μ_t represents year fixed effects, and ε_t is the random error term.

5. Empirical results and analyses

5.1. Analysis of the regression results of the baseline

Table 3. The effects of Digital Technology Innovation on Enterprise Value

Variables	(1)	(2)	(3)
Digtech	0.113*** (0.015)	0.117*** (0.022)	0.049** (0.024)
Size	-0.212*** (0.016)	-0.248*** (0.023)	-0.272*** (0.069)
Intass	0.011 (0.331)	-0.015 (0.428)	0.891 (0.812)
Lev	-1.273*** (0.108)	-1.198*** (0.140)	0.481** (0.239)
Roa	-0.464 (0.912)	-0.660 (0.836)	-0.359 (0.379)
Dirratio	0.337 (0.265)	0.311 (0.371)	0.035 (0.395)
OwnConl	-0.003* (0.001)	-0.002 (0.002)	-0.000 (0.005)

Variables	(1)	(2)	(3)
Age	-0.126*** (0.051)	-0.218** (0.085)	0.818* (0.419)
Constant	7.070*** (0.378)	8.350*** (0.567)	5.076*** (1.811)
Year Fixed Effects	No	Yes	Yes
Firm Fixed Effects	No	No	Yes
Sample Size	5583	5583	5583
Adjusted R ²	0.317	0.355	0.633

The benchmark regression results demonstrate that: (1) The regression coefficient of the enterprise digital technology innovation indicator (Digtech) remains significantly positive at the 1% level when the year and individual fixed effects are not controlled; (2) Even after controlling for the year fixed effect, the coefficient remains significantly positive in the second column; (3) When both year and individual fixed effects are controlled simultaneously in the third column, the coefficient reaches 0.049, passing the 5% statistical significance test. These findings indicate that digital technology innovation can significantly enhance corporate market value as shown in Table 3.

5.2. Heterogeneity test

5.2.1 Heterogeneity Test of Industry Competition Degree

In the theory of economics and management, the degree of industry competition is considered as an important factor that affects the enterprise strategy and market performance. According to Porter's Competitive Advantage Theory, the intensity of competition within an industry directly impacts corporate profit margins and market value. In highly competitive sectors, companies must continuously innovate technologically to maintain market position and counter competitive pressures. Consequently, the effectiveness of digital innovation may vary significantly across different competitive environments.

In highly competitive industries such as technology, telecommunications, and fast-moving consumer goods (FMCG), businesses face intense market competition and require rapid adaptation to market changes. Digital innovation in these sectors not only enhances operational efficiency and customer experience but also enables companies to introduce new value propositions in products and services. Such rapid technological advancements can substantially increase market value. In contrast, low-competition industries like government services and certain public utilities experience relatively less market competition, where companies may not need to actively pursue digital innovation to maintain competitiveness. Although digital innovation could improve efficiency in these sectors, its direct impact on market value remains limited. Therefore, it is expected that digital innovation will have a more pronounced effect on boosting market value for companies in highly competitive industries compared to low-competition sectors. To address this, this study constructs a dummy variable for industry competition intensity, measuring it as the reciprocal of the standard deviation of the main business profit margin across all sample industries classified by the China Securities Regulatory Commission (CSRC) (data sourced from Zhang Yeqing's 2021 study). Industries with competition intensity above the median are defined as highly competitive, while those below are considered low-competitive. As shown in Table 4, the (1) column reveals no significant coefficient for digital technology innovation (Digtech) in low-competitive industries, whereas the (2) column demonstrates a significant positive coefficient for Digtech in highly competitive industries. This indicates that digital technology innovation exerts a more pronounced positive impact on market value enhancement for firms in highly competitive industries compared to their low-competitive counterparts.

5.2.2 Heterogeneity Test of Industrial Technology Activity

Industry technology activity can be defined as the frequency and intensity of technological progress and innovation within a sector. This activity is influenced by multiple factors such as R&D investment, technology update rates, market demand changes, and competitive environments. Significant differences in technology activity across industries directly impact how digital innovation enhances corporate market value. For example, high-tech active industries like information technology, e-commerce, and pharmaceuticals typically see companies actively pursuing digital innovation. With rapid technological updates, businesses can not only improve products/services but also explore new market opportunities through innovation. Consequently, digital innovation significantly boosts market value in these sectors. In contrast, low-tech active industries such as traditional manufacturing and agriculture experience slower technological updates. Companies in these sectors may adopt more conservative approaches to digital innovation, resulting in less noticeable market value growth.

To verify potential heterogeneity in industry technology activity, this study adopts the methodology of Li Wenqing and Zheng Manni (2016) by constructing dummy variables for high-tech industries to test for heterogeneity. As shown in Table 4, the Digtech coefficient in high-tech industries (Column 3) is not statistically significant, while in low-tech traditional industries (Column 4), the Digtech coefficient is significantly positive. This indicates that digital innovation exerts a more pronounced positive effect on market value enhancement for enterprises in low-tech traditional industries compared to high-tech sectors.

Table 4. Heterogeneity tests for industrial characteristics

Variables	Industry Competition Intensity		Industry Technology Activity	
	(1) Low Market Competition Intensity	(2) High Market Competition Intensity	(1) High-Tech Industry	(2) Low-Tech Industry
Digtech	0.073 (0.047)	0.056* (0.029)	0.060 (0.041)	0.054* (0.030)
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Sample Size	1999	3282	1501	4070
Adjusted R ²	0.617	0.607	0.669	0.606
Digtech	0.073 (0.047)	0.056* (0.029)	0.060 (0.041)	0.054* (0.030)
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Sample Size	1999	3282	1501	4070
Adjusted R ²	0.617	0.607	0.669	0.606

5.2.3 Heterogeneity Test of Industry Size

The motivations for digital technology innovation vary across industries of different scales. In large-scale sectors such as consumer goods, automotive, and finance, companies typically possess greater resources and technical capabilities to drive extensive digital innovation. Firms in these industries often prioritize efficiency gains, cost reduction, and enhanced customer experience to gain competitive advantages. Consequently, digital innovation can significantly boost market value and

increase their appeal in capital markets. In contrast, small-scale industries like niche manufacturing and regional service sectors face limited resources and fewer market opportunities, resulting in weaker incentives for digital innovation. While digital innovation may still create some market value growth in these industries, the constrained market space exposes companies to greater risks and challenges during digital transformation, thereby restraining value expansion. To examine the differential impact of digital innovation on market value across enterprise sizes, this study constructs a dummy variable for firm size, defining companies with total assets above the industry median as large enterprises and others as small/mid-sized enterprises. As shown in Table 5, the (1) column reveals insignificant coefficients for digital innovation (Digtech) in large enterprises, whereas the (2) column demonstrates significantly higher and positive coefficients for small/mid-sized enterprises. This indicates that digital innovation exerts a more pronounced positive effect on market value growth for small/mid-sized enterprises compared to large enterprises.

5.2.4 Test on the Heterogeneity of Enterprise Property Right

The impact of digital technology innovation on market value may vary significantly between enterprises with different ownership structures. On one hand, private enterprises focus primarily on profit maximization, establishing governance frameworks and management systems aligned with this objective. In contrast, state-owned enterprises pursue multiple goals including economic, social, and political objectives, requiring them to fulfill strategic and social policy responsibilities beyond profit-driven operations (Lin et al., 2004). This dynamic creates stronger incentives for private enterprises to enhance market value through digital innovation. On the other hand, state-owned enterprises benefit from soft budget constraints and easier access to policy support, while private enterprises face greater challenges in obtaining bank loans and preferential policies (Allen et al., 2005). Consequently, private enterprises experience greater pressure to leverage digital innovation for market value enhancement. To examine this, this study employs the CSMAR database's enterprise ownership data to conduct heterogeneity tests between state-owned and private enterprises. As shown in Table 5, the third column reveals that state-owned enterprises demonstrate lower coefficients for digital technology innovation (Digtech), whereas the fourth column shows significantly higher and positive coefficients for private enterprises. This indicates that digital technology innovation exerts a more pronounced positive effect on market value for private enterprises compared to state-owned counterparts.

Table 5. Heterogeneity Test of Firm Characteristics

Variables	Heterogeneity of Firm Size		Heterogeneity of Firm Ownership	
	(1) Large Firms	(2) SEMs	(1) SOEs	(2) Private Enterprises
Digtech	0.020 (0.033)	0.082** (0.035)	0.028 (0.035)	0.073** (0.032)
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Sample Size	2674	2561	1655	3364
Adjusted R ²	0.670	0.627	0.702	0.606
Digtech	0.020 (0.033)	0.082** (0.035)	0.028 (0.035)	0.073** (0.032)
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Sample Size	2674	2561	1655	3364
Adjusted R ²	0.670	0.627	0.702	0.606

6. Summary

This paper conducts an empirical study on the impact of digital technology innovation on the market value of Chinese listed enterprises from 2013 to 2020. The research findings are as follows: (1) Digital technology innovation can promote the improvement of corporate market value; (2) Heterogeneity analysis shows that digital technology innovation can significantly enhance the market value of small and medium-sized enterprises, private enterprises, highly competitive industries, and low-tech traditional industries, but has no significant impact on the market value of large enterprises, state-owned enterprises, low-competitive industries, and high-tech industries.

Based on the above research conclusions, the paper draws the following policy recommendations:

1. Encourage enterprises to increase investment in digital technology innovation. The government should formulate relevant policies, such as tax reductions and fiscal subsidies, to encourage enterprises to invest more in digital technology innovation. This can include financial support for technology research and development, equipment procurement, and technical training, helping enterprises reduce innovation costs and enhance their digital transformation capabilities. In particular, small and medium-sized enterprises face significant financial pressure during digital transformation, and the government needs to provide more attention and support.

2. Strengthen digital technology education and talent cultivation. It is recommended that the government collaborate with universities and vocational training institutions to establish digital technology-related courses and training programs, cultivating more talents with digital skills. Through talent cultivation, enterprises can enhance their capabilities in digital technology innovation. At the same time, enterprises are encouraged to jointly conduct internships and practical projects with educational institutions, enabling students to understand industry demands and improve their employability.

3. Support enterprises in establishing an innovation culture. Policy recommendations include guiding enterprises to establish innovation-driven corporate cultures and encouraging them to actively explore and implement digital technologies internally. Governments can facilitate this through case studies and experience-sharing platforms, helping businesses learn from successful digital transformation cases and best practices, thereby motivating more companies to proactively pursue digital innovation.

4. Enterprises should be encouraged to grant employees greater autonomy and creative freedom during innovation processes, which will enhance employee motivation and creativity. IV. Building a Favorable Digital Ecosystem. Governments should actively foster a robust digital ecosystem by improving relevant laws and regulations, protecting intellectual property rights, and ensuring fair competition, thereby providing enterprises with adequate protection and support during their digital innovation endeavors.

5. Furthermore, legislation on data security and privacy protection should be strengthened to enhance public trust in digital technologies, thereby encouraging enterprises to actively explore these technologies. Fifth, policy support should be advanced in key technological fields. Particularly in critical digital domains such as artificial intelligence, big data, and cloud computing, the government should establish targeted policies to support corporate R&D and technology commercialization. By funding research projects and hosting innovation competitions, these measures will drive technological progress and market adoption in these fields, enabling enterprises to achieve breakthroughs and boost their market value.

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