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The impact of technology absorption capacity on competitive advantage in Vietnamese small and medium enterprises

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Abstract: This study examines the impact of technology absorption capacity on competitive advantage in Vietnamese small and medium enterprises. Technology absorptive capacity can help SMEs enhance their competitive advantage by improving customer interactions, optimizing business processes, encouraging innovation, expanding markets, and increasing transparency and trustworthiness. The study assessed the impact of technology absorptive capacity on SME's competitive advantage. The research team conducted a questionnaire survey to assess the impact of technology absorption capacity on the competitive advantages of 300 Vietnamese small and medium-sized enterprises, specifically those engaged in digital transformation and the integration of technologies into their production and business activities. With the survey data collected, the study uses quantitative analysis methods, including steps to evaluate the reliability of variables in the model based on the Cronbach Alpha coefficient; Exploratory Factor Analysis (EFA) and Confirm Factor Analysis (CFA) are used to identify and confirm the factors and scales in the model, Structural Equation Modeling (SEM) is applied to determine the impact relationship between the factors and variables in the research model. The results show that technology absorption capacity has a strong impact on the innovation business model, strategic flexibility, and competitive advantage of the SME. Based on the results, the study has given some specific policy implications for the digital transformation process to enhance technological capacity through identifying and applying emerging technologies to current small and medium enterprises.

Keywords: *Competitive advantage, Digital transformation, Innovate business models, SMEs, Strategic agility, Technology absorptive capacity.*

1. Introduction

The digital transformation trend of small and medium enterprises (SMEs) in Vietnam is becoming increasingly essential and emphasized, especially with globalization and fierce competition. After the COVID pandemic, most businesses, including SMEs, are aware that digital transformation is an irreversible trend for companies to adapt and overcome the difficulties of the pandemic. Therefore, the number of SMEs accessing the Program to support small and medium-sized enterprises in digital transformation (SMEdx) of the Ministry of Information and Communications of Vietnam has increased sharply, from 190 thousand businesses in April 2022 to more than 490 thousand businesses by September 2022, an increase of 250%. Many SMEs are applying new technologies such as artificial intelligence (AI), Internet of Things (IoT), big data, and blockchain to improve performance and competitiveness. Businesses have begun to be flexible in upgrading and converting technology infrastructure to meet business growth needs. Management information systems such as enterprise resource planning (ERP) are built by businesses to integrate and connect data from multiple sources to create a comprehensive view of the business. In addition, increased coordination with partners and flexible cooperation are necessary to take advantage of the power of the business ecosystem. This relaxed digital transformation process has helped small and medium-sized enterprises in Vietnam build

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the capacity to absorb emerging technologies, thereby promoting innovation in business models and flexibility in business strategies, and gradually creating competitive advantages in the market. Digital transformation involves leveraging technology to create new customer value and providing innovative products and services. Digital transformation helps SMEs expand markets and explore new opportunities through flexible business models and strategies. Furthermore, digital transformation also poses a challenge for Vietnamese SMEs.

Businesses in areas such as initial investment costs, change management capabilities, and information security. This study experimentally measures and evaluates the impact of technology absorption capacity on business model innovation, strategic flexibility, and competitive advantage of small and medium-sized enterprises in Vietnam through survey results of close to 300 small and medium enterprises. This research is conducted with a structure of 6 parts: introduction, research model, research method, results, discussion, and conclusion.

2. Research Model and Hypotheses

2.1. Competitive Advantage

According to Porter [1] Competitive Advantage (CA) is "the advantages, strengths, or special capabilities of an enterprise compared to competitors, in the same field or market. Competitive advantage helps businesses achieve a better position in the market, creates special and different values compared to competitors and helps improve the business's position in the market." According to Clulow, et al. [2] "competitive advantage is when a business implements a strategy that creates value that no current or potential competitor can implement." According to Porter [1] "Enterprises can gain competitive advantages over their competitors through cost and differential advantages. A cost advantage is when a business offers similar products and services to its competitors at a lower price. Differentiation advantage is when a company provides better products and services than its competitors."

2.2. Technology Absorptive Capacity

According to the definition by Zahra and George [3] "absorptive capacity" is a set of working methods and processes in the organization through which an enterprise can receive, absorb, transfer, exchange, and utilize knowledge to develop long-term capabilities. In Zahra and George's view, absorptive capacity is an essential factor affecting a business's competitiveness. It helps create and exploit the knowledge necessary to build new capabilities—other organizational activities.

Research by García-Morales, et al. [4] introduced the concept of TAC as a process related to technology acquisition, assimilation, and transformation (the ability to develop and improve routine activities to create favorable conditions for combining existing technological knowledge with acquired knowledge and for assimilating this knowledge and exploiting specialized knowledge). According to Yin and Zeng [5] technology absorptive capacity (TAC) refers to the ability to learn and use knowledge, an essential factor affecting the relationship between technology and environmental performance in business.

2.3. Innovate Business Models

Business model: According to Osterwalder, et al. [6] a business model is a conceptual information system that describes how an enterprise operates and can be used to analyze and compare. Compare and evaluate performance, management, communication, and innovation. Research by Rasmussen [7] has shown that business models are concerned with how businesses determine their competitive strategies through the design of products and services provided to the market, as well as how to determine the costs, and differences of products and services from other businesses by value proposition, integrating the business's value chain with the industry's shared value network, and how the business integrates its value chain with the value chain of other businesses in the value network. According to Voigt, et al. [8] the business model includes three elements:

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Value proposition: potential benefits for customers.

Value creation: methods used by businesses to provide customers with value proposition.

Capturing value: involves the payment, not necessarily in money, from customers to businesses.

Innovate Business Models (IBM): According to Albayraktaroglu [9] an innovative business model is the process of creating, updating, or determining the structure and essential components of the model. business model to create new value propositions, capture new market opportunities, and gain a competitive advantage. Innovative business models involve developing creative ways to generate revenue, deliver products or services, and create and capture customer value. According to Foss and Saebi [10] "business model innovation is a process of designing, refreshing, and changing the links between key components in a business model."

2.4. Strategic Flexibility

Competitive strategy: A general competitive strategy describes how a business deploys competitive advantage in its chosen market. According to Porter [1] "three general types of strategies used in businesses to achieve and maintain competitive advantage are low-cost strategy, differentiation strategy, and focus strategy."

Strategic Agility (SA): According to Tallon and Pinsonneault [11] strategic agility requires changes that are different from the regular change in the organization and originate from the organization's strategy. Strategic agility is continuous, systematic changes in an organization's products, processes, services, and structures. According to Weber and Tarba [12] and Doz [13] strategic agility refers to an organization's ability to quickly adjust its strategies and tactics in response to market conditions. Changing markets, technological advances, competitive pressures, or other internal and external factors. Strategic agility involves being proactive rather than reactive, anticipating changes, and quickly adjusting plans and resources to take advantage of emerging opportunities or mitigate risks.

2.5. The Relationship between Technology Absorptive Capacity and Competitive Advantage

2.5.1. Technology Absorptive Capacity and Competitive Advantage

Industrial Revolution 4.0, with emerging technologies such as big data, artificial intelligence, blockchain technology, Internet of Things, robotic process automation, safety and security, and immersive technology, has accelerated the digital transformation process of businesses, shaping review of the business processes of the enterprise from the operational level to the strategic level [14].

According to Mahmood and Mubarik [15] development in the context of digital transformation is happening intensely, and TAC helps businesses adapt flexibly and thrive. From there, TAC allows companies to maintain a sustainable competitive advantage in the dynamically growing digital economy. In addition, TAC also promotes the process of forming dynamic capabilities of enterprises through technology absorption and promoting the innovation process at enterprises.

According to Vaghef [16] the increasingly competitive landscape requires businesses to innovate to maintain a sustainable competitive advantage. Technology transfer encourages SMEs to innovate. Technology transfer in the current context includes physical assets, know-how, and processes. Successful technology transfer requires the receiving enterprise to have the ability to absorb technology.

Adopting disruptive technologies encourages the creation of flexible and interconnected corporate systems [17]. Disruptive technologies can potentially revolutionize a sector or part of the market entirely, determining the digital revolution of companies and transforming their processes and business models [18]. Applying new technologies has created a collaborative approach to innovation [19, 20].

2.5.2. The Mediating Role of Business Model Innovation and Strategic Agility in the Relationship between Technology Absorptive Capacity and Competitive Advantage

According to Tohănean, et al. [21] and Acciarini, et al. [22] business model innovation creates a competitive advantage in the digital environment. Business model innovation is a powerful strategy to

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gain a competitive advantage. It enables companies to differentiate, improve efficiency, adapt to changing circumstances, and better meet customer needs, all of which contribute to long-term success in the business landscape.

Research by Clauss, et al. [23] and Battour, et al. [24] has shown the relationship between strategic flexibility and competitive advantage. There is a close relationship between strategic flexibility and competitive advantage. Strategic agility enables organizations to proactively navigate change, innovate, and respond quickly to market dynamics. That way, organizations can maintain a competitive advantage over time in an ever-evolving business environment.

Therefore, the author sets out the research model and research hypotheses, as shown in Figure 1:

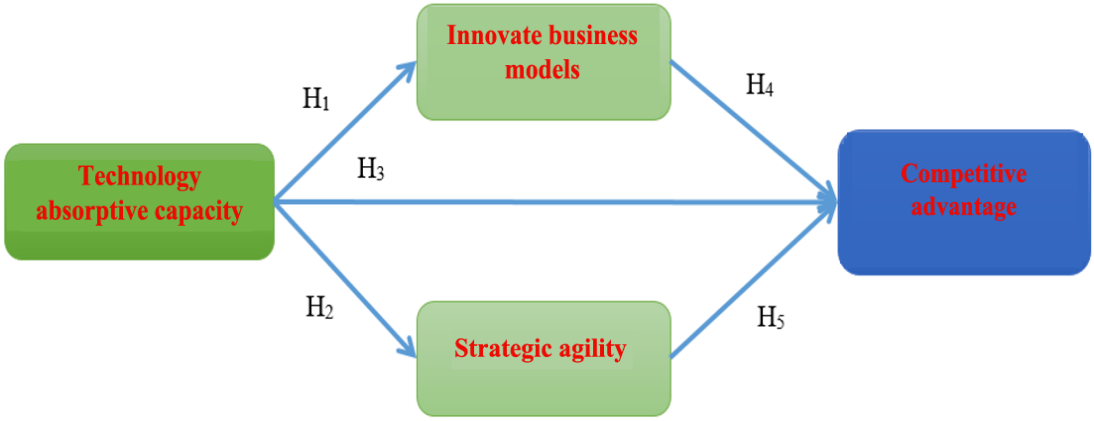

Figure 1.
Research model.

H_1: The ability to absorb emerging technology positively impacts the business model innovation of SMEs.

H_2: The ability to absorb emerging technology positively impacts the business strategy flexibility of SME enterprises.

H_3: The capacity to absorb emerging technology positively impacts the competitive advantage of SMEs.

H_4: Business model innovation has a positive impact on the competitive advantage of SME enterprises.

H_5: Strategic flexibility positively impacts the competitive advantage of SME enterprises.

3. Research Methods

3.1. Data Measurement

In this study, the authors use the concepts of "technology absorptive capacity," "innovate business models," "business strategy flexibility," and "competitive advantage" of companies. SME enterprises. We inherited these scales from previous studies and adjusted them to suit the context of Vietnamese SMEs. The scales of the variables in the research model (Table 1) use a 5-level Likert scale, in which "1- completely disagrees, 5- completely agrees."

Table 1.
Scales of the research model.

Variable	Coding	Scale	Reference
Technology absorptive capacity	TAC1	Employee digital capabilities	Kastelli, et al. [25]
	TAC2	Existence of in- house research and development (R&D) department	
	TAC3	Have a process to evaluate, measure and reward employee progress	

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Variable	Coding	Scale	Reference
	TAC4	Programmes for retraining and/or enhancement of employees' skills	
	TAC5	Investing intensity in digital technologies/Solutions related to employee's development and learning	
Innovate business models	IBM1	Value creation innovation	Albayraktaroglu [9]
	IBM2	Value capture innovation	
	IBM3	Value proposition innovation	
Strategic agility	SA1	Strategic sensitivity	Doz [13]
	SA2	Leadership unity.	
	SA3	Resource fluidity	
Competitive advantage	CA_1	Optimize customer experience	Porter [1]
	CA_2	Differential advantage	
	CA_3	Cost advantage	

We designed the survey questionnaire using scales that measure concepts from the research model. The survey also includes general questions about Vietnamese SME businesses, such as year of establishment, main field of operation, and staff size.

3.2. Research Data

The aim of this study is to investigate how technology absorption capacity influences business model innovation, strategic flexibility, and competitive advantage in Vietnamese small and medium enterprises. Research and conduct surveys with Vietnamese SME businesses by emailing survey forms to business leaders. The results of the research sample analysis show the diversity of types of SME businesses in Vietnam that have undergone digital transformation and successfully applied technology to production and business activities. Descriptive statistics from the survey sample of 300 Vietnamese SME enterprises were obtained as follows:

Table 2.
Describes the data sample.

Criteria		Rate (%)
Industry	Retail trade	13
	Information technology	20
	Finance and insurance	18
	Entertainment	14
	Manufacturing	10
	E-commerce	19
	Others	6
Firm's size (Number of employees)	Less than 100	54
	100-200	24
	200-500	16
	500-1000	5
	Above 1000	1
Digital transformation maturity	Beginner	30
	Intermediate level	42
	Advanced	23
	Expert	5

Table 2 presents the descriptive statistics of the study's survey sample. Of these, most of the businesses in the survey sample are small and medium-sized enterprises (with less than 200 employees, accounting for 78%). These businesses operate primarily in various fields, including information technology, finance and insurance, e-commerce, retail trade, manufacturing, and entertainment, among others. Most companies have started implementing digital transformation, in which the level of digital maturity at the starting level accounts for 30%, the intermediate level accounts for 42%, the advanced level accounts for 23%, and the expert level accounts for 5%.

3.3. Analytical Method

After collecting data, the study used SPSS 26 and AMOS 26 software to analyze and evaluate relationships according to the hypotheses of the research model in the following order:

(1) Assess the reliability of the research model. Variables in the model are based on the Cronbach Alpha coefficient.

(2) Exploratory factor analysis (EFA).

(3) confirmatory factor analysis (CFA) methods were used to identify and confirm the factors and scales in the model.

(4) we applied the structural equation method (SEM) to determine the impact relationship between variables in the research model.

4. Research Results

The authors used Cronbach's Alpha reliability coefficient for the conceptual scales in the research model for preliminary evaluation. Cronbach's Alpha value less than 0.6 is not reliable enough; between 0.6 and 0.8 is acceptable, and more significant than 0.8 is considered highly reliable [26]. Results of Cronbach's Alpha reliability test of 14 observed variables of 04 concepts in the research model (technology absorption capacity, business model innovation, business strategy flexibility, and competitive advantage) all have satisfactory coefficients for inclusion in EFA exploratory factor analysis. Table 3 presents the results of testing the scale.

Table 3.
Summary of scale testing results.

Ingredient	Number of observed variables	Cronbach's alpha (α)	Variance (ρ_{vc})	Value
Technology absorptive capacity	5	0.778	0.842	Qualified
Innovate business models	3	0.807	0.791	
Strategic agility	3	0.883	0.860	
Competitive advantage	3	0.767	0.742	

The EFA analysis yielded four factors that qualified for inclusion in the CFA confirmatory factor analysis. The results of the CFA analysis show that the composite reliability, convergent validity, and discriminant validity of the model meet the requirements. To test the hypotheses of the research model, the author uses linear structural equation SEM with maximum likelihood estimation method.

CFA analysis results for statistical values: Chi-square is 138, 918 with 71 degrees of freedom (df), with a value of p_value = 0.000 < 0.05; Chi-square/df = 1,957. This statistical value meets compatibility requirements. Some other statistics of the model, such as GFI = 0.942, TLI = 0.950, CFI = 0.961, and RMSEA = 0.058 < 0.80, all meet the requirements. The statistical values of the CFA analysis show that the critical model is compatible with market data [26].

SEM results (Figure 2) show that the theoretical model has 72 degrees of freedom, with p_value = 0.000 < 0.05; Chi-square/df = 2.261, GFI = 0.934, TLI = 0.937, CFI = 0.950, RMSEA = 0.064. According to Anderson and Gerbing [26] the indexes of the CFA and SEM models all meet the

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requirements to ensure the model is sufficiently reliable. The model's results satisfy the statistical requirements, making them suitable for testing the research model's hypotheses.

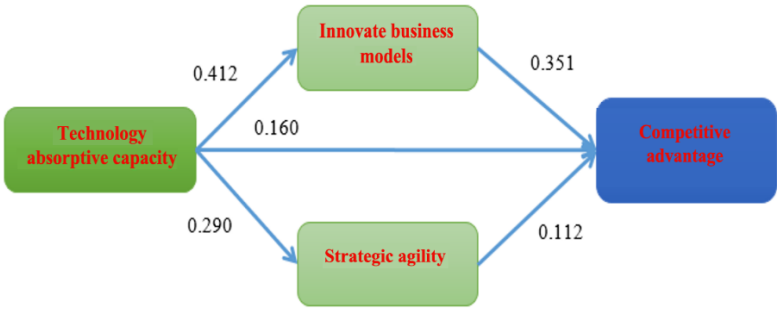

Figure 2.
Results of SEM model analysis (Standardized).

Table 4.
SEM analysis results.

Relationship	Estimate	Standard error (S.E.)	Composite reliability (C.R.)	P_value	Conclude
Technology absorptive capacity → Innovate business models	0.412***	0.071	3.281	0.000	Accept H_1
Technology absorptive capacity → Strategic agility	0.290***	0.124	2.180	0.000	Accept H_2
Technology absorptive capacity → Competitive advantage	0.160***	0.082	2.260	0.000	Accept H_3
Innovate business models → Competitive advantage	0.351***	0.121	3.785	0.000	Accept H_4
Strategic agility → Competitive advantage	0.112***	0.009	2.134	0.000	Accept H_5

Note: *** correspond to the 10%, respectively.

Testing the research model hypothesis: Results of SEM model analysis with unstandardized regression weights in Table 4 show that at the 5% significance level (95% confidence level), testing the relationships, the relationship between the variables in the research model is statistically significant, so hypotheses H1-H5 are accepted.

5. Discuss Research Results

The study tested the relationship between "technology absorption capacity", "innovate business models" and "strategic agility" to "competitive advantage" of SMEs in Vietnam.

According to research results, "technology absorption capacity" also directly affects the "competitive advantage" of SME enterprises with a coefficient of 0.160 standard units. This result is compatible with the research results of Mahmood and Mubarik [15]. The solid digital transformation process of SMEs has fundamentally changed the way businesses do business. "Technology absorptive capacity" refers to the ability of a company to absorb, integrate, and leverage new technology to improve business operations. In the case of small and medium-sized enterprises (SMEs), this capability can significantly affect their competitive advantage. In today's increasingly volatile business environment, flexibility integrating and using new technology can help them survive, thrive, and compete. Also, according to the research results, "technology absorption capacity" has a substantial impact on the "competitive advantage" of SME enterprises through the intermediate variables "innovate business models" and "strategic agility".

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"Technology absorption capacity" also strongly impacts "innovate business models" with a 0.412 standard coefficient, and "business model innovation" affects the "competitive advantage" of SME enterprises with a 0.351 standard coefficient. This result is consistent with the research results of Manita, et al. [18]; Cunningham and O'Reilly [19]; Del Giudice, et al. [17]; Tohănean, et al. [21] and Acciarini, et al. [22]. Technology absorptive capacity can create a creative environment within an organization, fostering new ideas and the ability to innovate. Technology is often a source of inspiration for developing innovative business model ideas. Technology absorption capacity means having solid knowledge and understanding of technology in the organization. This increases the ability to understand and apply technology to change current business models. In addition, the technology absorption capacity of SMEs helps optimize existing business processes. This can make the organization more agile and prepare the infrastructure to deploy new business models effectively. Technology absorptive capacity allows for creativity in developing new business solution. This may include developing new products and services or creating new business models. Technology absorption can expand the business scope by using technologies to reach and serve new customers, expand markets, and create new business opportunities. Technology absorption capacity enables SMEs to quickly adapt to recent market trends and respond to industry fluctuations. Strong technology absorption creates competitiveness, helping SME businesses create a competitive advantage over competitors in an increasingly competitive business environment. "Technology absorption capacity" also strongly impacts "business strategy flexibility" with a 0.290 standard coefficient, and "strategic agility" affects the "competitive advantage" of SME enterprises with a 0.112 standard coefficient. This result is consistent with the research results of Clauss, et al. [23] and Battour, et al. [24]. Technology absorption capacity plays an important role in building and maintaining flexibility in business strategy. SMEs that can effectively absorb technology effectively often have an advantage in adapting to market fluctuations and creating flexible business strategies to meet the needs of an increasingly evolving business environment, thereby creating a competitive advantage in today's digital economy.

6. Conclusions

The research was conducted based on the research model proposed from the review of related research results, followed by a verified model based on the results of investigations and surveys from more than 300 Vietnamese SMEs. This research finding significantly contributes to determining the impact of technology absorption capacity on SME enterprises' competitive advantage.

First, the research results are empirical evidence showing the strong, direct impact of "Technology absorption capacity" on SME enterprises' "Competitive advantage." The research results are empirical evidence in SME businesses through digital transformation and the application of new technology to increase sustainable competitive advantage in the market. The first is the ability to absorb technology that helps SMEs improve efficiency in production processes, human resource management, and other business activities. This can lead to increased competitiveness by providing high-quality and low-cost products or services. Second, the ability to absorb technology helps SMEs proactively create and develop new products. Integrating new technology can create unique products or services, helping businesses attract and retain customers. Third, applying technology can help SMEs expand their market through online channels, e-commerce, and other digital media. This can open up new opportunities and strengthen its competitive position. Fourth is the ability to absorb technology that helps SMEs optimize resource management, such as human resources, materials, and time. This can lead to flexibility and efficiency in business management, providing a competitive advantage. Fifth is a technology that can be used to improve customer experience. To build good customer relationships, SMEs can use technologies such as online payment systems, customer service, and automated customer care. Sixth, SME businesses with good technology absorption capacity can quickly adapt to competitive challenges from large competitors or companies that use technology effectively.

Second, the study also examines the indirect impact of technology absorption capacity on the competitive advantage of SMEs through business model innovation and business strategy flexibility.

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The research results have reaffirmed the role of technology absorption capacity to help SMEs increase their competitive advantage through business model innovation and flexible business strategies in the economic context. Numbers are changing very quickly today. Innovating business models based on the application of new technologies is a powerful strategy to gain a competitive advantage. It enables SME businesses to differentiate, improve efficiency, adapt to changing circumstances, and better meet customer needs - all of which contribute to long-term success in the business landscape. To gain a competitive advantage, SME businesses must identify emerging technologies, measure them, and apply them to their production and business activities. The rapid pace of technological change requires flexibility in business strategies for SMEs, helping businesses proactively navigate changes, innovate, and respond quickly to challenging market dynamics. That way, SME businesses can establish and maintain a competitive advantage over time in an ever-evolving business environment.

The study's limitation is that the sample size is small, and most Vietnamese SMEs are currently or recently in the digital transformation process. In the future, as the scale of SME enterprises increases and they have more time to vigorously apply new technologies to their production and business activities, research should concentrate on identifying new impacts and new distributions. The ability of SMEs to absorb technology leads to competitive advantage according to the characteristics of each field and each stage. In addition, research needs to be directed at how businesses absorb, distribute, and convert technology for competitive advantage.

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Transparency:
The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Competing Interests:
The author declares that there are no conflicts of interests regarding the publication of this paper.

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