

Digital Technology Search and New Venture Performance in Dynamic Environments: The Mediating Role of Competitive Advantage

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ABSTRACT

Technology search is crucial to establishing competitive advantage and improving firm performance. However, it is still unclear how different technology search strategies affect competitive advantage and performance at the firm level and how to determine technology search strategies in dynamic environments. Therefore, based on resource-based theory, this study explores the relationship between digital technology search, competitive advantage, and new venture performance (NVP) in dynamic environments with a sample of 267 Chinese new ventures. The results show that the breadth and depth of digital technology search positively affect NVP. Environmental dynamism weakens the positive effect of digital technology search breadth on NVP but strengthens the positive relationship between digital technology search depth and NVP. Moreover, digital technology search breadth affects NVP via differentiated competitive advantage, and digital technology search depth affects NVP through differentiated and cost-leadership competitive advantage. Finally, implications and limitations are discussed.

KEYWORDS

Cost-Leadership Competitive Advantage, Digital Technology Search Breadth, Digital Technology Search Depth, Differentiated Competitive Advantage, Environmental Dynamism, New Venture Performance

INTRODUCTION

Faced with the complex and changeable digital economy era, new ventures innovate management, process, and products/services constantly to establish diversified competitive advantages, achieving survival and sustainable development in the face of fierce competition (Duan et al., 2021). More and more entrepreneurs have realized that relying only on the internal technological knowledge of new ventures is far from satisfying the innovation and growth needs of new ventures (Rosenkopf & Nerkar, 2001), and could cause path dependence and a capability trap (Swift, 2016). To overcome these limitations, new ventures need to cross organizational boundaries and conduct digital technology searches through external channels (e.g., suppliers, customers, competitors, and research institutes) to acquire new technological knowledge and information (Tan et al., 2020).

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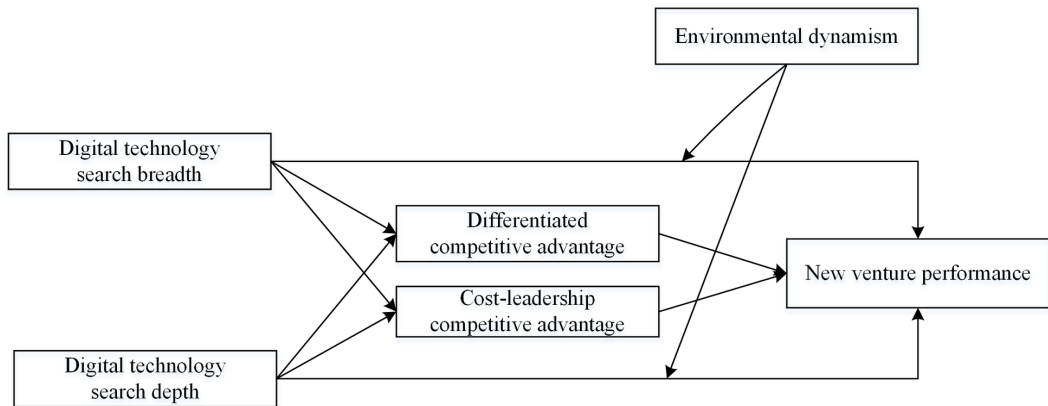
Digital technology search includes search breadth and depth. The former reflects the search scope of digital technology knowledge and information, while the latter reflects the enterprise's degree of adoption of digital technology knowledge and information from specific sources (Laursen & Salter, 2006; Li-Ying et al., 2014). Heterogeneous technology knowledge and information obtained through an extensive and in-depth technology search can help firms generate new ideas and technologies in the process of creative collision and improve the overall cognition and ability of firms (Dong & Netten, 2017). This also further promotes new ventures to better carry out innovation activities and establish competitive advantages, thus improving firm performance. However, as far as we know, scholars mainly pay attention to the effect of a technology search on innovation capability and innovation performance (e.g., Li-Ying et al., 2014; Zhang et al., 2019), but they rarely empirically explore the impact of different digital technology search strategies on the overall performance of new ventures in the context of the digital economy.

According to existing research, the specific process by which a technology search affects firm performance has been ignored (Ferrerias-Méndez et al., 2015), so the understanding of how a technology search affects firm performance is defective. An external knowledge search has gradually become an important way for firms to obtain and maintain competitive advantages (Foss et al., 2011). Previous studies have found that by investing a large amount of time, capital, and other relevant resources in technology search activities, firms can improve their ability to integrate existing knowledge and technology and respond to market changes, and effectively enhance their strategic decision-making ability and market competitive advantage (Fabrizio, 2009; Laursen & Salter, 2006). Based on Porter (1985), competitive advantage includes differentiated and cost-leadership competitive advantage. However, it is unknown whether technology search strategies have different effects on the establishment of distinct competitive advantages. As is known to all, the establishment of competitive advantages is critical for new ventures to achieve superior performance (Anwar et al., 2018). Thus, the technology search strategies of new ventures may influence new venture performance (NVP) through competitive advantage in theory, but this needs to be further empirically tested.

In addition, new ventures in emerging economies usually face highly dynamic environments with rapid technological changes and unclear market trends (Cai et al., 2016). Some studies have focused on the influence of technological dynamism on the relationship between different external search strategies and firm performance (Cruz-González et al., 2015). However, existing research mainly focuses on the impact of external dynamism on the relationship between search strategies and the performance of established enterprises, while ignoring new ventures, which have the "liability of newness." Therefore, the research on guiding the digital technology search strategies of new ventures under dynamic environments is still very limited.

Based on the above analysis, this study aims to explore the effect of digital technology search strategies of new ventures on the establishment of competitive advantage and the improvement of overall NVP in dynamic environments. According to resource-based theory, this study explores the relationship between digital technology search, competitive advantage, and NVP using a sample of 267 Chinese new ventures in the context of the digital economy. Furthermore, the moderating role of environmental dynamism in the link between digital technology search and NVP is considered. Figure 1 shows this study's research model. The results guide new ventures to determine digital technology search strategies and establish competitive advantages in a specific context.

Figure 1. Research model



This research has made three contributions to the literature on technology search and competitive advantage. First, based on the resource-based view, this study empirically clarifies the relationship between the breadth and depth of digital technology search and NVP. This is helpful to better understand the important role of different technology searches in the overall development of new ventures. Second, this study analyzes the influence mechanism of the breadth and depth of digital technology search on NVP from the perspective of competitive advantage. This not only provides new insights into the driving factors of establishing competitive advantage, but also provides a new perspective for opening the black box between technological search and firm performance. Third, based on the dynamic environment that new ventures are generally faced with, this study explores the moderating effects of environmental dynamism on the relationship between digital technology search and NVP. It is helpful to understand how to choose the appropriate technology search strategy in turbulent environments.

THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Digital Technology Search and NVP

Digital Technology Search Breadth and NVP

Digital technology search breadth plays an important role in obtaining heterogeneous technological knowledge and realizing breakthrough technological innovation, which is conducive to firms' innovation development and performance improvement. On the one hand, digital technology search breadth contributes to expanding the scope for enterprises' access to external innovation resources, increasing the diversity of their technological knowledge and enriching their technological knowledge base (Duan et al., 2021). New ventures can extensively collect technological knowledge and information through various channels, such as customers, suppliers, competitors, and research institutions (Cruz-González et al., 2015). All kinds of technological knowledge and information obtained from external sources help to provide opportunities for new ventures to develop new organizational competitiveness, which is crucial to the innovative development of new ventures (Kim et al., 2019). Meanwhile, utilizing the heterogeneous technological knowledge gained from technology search can help enterprises effectively improve the success probability of product/service innovation, and then promote enterprises to achieve better sales performance and entrepreneurial performance (Vega-Jurado et al., 2009).

On the other hand, digital technology search breadth can help new ventures understand the latest technological knowledge and development trends, combine and apply relevant technologies, and even achieve breakthrough technological innovation (Ardito et al., in press). Obtaining technological information from a wider range of sources can expand the organizational vision and better improve strategic flexibility, which is conducive to the cutting-edge technological innovation of new ventures. Moreover, new ventures' technology search in different fields can promote them to develop original technology by using new technological knowledge. These cutting-edge and original technologies can prevent firms from falling into the path dependence of their own technological knowledge, and promote them to develop new products/services to achieve higher profits by helping new ventures discover new technological development trajectories (Ahuja & Katila, 2001).

H1a: Digital technology search breadth positively affects NVP.

DIGITAL TECHNOLOGY SEARCH DEPTH AND NVP

Digital technology search depth promotes enterprise innovation and performance by increasing knowledge relevance and reducing innovation risk. First of all, digital technology search depth can enhance the relevance between external technological knowledge and enterprise needs. The essence of digital technology search depth is to improve the cognition level of enterprise research and development (R&D) personnel on existing digital technology and to improve the scientific decision-making of enterprise managers in digital technology transformation (Tang et al., 2019). Digital technology search depth can deepen enterprises' understanding of technological knowledge and effectively enhance their innovation ability (Laursen & Salter, 2006). Especially when searching in relatively familiar fields, enterprises can accumulate valuable tacit knowledge and generate new technological knowledge that is not easy to imitate, thereby forming their own technological barriers (Duan et al., 2021). This plays an important role in improving the competitiveness and performance of enterprises. With the deepening of digital technology search, enterprises' ability to distinguish various types of technological knowledge and information can also be enhanced. This may help improve the reliability of technology search, the efficiency of product/service innovation, and the success rate of enterprises.

Second, the in-depth search of enterprises in familiar technological fields can decrease the complicity of management and reduce the variety of knowledge, which helps firms to lessen innovation risks by quickly matching external technological knowledge with their own technological needs (Kaplan & Vakili, 2015). Digital technology search depth emphasizes improving production efficiency and activating innovative ideas through the in-depth usage and reorganization of available technological knowledge, and enhancing the success probability of transforming new ideas into new products/services. Moreover, an in-depth search for specific technological knowledge can effectively promote close interaction and knowledge sharing between enterprises and external channels and optimize the allocation of innovation resources among various entities, thus producing higher-quality innovation outcomes and firm performance (Duan et al., 2021).

H1b: Digital technology search depth positively affects NVP.

DIGITAL TECHNOLOGY SEARCH AND COMPETITIVE ADVANTAGE

Digital Technology Search and Differentiated Competitive Advantage

As a dynamic capability of enterprises, a technology search helps enterprises to match and adapt their internal resources to the external environment and enables firms to establish and maintain competitive advantages over a period of time (Blichfeldt & Faullant, 2021). Competitive advantage refers to the degree that an organization can surpass its competitors to create a defensive position (Porter,

1985). Competitive advantage reflects firms' ability to outperform their competitors and focuses on economic value creation and relative performance (Ong et al., 2018). Competitive advantage includes differentiated and cost-leadership competitive advantage. Differentiated competitive advantage is an advantage that creates higher perceived value and economic value through the differentiation of products/services (López-Gamero et al., 2009; Porter, 1985). Cost-leadership competitive advantage refers to the advantage of producing products and providing services at relatively low costs through mass production and the accumulation of learning experience (López-Gamero et al., 2009; Porter, 1985).

Differentiated competitive advantage is mainly manifested in the leading advantage and personalized advantage of developing new products/services. The breadth and depth of digital technology search affect the establishment of these advantages. On the one hand, the technological knowledge and competitive intelligence obtained by enterprises through digital technology search can help them grasp the frontier trends of technology and the competitive pattern of the industry and promote enterprises to take the lead in developing new products/services. Enterprises acquire digital technology knowledge and information through a broader and deeper digital technology search, which can help them understand the cutting-edge trends of digital technology and improve their ability to identify potential market opportunities. These endow firms with keen insights to improve the innovation efficiency of new products/services through flexible innovation (Ferrerías-Méndez et al., 2015). Moreover, extensive and in-depth interactions between firms and external channels can increase entrepreneurs' chances of finding technological solutions to meet the needs of new customers, enabling firms to rapidly enter entirely new market segments (Flor et al., 2018). This can help firms respond to market demand in a more targeted manner, and achieve differentiated competitive advantages by adopting new technologies to improve production processes and speed up R&D.

On the other hand, digital technology search can enable enterprises to launch personalized products/services that are more suitable for customer needs, forming unique personalized advantages. Digital technology search depth focuses on developing personalized products/services to meet current customer needs. Digital technology search depth is mainly to deepen the utilization of existing knowledge and the improvement of existing technology. This plays an important role in enterprise innovation and brings various benefits to enterprises (Shi et al., 2019). Digital technology search depth pays particular attention to obtaining information from customers. Because it can help enterprises to develop personalized products that are more in line with user needs than their competitors (Lorenz et al., 2020), and then establish differentiated competitive advantages. In contrast, digital technology search breadth focuses on developing new products/services by satisfying potential customers' needs. Digital technology search breadth emphasizes expanding the search scope of external new technological knowledge. It requires enterprises to cross-organizational routines to search for some technological knowledge with small connections related to their own original technology but high value, thus improving enterprises' access to new competitive knowledge flows. The new technology knowledge brought by digital technology search depth provides conditions for enterprises to create new products/services that meet the needs of potential customers. Moreover, this knowledge may make the enterprises sensitive and flexible to the changes in the external environment, which is of great significance to increasing their differentiated competitive advantages.

H2a: Digital technology search breadth positively affects differentiated competitive advantage.

H2b: Digital technology search depth positively affects differentiated competitive advantage.

DIGITAL TECHNOLOGY SEARCH AND COST-LEADERSHIP COMPETITIVE ADVANTAGE

Cost-leadership competitive advantage is mainly reflected in low commercial operation cost and high operation efficiency. The breadth and depth of digital technology search affect cost reduction

and efficiency improvement through the introduction of technological knowledge and new ideas. First of all, digital technology search improves organizational structure and management mode by introducing new digital technologies and reducing operating costs while improving organizational flexibility (Chen & Siau, 2020). Searching for digital technologies and related knowledge from different external sources helps firms restructure their organizational form (Earle et al., 2006). The introduction of emerging technologies such as big data and blockchain has gradually flattened and decentralized the organizational structure (Wang et al., 2019) and made the management mode more flexible and efficient. Increased organizational flexibility further reduces transaction costs among enterprises. Moreover, with the deepening of digital technology search, acquiring technological knowledge from specific sources can deepen the trust and reciprocity between enterprises and external search channels, thus reducing the negotiation and transaction costs of enterprises. At the same time, digital technology search can enable firms to master more comprehensive market information and data. Forecasting the future development trends based on a large amount of data can make firms approach the market with more agility, thus reducing the cost of product/service listing failure (Candi & Beltagui, 2019).

Second, digital technology search can improve the input and output efficiency of enterprises by introducing new digital technologies and the overall operational efficiency of enterprises (Opresnik & Taisch, 2015). In terms of improving the input efficiency, enterprises introduce new technologies and provide rich information through digital technology search (Morandi Stagni et al., 2021), which is helpful to improve the input efficiency of production factors and establish cost-leadership competitive advantages. In the era of the digital economy, digital technology itself has high production efficiency, which can help enterprises achieve efficient operation. Moreover, technological updates and integration resulting from digital technology search play a key role in saving production resources and improving the efficiency of value creation. In terms of output efficiency improvement, enterprises introduce new ideas and new knowledge through digital technology search, which has a significant efficiency improvement effect on product R&D and production and helps to establish cost-leadership competitive advantages. The introduction of digital technologies can significantly shorten the cycle of product experimentation and analysis, enabling product developers to refine product designs faster than competitors and to control costs while adapting to new market trends (Candi & Beltagui, 2019). Meanwhile, new ventures can improve collaboration capabilities and business process agility by introducing technological knowledge that is more suitable for their own needs through technology search, thus improving their operational efficiency.

H2c: Digital technology search breadth positively affects cost-leadership competitive advantage.

H2d: Digital technology search depth positively affects cost-leadership competitive advantage.

THE MEDIATING ROLE OF COMPETITIVE ADVANTAGE

The relationship between competitive advantage and firm performance has received extensive attention. On the one hand, differentiated competitive advantage can improve firm performance by enhancing customer loyalty and bargaining power (Zou et al., 2003). Enterprises with differentiated competitive advantages pay attention to creating unique advantages in the industry and tend to provide customers with products/services that are different from those of competitors. Differentiated competitive advantage emphasizes that the innovative attributes, richness, and personalization of products/services are higher than those of other enterprises in the industry, creating a higher value experience for customers (Orsato, 2006). These help to improve customer satisfaction and loyalty, and then increase the market share of the enterprise and obtain excess profits. Moreover, differentiated competitive advantage plays an important role in improving the bargaining power of enterprises in the market. This is because differentiation advantage helps enterprises generate higher marginal revenue and enhance their bargaining power with suppliers. As customers become less sensitive to the price of products/services and pay more attention to high quality, new ventures' bargaining power

will also increase. Strong bargaining power for both suppliers and customers can enable enterprises to achieve better profits in the industry competition. In short, differentiated competitive advantages can generate higher sales and profits (Leonidou et al., 2015).

On the other hand, cost-leadership competitive advantage is mainly to attract customers with low-price products/services, improve profitability, and gain a broader market (Anwar et al., 2018). Enterprises with cost-leadership competitive advantages have lower-priced products or services than their competitors. In other words, cost-leadership competitive advantage means more competitive low prices. This can not only satisfy existing customers but also attract more new customers (Miles & Covin, 2000). The increase in customer volume can promote enterprises to achieve better sales. Moreover, enterprises can reduce the cost of business operation and production by introducing new technologies on the premise of ensuring the quality of products/services. This plays an important role in providing quality and affordable products or services for enterprises, which in turn helps enterprises to obtain better financial performance in the industry competition. In short, cost-leadership competitive advantages improve sales, profits, and other financial performance (Murray et al., 2011).

Based on the relationship between digital technology search and competitive advantage and the effect of competitive advantage on firm performance, this study proposes the mediating effect of competitive advantage. Enterprises can acquire heterogeneous technological knowledge and achieve breakthrough technological innovation by expanding the scope of digital technology search, which provides resource support for enterprises to establish differentiated and cost-leadership competitive advantages. These advantages are subsequently reflected in enterprises' market competitiveness and overall performance. Moreover, by deepening the depth of digital technology search, enterprises enhance knowledge relevance and reduce the uncertainty of innovation, which effectively promotes differentiated and cost-leadership competitive advantages. The establishment of these advantages helps to improve the sales and profits of enterprises. In general, the breadth and depth of digital technology search can enable enterprises to interact closely with a wide range of external channels, promote the flow of technological knowledge, the dissemination of technological information, and the introduction of new ideas, and provide important resource support for establishing differentiated and cost-leadership competitive advantages. In turn, by establishing competitive advantages, the market share and sales profit of enterprises will be further increased.

H3a: Differentiated competitive advantage mediates the relationship between digital technology search breadth and NVP.

H3b: Cost-leadership competitive advantage mediates the relationship between digital technology search breadth and NVP.

H3c: Differentiated competitive advantage mediates the relationship between digital technology search depth and NVP.

H3d: Cost-leadership competitive advantage mediates the relationship between digital technology search depth and NVP.

THE MODERATING ROLE OF ENVIRONMENTAL DYNAMISM

In the era of the digital economy, the main challenges faced by new ventures are rapidly changing technologies and unpredictable market trends. Technology search strategies in specific environments ultimately determine whether a new venture can achieve good firm performance. Therefore, to better understand the effect of technology search strategy on firm performance, it is necessary to consider the joint effects of different technology search and key environmental factors (i.e., environmental dynamism) (Cai et al., 2016). Environmental dynamism refers to the unpredictability or volatility caused by market and technological changes (Hung & Chou, 2013). Among them, market changes include the unpredictability of various factors such as raw material supply, customer preference, product demand, competitor strategy, partner behavior, and government policy (Wu et al., 2020).

Technological changes include the uncertainty caused by technological updates in industries. This unpredictability and turbulence influence the relationship between firm strategy and firm performance (Taghizadeh et al., 2020). In particular, these dynamic environments pose a greater challenge to the technology search strategy of enterprises in acquiring technological knowledge and information.

On the one hand, high environmental dynamism means that market demand is constantly changing. In this environment, only increasing the number of search channels cannot produce truly valuable innovation, which makes the new ventures unable to meet the volatile market demand (Voss et al., 2008). As enterprises find it increasingly difficult to predict the behavior of customers and competitors, identifying innovation opportunities for new product/service development is likely to be accidental (Denrell et al., 2003). The lack of innovation will directly lead to the reduction of market share and firm performance. On the other hand, due to the rapid technology update of the industry in the highly dynamic environment, it is very disadvantageous for new ventures to only pursue a wide range of technology search. This search strategy, which simply pursues the number of searches, makes it impossible for enterprises to substantially develop innovative products/services comparable to competitors, which will be unfavorable for enterprises to achieve better profits and performance (Cai et al., 2016).

Conversely, a deeper understanding of the tacit knowledge and experience embedded in external channels can enhance firms' ability to integrate their own knowledge base with newly acquired knowledge and help activate the innovation and development of enterprises. Moreover, based on the mutual trust relationship with external channels, it is possible to reduce the transaction costs related to acquiring external knowledge by reducing the opportunistic behavior of the other party (Kim et al., 2019; Wu, Su, et al., 2021), which has an important impact on enterprises to achieve higher profits. In other words, the increase in digital technology search depth can help improve the relevancy of knowledge acquisition and organizational learning and reduce the uncertainty of innovation, which plays an important role in buffering the impact of the turbulent external environment.

H4a: Environmental dynamism weakens the positive relationship between digital technology search breadth and NVP.

H4b: Environmental dynamism strengthens the positive relationship between digital technology search depth and NVP.

METHODOLOGY

Sample and Data Collection

The data for this study are from Chinese new ventures. The authors employed a professional market research company to help the authors collect data through a questionnaire. Based on the research objectives, the authors identified two criteria to screen out entrepreneurs who are eligible to participate in the current study. First, the entrepreneur's new venture cannot be established for more than eight years. This minimizes intra-firm differences that may explain competitive advantages and NVP. Because established enterprises have richer management resources, market strategies, and technological experience, all of these may become internal factors affecting their competitive advantages and NVP. Second, the entrepreneur must be a founder or senior executive to ensure they have a more comprehensive understanding of their firm's digital technology search status, competitive advantage, and performance.

The published English scale was used in this study. Since the actual data collection process needs to be conducted for the Chinese respondents, the authors used the back-translation to ensure the accuracy of the questionnaire and examined the equivalence between the original scale and the back-translation version. Before the formal investigation, the authors randomly selected 20 entrepreneurs to participate in the pre-test with the assistance of the market research company. These

data were excluded from the final sample. To improve the semantic clarity of the scale, the authors modified some ambiguous items according to their feedback. Furthermore, the authors invited three professors with decades of experience in entrepreneurial research to independently review this scale and determine the final scale.

With the assistance of the market research company, the authors conducted the questionnaire survey from January 2022 to March 2022. During this period, 1,800 questionnaires were issued to potential sample groups by random sampling, and 347 respondents were willing to fill in the questionnaire and met the two sample screening conditions, with a recovery rate of 19.28%. After eliminating 64 questionnaires with missing key data and 16 questionnaires with consistent options, a total of 267 valid questionnaires were finally received, with an effective rate of 14.83%. Table 1 presents the characteristics of the respondents and their new ventures.

Table 1. Characteristics of the respondents and new ventures

Variable	Level	Number	Proportion (%)
Gender	Male	159	59.55
	Female	108	40.45
Age	26-30	71	26.59
	31-35	113	42.32
	36-40	61	22.85
	More than 41	22	8.24
Education	High school diploma or below	2	0.75
	Junior college degree	7	2.62
	Bachelor degree	196	73.41
	Master's degree	55	20.60
	Doctoral degree or above	7	2.62
Firm age	2 years	33	12.36
	3 years	61	22.85
	4 years	37	13.86
	5 years	57	21.35
	6 years	39	14.61
	7 years	15	5.62
	8 years	25	9.35
Firm size	Less than 51	94	35.21
	51-100	63	23.59
	101-200	55	20.60
	More than 200	55	20.60

Table 1 continued on next page

Table 1 continued

Variable	Level	Number	Proportion (%)
Industry type	Manufacturing	116	43.45
	Service	151	56.55
Location	Beijing	31	11.61
	Shanghai	45	16.85
	Guangzhou	16	5.99
	Shenzhen	14	5.24
	Others	161	60.31
Total		267	100.00

MEASURES

Dependent Variable

New venture performance is measured by a six-item from Shan et al. (2016). These items provide a relatively comprehensive assessment of NVP from six aspects. Three items evaluate the level of return on investment, the achievement of expected goals, and the profitability of enterprises by self-comparison. The other three items evaluate the enterprise's sales growth rate, market share, and net profit by comparing them with competitors in the same industry and a similar environment.

INDEPENDENT VARIABLES

The measurement method of digital technology search breadth and depth comes from Cruz-González et al. (2015). The respondents were asked, "During the last three years (if less than three years, the time interval is from the establishment of the enterprise to the present), how important is each external source of digital technology information and knowledge to your firm's growth and development?" (1 = not used; 7 = key source).

This study used this set of data to measure the breadth and depth of digital technology search. The code is "0" when the respondent considers an external source to be not important to the innovation and development of the enterprise (scores are 1-2), and "1" otherwise (scores are 3-7). The sum of these dummy variables is the digital technology search breadth of the enterprise. When the respondent thinks that an external source is important to the innovation and development of the enterprise (scores are 6-7), it is coded as "1", otherwise it is coded as "0" (scores are 1-5). The sum of these dummy variables indicates the digital technology search depth of the enterprise.

MEDIATOR VARIABLES

According to Anwar et al. (2018), this study uses three items to measure differentiated competitive advantage and cost-leadership competitive advantage, respectively. This study comprehensively evaluates differentiated competitive advantage from the leading advantage and personalized advantage of launching products/services and marketing technology advantage. Cost-leadership competitive advantage is evaluated by commercial operation costs, operation efficiency, and production costs.

MODERATOR VARIABLE

The measurement of environmental dynamism consists of five items from Jansen et al. (2006). The scale measures environmental dynamism through the change degree of the overall external environment, market, customer demand, and product/service quantity demand.

CONTROL VARIABLES

This study includes three sets of control variables to control for variables that may have an impact on competitive advantage and NVP. The first set is the control variables at the individual level, including gender, age, education level, industry experience, and firm experience. Industry experience is assessed by asking the respondents if they had work experience in the same industry before they set up the current new venture (Semrau & Werner, 2014). The firm experience is assessed by asking the respondents how many firms they worked work for before setting up their current new venture (Crossland et al., 2014).

The second set is firm-level control variables, including firm age, firm size, R&D capital investment intensity, and R&D human capital investment intensity. Firm size is measured by the logarithm of the number of employees. The R&D capital investment intensity is evaluated by the ratio of R&D expenditure to total sales revenue (Mu et al., 2009). The R&D human capital investment intensity is measured by the ratio of R&D personnel to the number of employees (Duan et al., 2021).

The third set is the control variables at the level of industry and external environment, including industry type, industry competition intensity, city, and local economic growth trend. Industry types are divided into manufacturing and services (Taghizadeh et al., 2020). Industry competition intensity is evaluated by a six-level scale (1= no competition; 6= strong competition; Samuelsson & Davidsson, 2009). The city is divided into first-tier cities (1= Beijing, 2= Shanghai, 3= Guangzhou, 4= Shenzhen) and non-first-tier cities (5= other cities). The local economic growth trend is evaluated by a four-level scale (1= getting weaker; 4= getting stronger; Samuelsson & Davidsson, 2009).

RESULTS

Reliability and Validity

Table 2 presents the measurement indexes of reliability and validity of all constructs. First, the Cronbach's alpha coefficient of each construct was greater than 0.70, indicating that internal consistency is acceptable. Next, the authors evaluated the correspondence between each item and its measured construct through confirmatory factor analysis. The factor loadings of all items were between 0.669 and 0.787, which was within the acceptable range. Moreover, the fit between the model and the data was good: $\chi^2 = 161.099$, $df = 113$, $p = 0.002$, $CFI = 0.976$, $TLI = 0.971$, $IFI = 0.976$, $NFI = 0.925$, $SRMR = 0.053$, $RMSEA = 0.040$. Then, the authors calculated the average variance extracted (AVE) value by the factor loadings. The AVE value of each construct was greater than 0.50, and the square root of AVE was significantly higher than the correlation coefficients with other constructs (see Table 3). This indicates the scale has good discriminant validity (Fornell & Larcker, 1981). Finally, the authors calculated the composite reliability (CR) value through the factor loadings. The CR values of all constructs were in the range of 0.762-0.889, exceeding 0.70, indicating that the convergent validity of the scale is good. In conclusion, the reliability and validity of the scale are acceptable.

Table 2. Reliability and validity of the constructs

Variables	Items	Factor loadings	Cronbach's α	CR	AVE
Differentiated competitive advantage (DCA)	DCA1	0.691	0.762	0.762	0.516
	DCA 2	0.690			
	DCA 3	0.772			
Cost-leadership competitive advantage (CCA)	CCA1	0.711	0.779	0.781	0.543
	CCA 2	0.712			
	CCA 3	0.785			
Environmental dynamism (ED)	ED1	0.724	0.847	0.848	0.528
	ED2	0.787			
	ED3	0.745			
	ED4	0.702			
	ED5	0.669			
New venture performance (NVP)	NVP1	0.730	0.887	0.889	0.573
	NVP2	0.786			
	NVP3	0.672			
	NVP4	0.781			
	NVP5	0.782			
	NVP6	0.782			

Notes: AVE = average variance extracted; CR = composite reliability.

COMMON METHOD BIAS

Self-reported data from the same source may increase the risk of common method bias (CMB). To reduce the risk of CMB, this study took some preventive measures. First, the authors adjusted the order of the items to reduce the respondents' guesses about this study. Second, the authors reduced the ambiguity of the items through a pre-test and expert evaluation. Finally, the respondents were informed that the questionnaire was anonymous and confidential. In addition, Harman's single-factor test was used to evaluate the risk of CMB. The results showed that the first factor accounted for 36.23% (less than 50%) of the variance. This indicates that there is no single factor with strong explanatory power (Podsakoff et al., 2003). Therefore, CMB is not a serious issue.

HYPOTHESIS TESTING

Multicollinearity was evaluated using variance inflation factor before hypothesis testing. The results showed that the maximum value of variance inflation factor was 1.98, which is well below the recommended threshold of 10. This indicates that multicollinearity is not a concern. Table 3 presents the descriptive statistics for the variables.

Table 3. Descriptive statistics

	Mean	SD	1	2	3	4	5	6
1. Digital technology search breadth	15.348	1.125	n/a					
2. Digital technology search depth	7.487	3.610	0.350**	n/a				
3. Differentiated competitive advantage	5.583	0.853	0.300**	0.536**	0.718			
4. Cost-leadership competitive advantage	5.358	0.906	0.199**	0.473**	0.545**	0.737		
5. Environmental dynamism	5.348	0.676	0.014	0.307**	0.337**	0.079	0.727	
6. New venture growth	5.049	0.860	0.278**	0.559**	0.569**	0.560**	0.180**	0.757

Notes: n = 267. SD = standard deviations. The diagonal elements in bold are square roots of the AVE. The "n/a" refers to this item is not adaptive to analysis. * $p < 0.05$; ** $p < 0.01$.

The ordinary least squares regression analysis was used to test the hypotheses. Table 4 presents ordinary least squares regression analysis results. H1a and H1b predict that the breadth and depth of digital technology search positively affect NVP, respectively. In other words, the wider the sources of digital technology information and knowledge and the more important these sources are to the enterprise, the higher the enterprise performance will be. The results in Model 1 show that digital technology search breadth ($\beta = 0.090$, $p < 0.05$) and search depth ($\beta = 0.116$, $p < 0.001$) have positive and significant effects on NVP. Therefore, both H1a and H1b are supported.

Table 4. Ordinary least squares regression analysis results

Variables	New venture performance				DCA	CCA
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	2.029*	0.276	1.922*	2.061*	3.269***	3.844***
Gender	-0.104	-0.098	-0.105	-0.097	0.054	-0.077
Age	0.000	-0.003	0.000	0.000	0.001	0.012
Education	0.040	0.060	0.040	0.050	-0.081	-0.003
Industry experience	-0.135	-0.003	-0.135	-0.124	-0.340	-0.197
Firm experience	-0.042	-0.034	-0.042	-0.014	-0.024	-0.007
Firm age	0.029	0.027	0.029	0.023	0.013	-0.007
Firm size	0.085*	0.064+	0.086*	0.088*	0.022	0.065
R&D intensity	-0.081	0.034	-0.074	0.045	-0.175	-0.289
R&D human capital Intensity	-0.201	-0.244	-0.207	-0.294	-0.037	0.204
Industry type	0.061	0.045	0.061	0.086	-0.039	0.100
Industry competitiveness	-0.024	-0.002	-0.030	-0.043	0.023	-0.111
Location	-0.010	0.005	-0.010	-0.013	-0.022	-0.038
Local economic growth trends	0.152*	0.074	0.151*	0.151*	0.136+	0.179*
Digital technology search breadth	0.090*	0.060	0.092*	0.089*	0.106*	0.020
Digital technology search depth	0.116***	0.063***	0.114***	0.116***	0.105***	0.108***

Table 4 continued on next page

Table 1 continued

Variables	New venture performance				DCA	CCA
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
DCA		0.239***				
CCA		0.253***				
Environmental dynamism			0.023	-0.010		
Digital technology search breadth × Environmental dynamism				-0.161**		
Digital technology search depth × Environmental dynamism				0.043*		
R ²	0.383	0.505	0.383	0.409	0.339	0.268
Adjusted R ²	0.346	0.472	0.344	0.366	0.300	0.224

Notes: n = 267. DCA = Differentiated competitive advantage; CCA = Cost-leadership competitive advantage. * $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

H2a and H2b hypothesize that the breadth and depth of digital technology search positively affect differentiated competitive advantage, respectively. The results in Model 5 support these hypotheses. Digital technology search breadth ($\beta = 0.106, p < 0.05$) and search depth ($\beta = 0.105, p < 0.001$) have a positive impact on differentiated competitive advantage. Therefore, both H2a and H2b are verified.

H2c and H2d predict cost-leadership competitive advantage is positively affected by the breadth and depth of digital technology search, respectively. The results of Model 6 show that digital technology search breadth has no significant effect on cost-leadership competitive advantage ($\beta = 0.020, p = 0.687$), but digital technology search depth positively affects cost-leadership competitive advantage ($\beta = 0.108, p < 0.001$). Therefore, H2c is rejected, and H2d is verified. Digital technology search breadth is beneficial for enterprises to establish differentiated competitive advantages, but the knowledge integration cost, financial cost, cognitive cost, and major management challenges caused by search breadth are ignored (Lorenz et al., 2020). In other words, with the expansion of the digital technology search scope, the operation cost and management cost of enterprises also become higher (Cruz-González et al., 2015). Thus, search breadth does not promote cost-leadership competitive advantage.

MEDIATING EFFECT TEST

The authors added competitive advantages in Model 2 to preliminarily test the mediating effect. The results show that differentiated competitive advantage ($\beta = 0.239, p < 0.001$) and cost-leadership competitive advantage ($\beta = 0.253, p < 0.001$) positively affect NVP. Compared to the results in Model 1, the effects of the breadth and depth of digital technology search on NVP are mitigated in Model 2. This study used the PROCESS macro in SPSS 25.0 software to formally test the mediating effect of the two types of competitive advantages. According to Hayes (2017), 5,000 bootstraps were used to derive 95% confidence intervals (CIs) for bias correction.

H3a and H3b hypothesize that differentiated and cost-leadership competitive advantage mediate the relationship between digital technology search breadth and NVP, respectively. The results show that differentiated competitive advantage mediates the relationship between digital technology search breadth and NVP (indirect effect = 0.026, 95% CIs = 0.003 to 0.063), but cost-leadership competitive advantage has no mediating effect on the relationship between digital technology search breadth and

NVP (indirect effect = 0.005, 95% CIs = -0.022 to 0.037). Therefore, H3a is supported, and H3b is rejected.

H3c and H3d predict that digital technology search depth affects NVP through differentiated and cost-leadership competitive advantage, respectively. The results show that the relationship between digital technology search depth and NVP is mediated by differentiated competitive advantage (indirect effect = 0.025, 95% CIs = 0.011 to 0.043) and cost-leadership competitive advantage (indirect effect = 0.027, 95% CIs = 0.015 to 0.043). Therefore, both H3c and H3d are supported.

MODERATING EFFECT TEST

This study examined the moderating effect of environmental dynamism by hierarchical regression analysis. The authors created the interaction term after decentralizing the independent and moderating variables (Cohen et al., 2003). H4a and H4b predict that the effects of digital technology search breadth and depth on NVP are moderated by environmental dynamism. Based on Model 3, the authors added interaction terms of digital technology search and environmental dynamism in Model 4. The results show that environmental dynamism weakens the positive relationship between digital technology search breadth and NVP ($\beta = -0.161, p < 0.01$) but strengthens the positive impact of digital technology search depth on NVP ($\beta = 0.043, p < 0.05$). Furthermore, this study plotted the interaction diagram of the moderating effects according to Aiken et al. (1991). As shown in Figure 2, with the increase in environmental dynamism, the positive relationship between digital technology search breadth and NVP gradually weakens. As shown in Figure 3, when the environmental dynamism is high, the effect of digital technology search depth on NVP is more positive. Therefore, both H4a and H4b are verified.

Figure 2. Interaction plot of digital technology search breadth and environmental dynamism on new venture performance

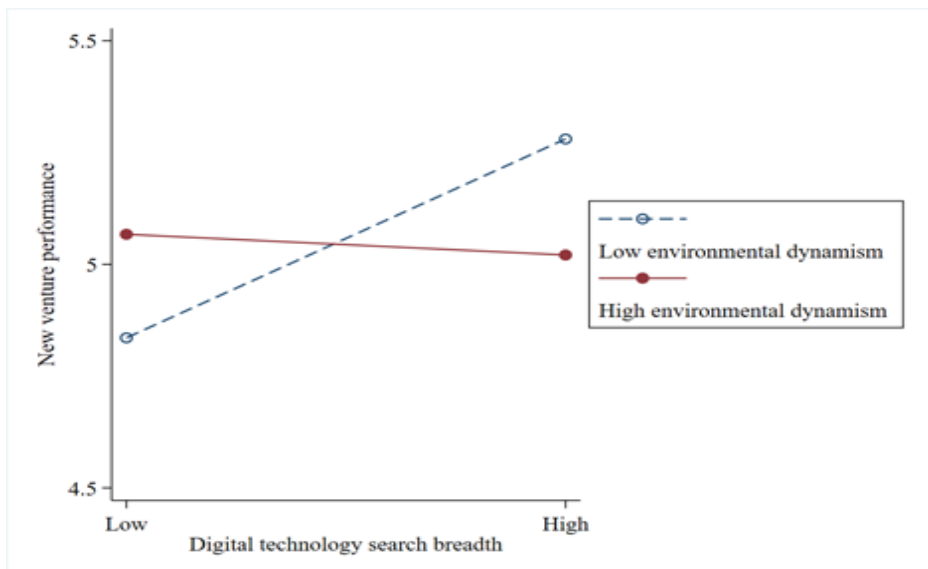
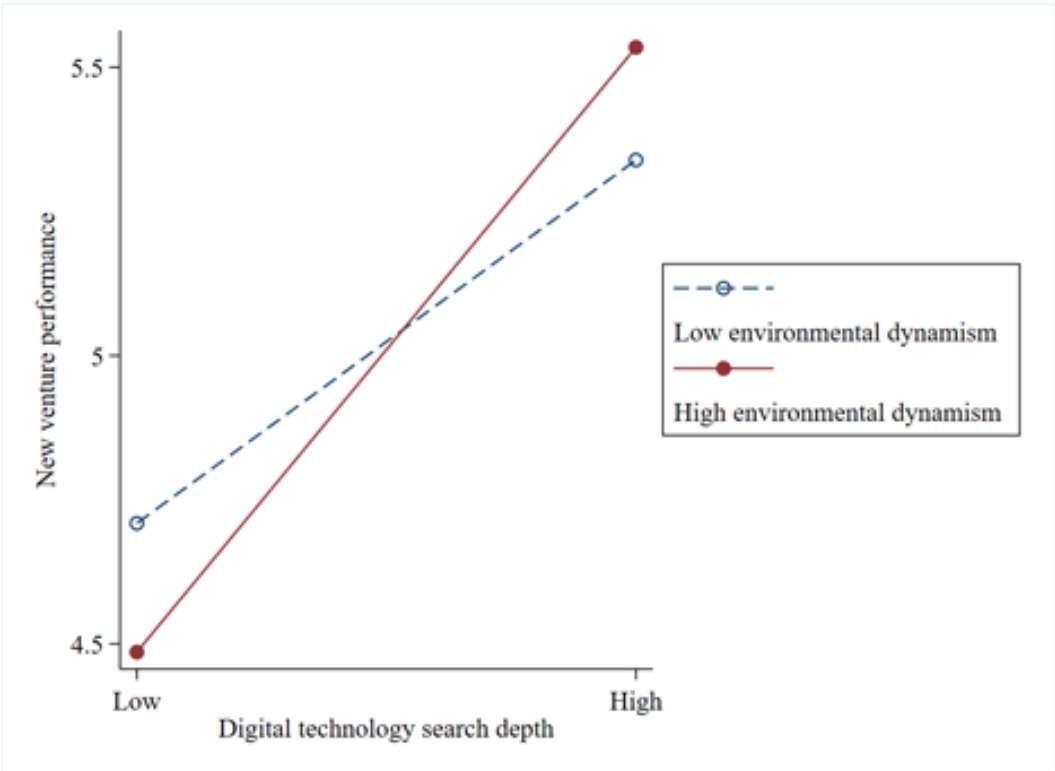


Figure 3. Interaction plot of digital technology search depth and environmental dynamism on new venture performance



DISCUSSION

Theoretical Implications

This study contributed to the literature on technology search and competitive advantage. First, based on the resource-based view, this study explores the relationship between the breadth and depth of digital technology search and NVP, indicating the important value of digital technology search to new ventures in the context of the digital economy. Previous studies have mainly focused on the effect of technology search on firm innovation (e.g., Li-Ying et al., 2014; Zhang et al., 2019), which helps to understand the benefits of technology search on a single aspect of enterprises. However, few empirical studies have analyzed the relationship between technology search strategies and overall performance at the firm level. Especially in the context of the digital economy, the empirical test of these relationships is particularly urgent (Cruz-González et al., 2015). Therefore, taking the digital technology search practice of new ventures as the research context, this study empirically examines the effect of the breadth and depth of digital technology search on NVP, which contributes to a better understanding of the important role of technology search in the overall development of enterprises.

Second, this study analyzes the impact mechanism of the breadth and depth of digital technology search on NVP from the perspective of competitive advantage, which enhances the understanding of the role of competitive advantage in the relationship between technology search and performance. Theoretically, the direct effect of technology search on shaping performance deepens enterprises' understanding and attention to technology search strategy (Ardito et al., in press; Duan et al., 2021). However, existing research ignores the specific process of technology search affecting firm performance. This leads to our cognition of technology search strategy being flawed. Technology

search has gradually become an important way for enterprises to obtain and maintain competitive advantages (Foss et al., 2011), and the establishment of competitive advantages is crucial for promoting enterprise performance. Therefore, this study explores the mediating role of competitive advantage in technology search and NVP. The findings provide new insights into the drivers of competitive advantage establishment and contribute to opening the black box between technology search and NVP from the perspective of competitive advantage.

Third, the moderating effect of environmental dynamism on digital technology search and firm performance is discussed, which provides new insights into the selection of technology search strategies in dynamic environments. New ventures in emerging economies often face complex and changeable environments. Especially under the dual influence of market turbulence and technological change, new ventures need to always deal with innovation risks and survival threats. Although previous studies have analyzed the impact of different external search strategies on firm performance under the dynamic technology environment from the perspective of cost and benefit (Cruz-González et al., 2015), it is still very limited to guide the digital technology search strategy under the whole dynamic environment. Because existing research focuses on established enterprises but ignores new ventures with the “liability of newness,” based on the context of the digital economy faced by new ventures, this study provides empirical evidence of the impact of digital technology search on NVP in dynamic environments. This study contributes to an increased understanding of how to select the appropriate technology search strategy in dynamic environments.

MANAGERIAL IMPLICATIONS

The findings guide entrepreneurs to deploy digital technology search strategies and carry out digital technology search activities. First, entrepreneurs need to expand the scope of digital technology search and strengthen the depth of technology search, thus promoting firm performance by establishing competitive advantages. In the era of the digital economy, digital technology has a profound impact on the operation mode of various ventures and the overall business environment. Therefore, new ventures must actively obtain relevant technological knowledge and information through external technology search and thus establish competitive advantages driven by digital technology. On the one hand, new ventures need to obtain heterogeneous technological knowledge and achieve breakthrough technological innovation by expanding the search scope. New ventures should dare to cross organizational and technological boundaries and widely absorb digital technology knowledge and information from external sources (Choi et al., 2018). By grasping the development trend of technology and the market, new ventures can establish the leading and personalized advantages of developing new products/services, and thus improve firm performance. On the other hand, new ventures should strengthen the search depth of specific external sources to improve knowledge relevance and reduce the uncertainty of innovation. New ventures should maintain close relationships with some specific external channels and constantly strengthen the understanding and utilization of the technological knowledge of existing search channels (Ferrerías-Méndez et al., 2015). By absorbing the nutrients of this knowledge and information, new ventures can create technological knowledge that is not easy to imitate and create technological barriers to establishing differentiated competitive advantages. At the same time, in-depth technology search activities can reduce business operating costs and improve operational efficiency. The establishment of these competitive advantages is an important prerequisite for new ventures to achieve excellent performance (Ong et al., 2018).

Second, new ventures need to adopt appropriate technology search strategies according to the dynamic level of the environment. Appropriately leaning towards digital technology search depth may be more conducive to enterprises coping with the dynamic environment. Although both the depth and breadth of technology search have positive effects on NVP, it cannot always guarantee that NVP can be improved (Ferrerías-Méndez et al., 2015). This is because, with the change in the external environment, the relationship between technology search strategies and NVP will be significantly

affected. When the external environment is uncertain and turbulent, new ventures' technological knowledge and information in the competitive environment will soon become outdated and even hinder their innovation and development (Jansen et al., 2006). At this time, to respond to the changing environment and maintain stable profitability, new ventures need to deploy and adjust their technology search strategies promptly according to the characteristics of technological changes in their market and industry (Morandi Stagni et al., 2021). As the result of this study, environmental dynamism weakens the positive relationship between digital technology search breadth and NVP and strengthens the positive impact of digital technology search depth on NVP. In other words, when the dynamic level of the environment is high, the digital technology search breadth becomes ineffective in dealing with environment dynamism and leads to performance decline. Therefore, enterprises should appropriately narrow the search scope of digital technology and strengthen the search depth of digital technology. Meanwhile, enterprises should carry out more in-depth digital technology search activities through specific external channels to reduce the uncertainty of innovation and develop new products/services with real market competitiveness. In short, in turbulent situations, preferring technology search depth may help new ventures to maintain high performance.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Inevitably, there are several limitations to this study. First, this study analyzes the number and dependence of digital technology search channels for new ventures but ignores the organizational patterns between new ventures and external sources. The organization patterns include license agreements, cooperation alliances, and so on. Different organizational patterns or structures have an important impact on the quality of knowledge and information acquired by new ventures (Wu, Ma, et al., 2021). Therefore, future research should consider not only the search breadth and depth but also the impact of different organizational patterns when analyzing technological search strategies.

Second, cross-sectional data were used to test the hypothesis, which may lead to certain endogeneity problems. Although this study has taken some preventive measures in the questionnaire design and data collection process, there are still concerns about endogenous problems. Therefore, future research can use longitudinal research design to deeply analyze the dynamic relationship between technology search, competitive advantage, and firm performance.

Third, since this study only studied Chinese new ventures, caution should be exercised when the results are generalized to new ventures in other countries. There are significant differences in the entrepreneurial culture and the internal management mechanism of new ventures in different countries. Therefore, future research can analyze the impact of technology search strategy on competitive advantage and firm performance by comparing new ventures in different countries. This helps to provide more robust and reliable results.

CONFLICT OF INTEREST

The authors of this publication declare there is no conflict of interest.

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