# Business Model Innovation in Platform Enterprises under the Synergy of Cross-boundary Search and Big Data Capabilities: Postprint

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## Abstract

[Purpose/Significance] Against the backdrop of open innovation, platform enterprises are confronted with increasingly intense market competition and severe platform homogenization. The insufficient innovation resources and capabilities within these enterprises cannot effectively support business model innovation. The synergistic interplay between boundary-spanning search and big data capabilities can provide robust support for platform enterprise business model innovation.

[Method/Process] This study systematically reviews relevant literature on boundary-spanning search, big data capabilities, and business model innovation. Based on the constituent elements of platform enterprise business models, it constructs a synergistic effect model of boundary-spanning search and big data capabilities.

[Results/Conclusion] Boundary-spanning search facilitates the flow of innovative knowledge and the acquisition of innovation resources, while big data capabilities enable resource integration and in-depth analysis. Their synergistic effect can promote the discovery of new market knowledge, thereby benefiting platform enterprise business model innovation.

## Full Text

### Business Model Innovation in Platform Enterprises Under the Synergistic Effect of Boundary-Spanning Search and Big Data Capability

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**Abstract**

[**Purpose/Significance**] In the context of open innovation, platform enterprises face increasingly fierce market competition, severe platform homogenization, and insufficient internal innovation resources and capabilities that cannot effectively support business model innovation. The synergistic effect of boundary-spanning search and big data capability can provide strong support for platform enterprise business model innovation. [**Method/Process**] This study reviews literature on boundary-spanning search, big data capability, and business model innovation, and constructs a synergistic model of boundary-spanning search and big data capability based on the constituent elements of platform enterprise business models. [**Result/Conclusion**] Boundary-spanning search facilitates the flow of innovative knowledge and the acquisition of innovative resources, while big data capability enables resource integration and in-depth analysis. The synergistic effect of these two elements can promote the discovery of new market knowledge and facilitate business model innovation in platform enterprises.

**Keywords:** platform enterprise; business model innovation; boundary-spanning search; big data capability; value network

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In recent years, the emerging platform enterprise business model represents a great commercial transformation of the new era, creating enormous economic and social value. Platform enterprises such as Alibaba, Meituan, and Didi Chuxing have become paradigms of emerging business model innovation in the internet economy era. As external competition and business environments become increasingly complex, platform homogenization has become severe, user traffic is gradually drying up, and growth has become difficult. Competition among platform enterprises has escalated to competition between business models, drawing widespread attention from both industry and academia to the issue of platform enterprise business model innovation. Numerous scholars have studied platform enterprise business model innovation, but most have focused on business model components, innovation pathways, and influencing factors. Under the resource-based view, enterprise business model innovation is influenced by resource endowments [1]. Boundary-spanning search represents an important way for enterprises to acquire external innovation resources [2], enabling them to accumulate innovative resources and enhance innovation capabilities. Zhang Rongkai [2] empirically verified that boundary-spanning search has a significant positive impact on enterprise business model innovation; Chen Yiran [3] found that the higher the environmental turbulence, the more market knowledge boundary-spanning search facilitates business model innovation; Lü Hongjiang [4] argued that business model innovation involves a complex and interdependent set of operational activities and new business development within enterprises to achieve profitability. The key research questions addressed in this study are: (1) What is the content of platform enterprise boundary-spanning

search? (2) What is the connotation of big data capability? (3) What is the relationship between boundary-spanning search and big data capability? (4) How can this relationship be leveraged for business model innovation?

Big data capability has become a core competency for business model innovation. Jing Hao [6] effectively combined big data with business models, exploring the impact of big data on competitive advantages from economic, operational, and strategic perspectives; Li Wenlian [7] proposed six basic business model types in the context of big data at the industrial chain level. Existing research has begun to examine business model innovation from the perspectives of boundary-spanning search for external innovation resources and utilization of big data capability, but few scholars have connected boundary-spanning search with big data capability for business model innovation based on the characteristics of platform enterprises. This study aims to construct a model of platform enterprise business model innovation under the synergistic effect of boundary-spanning search and big data capability. By mining tacit customer needs to promote value proposition innovation, and continuously integrating resources under the synergistic effect of boundary-spanning search and big data capability to support operations, platform enterprises can achieve business model innovation.

## 2. Related Concepts and Theories

### 2.1 Platform Enterprise Business Model Innovation

In the big data era, data resources have become the most important strategic resources for enterprises [5]. The platform enterprise business model is based on internet technology, integrating information from enterprises, customers, partners, competitors, and other stakeholders through innovative production methods to build an interactive communication network platform that connects bilateral or multilateral markets, achieves multi-party resource integration, meets group needs, and generates profits [8]. Simply put, a business model explains how an enterprise makes money. Most scholars currently study business models from a component perspective. M. Johnson et al. [9] argued that business models consist of four elements: customer value proposition, profit formula, core resources, and key processes—a view widely accepted by scholars. Based on this perspective and starting from business model components, this study posits that customer value proposition is the source of business model innovation. In the existing market environment, enterprises must satisfy continuously upgrading and changing customer needs through product and service design, requiring the integration of partner resources, partner screening, and consideration of external competitor information to design differentiated products and services. Platforms must allocate and adjust partner resources rationally according to customer needs, determine key businesses and processes, complete platform operations, and ultimately achieve profitability.

### 2.2 Boundary-Spanning Search

The concept of "boundary-spanning" first emerged in organizational behavior and organizational theory as activities enterprises conduct across organizational boundaries. K. G. Ahuja [10] viewed boundary-spanning search as an inevitable path for enterprises to seek heterogeneous resources to compensate for deficiencies in local knowledge search; K. Atuahene-Gima et al. [11] believed enterprises could acquire new knowledge, new skills, or create new business processes through boundary-spanning activities; L. Rosenkopf and A. Nerkar [12], as well as Wei Jiang et al. [13], considered boundary-spanning search as essentially the exploration of new knowledge, externally manifested as crossing different knowledge bases and organizational boundaries; Zhou Fei et al. [14] regarded boundary-spanning search as a link connecting external knowledge sources with internal innovation processes, serving as a bridge for new knowledge identification, absorption, and utilization; Zhu Yixia et al. [15] defined boundary-spanning search as knowledge development, acquisition, and integration activities that organizations conduct across their own boundaries and knowledge bases. Scholars have defined boundary-spanning search from different perspectives and levels, with a relatively unified view that it represents activities enterprises conduct across organizational, cognitive, and knowledge boundaries to search for heterogeneous resources in the context of open innovation.

Regarding the dimensional division of boundary-spanning search, J. B. Sorenson et al. [16] divided it into local search and remote search based on organizational boundaries; K. Laursen et al. [17] further used search depth and breadth to represent the characteristics of boundary-spanning search behavior; J. S. Sidhu et al. [18] divided boundary-spanning search dimensions from three aspects—supplier, demander, and market—based on knowledge boundaries. Drawing on these scholars' perspectives and focusing on market knowledge boundary-spanning search, this study primarily involves knowledge about suppliers, customers, and competitors.

### 2.3 Big Data Capability

The high integration of human, machine, and physical worlds has triggered an explosive growth in data scale and increasing complexity in data patterns, ushering the world into the big data era [19-20]. Regarding the definition of big data, scholars primarily approach it from resource and data application perspectives. From the resource perspective, big data is characterized by huge volume, diverse types, and rapid updates. Bai Jungui and Wang Dan [21] argued that the integration of information resources under big data resources helps enhance information value; Ye Yingping [22] believed that in the big data era, the use of big data technology and management tools can complete the transformation process from data to knowledge and accelerate knowledge production. Although the resource perspective of big data has gained academic recognition, the value of data itself is limited. Only by elevating big data to the capability level and fully 挖掘 its commercial value can it become meaningful for people's production

and life. S. LaValle et al. [5] mentioned in their research capabilities for data screening, integration, analysis, and application, particularly emphasizing that in-depth business analysis capabilities can help enterprises gain differentiated competitive advantages. Du Xingye et al. [23] proposed that in data-intensive research environments, the improvement of team data capabilities can promote knowledge innovation. Cheng Gang et al. [24] defined big data capability as the big data awareness, collection, storage, analysis, transmission, and utilization capabilities that enterprises cultivate in the process of developing, managing, and utilizing big data. Xie Weihong et al. [25] proposed that big data capability is a dynamic capability for enterprises to adapt to external environmental changes, enabling them to acquire and integrate internal and external big data resources for in-depth analysis to process and extract potential commercial value. Drawing on these research conclusions, this study defines big data capability as comprising big data resource integration capability, big data analysis and mining capability, and big data application capability.

## 3. Platform Enterprise Boundary-Spanning Search and Big Data Capability

Knowledge-based theory posits that to achieve sustainable competitive advantage, enterprises must utilize various resources to create new knowledge. Market knowledge is the ultimate source of enterprise profits and represents cumulative knowledge for creating and integrating market competition strategies [26]. Platform enterprises' boundary-spanning search for market knowledge can enhance their knowledge stock and flow. Platform enterprises are inherently endowed with massive data resources, providing an application environment for the formation of big data capability. Through the integration, analysis, and utilization of data resources, enterprises can optimize platform business processes and identify new market opportunities.

### 3.1 Platform Enterprise Boundary-Spanning Search

Platform enterprises themselves do not produce products but serve as intermediary platforms connecting multiple user groups and act as value integrators. In the context of internet-based open innovation, boundary-spanning search has become the primary method for platform enterprises to acquire heterogeneous knowledge, representing a market-driven search behavior that crosses organizational boundaries. Xiao Dingding and Zhu Guilong [27] argued that market-driven boundary-spanning search has a positive impact on enterprises' exploration and exploitation capabilities. Platform enterprise boundary-spanning search primarily involves searching for market information such as customer needs and product/service improvements, systematically processing dispersed market information, expanding potential partnership relationships during the search process, improving or updating existing value networks, and thereby achieving business model innovation.

Drawing on scholar J. S. Sidhu et al. [18], this study focuses on market knowledge search regarding customers, partners (suppliers), and competitors. The search process mainly includes knowledge identification, knowledge evaluation, and knowledge screening.

**(1) Customer Knowledge Boundary-Spanning Search.** Customer knowledge is a dynamic combination of experience, values, contextual information, and expert insights generated through communication and interaction between enterprises and customers, providing the basis for evaluating and absorbing new experiences and information [28]. In the process of participating in market activities on the platform, customers generate large amounts of descriptive information, such as purchasing habits, consumption frequency, and consumption amounts, which reflect customer preferences and expectations for products and services. In the internet environment, people have various spaces to express opinions and evaluations, allowing them to speak freely in different thematic spaces, providing platform enterprises with an alternative perspective to grasp user experience, service quality, and corporate reputation. This knowledge offers opportunities for platform enterprises to examine market needs and evaluate their own gaps, helping identify operational problems and discover unique customer value elements in new fields. Therefore, platform enterprises must treat customer knowledge as a resource in business model innovation, conduct boundary-spanning search for customer knowledge, mine tacit customer needs and preferences, and adopt dominant behavioral approaches to achieve lasting competitive advantage.

**(2) Partner Knowledge Boundary-Spanning Search.** Partner knowledge refers to information that platform enterprises search for to match suppliers, logistics providers, platform developers, financial institutions, and other partners to satisfy increasingly diverse and personalized customer needs. It mainly includes partners' core capabilities, related products, service levels, geographical locations, etc. With the development of internet technology and global economic integration, the number of partners available to platform enterprises has exploded, making partner selection and effective evaluation critical issues. Boundary-spanning search for partner knowledge helps enterprises construct partner evaluation indicator systems, select appropriate partners, establish stable cooperative relationships, control cooperation risks, and adjust benefit distribution.

**(3) Competitor Knowledge Boundary-Spanning Search.** Competitor knowledge is another key element of market knowledge, primarily including competitors' human knowledge, financial knowledge, production knowledge, product and technology knowledge, culture and brand knowledge, patent knowledge, and other aspects. K. Brockhoff [29] pointed out that the more information enterprises obtain about competitors, the more effective their competitive strategies will be. Boundary-spanning search for competitor knowledge helps platform enterprises understand dynamic information about other platforms, adjust business strategies and competitive strategies in a timely manner. Particularly dur-

ing the startup phase, paying attention to dynamic information about industry leaders helps enterprises establish benchmarks and achieve rapid growth. Additionally, in the internet environment, competition and cooperation can transform into each other. A comprehensive understanding of competitor knowledge and identification of common interests facilitates the implementation of co-opetition strategies.

### 3.2 Platform Enterprise Big Data Capability

Platform enterprises are inherently endowed with massive data genes. Although data itself cannot bring competitive advantage, the big data capability formed on this basis can discover tacit customer needs, analyze and screen partners, and analyze and predict competitors. Simultaneously, multi-channel collection and analysis of platform data enables real-time perception, prediction and early warning, situation analysis, and control decision-making regarding customer consumption behavior and platform public opinion. Based on the resource-based view and dynamic capability theory, this study argues that the internal hierarchy of platform enterprise big data capability mainly includes big data resource integration capability, big data analysis and mining capability, and big data application capability, completing the transformation process from data to information to knowledge to wisdom. The internal hierarchical structure of big data capability is shown in [Figure 1: see original paper].

**(1) Big Data Integration Capability.** Big data integration capability refers to the ability to continuously acquire internal and external data resources from the platform and process and store them. Internal data resources mainly include customer data and partner data, which appear in different business processes and may be in the form of standard structured data or unstructured data (such as multimedia). External data resources refer to data outside the platform, such as competitor data, potential partner data, and network evaluation data. Acquired internal and external data are processed—for example, converting web page data and multimedia data into standard structured data, denoising and cleaning them, filtering out garbage and invalid data, and storing them using data warehouses and cloud platforms. This stage completes the transformation from data to information.

**(2) Big Data Analysis Capability.** Big data analysis capability is the ability of platform enterprises to use big data algorithms to analyze integrated data information and convert valuable hidden information into knowledge. Techniques such as multidimensional analysis, data mining, machine learning, and pattern recognition can be utilized, with big data algorithms at the core. In the big data environment, data analysis and capture become easier, broadening the breadth of boundary-spanning search. The improvement of big data analysis capability can mine deeper knowledge, promote the depth and novelty of boundary-spanning search, and provide market opportunities for business model innovation. By analyzing customer information, enterprises can search for customers' true intentions and extract customer value propositions; by ana-

lyzing partner information, they can construct partner evaluation models; and by mining and analyzing competitor information, they can identify main competitors and potential rivals both within and outside the industry and analyze competitors' objectives.

**(3) Big Data Application Capability.** Big data application capability refers to the ability to effectively predict markets based on data analysis results, achieve intelligent operations, enhance market competitiveness and adaptability, and transform platform knowledge into wisdom. Platform enterprises can use big data to understand consumer needs, conduct customer segmentation and positioning, and implement precision marketing using customer portraits. They can also predict potential partners based on partner evaluation models and use big data for real-time early warning of platform public opinion information and emergency management.

### 3.3 The Relationship Between Platform Enterprise Boundary-Spanning Search and Big Data Capability

Platform enterprises are oriented toward boundary-spanning search for market knowledge, and the demand for market knowledge search drives the formation of big data capability. Using big data capability to integrate, analyze, and apply internal and external platform data can expand the width, depth, and novelty of boundary-spanning search. The mutual promotion between the two facilitates the discovery of new market knowledge for platform enterprises.

**(1) Boundary-Spanning Search Drives Big Data Capability Formation.** To increase opportunities for acquiring innovative resources, platform enterprises need to establish extensive search channels to add complementary resources for the enterprise. To expand the breadth of boundary-spanning search, platform enterprises need to conduct multi-channel data resource collection, cleaning, structural processing, and data storage, thereby driving the formation of big data integration capability. To cultivate long-term customer relationships and gradually establish cooperation routines with partners, platform enterprises need to strengthen their familiarity and rapport with external knowledge sources, increase the depth of boundary-spanning search, and use big data algorithms to model integrated data information through association analysis, cluster analysis, predictive analysis, etc., to mine tacit knowledge, thereby driving the formation of big data analysis capability. To enhance their competitive advantage and provide products and services different from competitors, platform enterprises need to search for more novel and unique market knowledge to provide personalized and visualized services for customers, thereby driving the formation of big data application capability.

**(2) Big Data Capability Promotes Boundary-Spanning Search.** As a resource capability of platform enterprises, big data capability influences boundary-spanning search. Internet platforms generate massive amounts of data every moment. Using big data capability to collect, analyze, and reor-

ganize these data and mine the hidden value behind them enables enterprises to grasp comprehensive market information and increase corporate profits and consumer surplus. With big data capability, platform enterprises can conduct full-sample data analysis, improving the precision of knowledge search. Big data capability makes data collection and capture easier, broadening the breadth of boundary-spanning search. The improvement of big data analysis capability can mine deeper knowledge, promoting the depth and novelty of boundary-spanning search and providing market opportunities for business model innovation. As platform enterprises' big data capabilities mature, the precision of searching for new market knowledge gradually improves, helping platform enterprises better understand customer needs, gain insights into new market opportunities, and promote business model innovation. Driven by factors such as new business models, new customer needs, and fierce market competition, platform enterprises' demand for knowledge increases, which also promotes the development of big data capability in deep analysis and visual exploration, improving platform enterprises' ability to identify, evaluate, and screen new market knowledge. Therefore, the relationship between the two presents a spiral upward structure, as shown in [Figure 2: see original paper].

## 4. Model Construction of the Synergistic Effect of Boundary-Spanning Search and Big Data Capability on Platform Enterprise Business Model Innovation

Under the synergistic effect of boundary-spanning search and big data capability, platform enterprises use customer value proposition innovation as the source of business model innovation to drive platform resource integration, thereby supporting various operational activities and achieving profitability. In turn, profitability promotes a new round of customer value proposition exploration. The synergistic effect model of boundary-spanning search and big data capability is shown in [Figure 3: see original paper].

### 4.1 Synergistic Effect on Customer Value Proposition

Customer value proposition represents the value enterprises provide to attract and retain customers by satisfying their needs. The source of customer value proposition is customer knowledge. To explore unique customer value elements, platform enterprises can use big data capability to integrate internal platform customer data (such as purchase records, browsing records, collection records, page click duration, etc.) and external customer data (such as external media data, community user evaluation data, etc.), analyze them to extract customer characteristics, mine tacit customer knowledge, and complete the transformation from customer data to customer information to customer knowledge. The process of boundary-spanning search also involves identifying, evaluating, and screening customer knowledge, with valuable customer knowledge being stored in knowledge warehouses. Platform enterprises use this knowledge to complete customer value proposition innovation. After new customer value propositions

are launched into the market for validation, results are fed back to the knowledge warehouse, and value propositions that fail to meet market expectations may be eliminated, requiring knowledge warehouse updates. The specific implementation process is shown in [Figure 4: see original paper].

Taking the internet finance platform "Ant Financial" as an example, this platform provides financial services for small and micro enterprises and individual consumers, originally starting with Alipay. As the successor to Alibaba's financial business, Ant Financial holds user registration data, online consumption data, and financial management data for 300 million people on Alibaba's e-commerce platform, as well as transaction data for over 37 million small and micro enterprises. Additionally, it acquires external data through investment and acquisition of other companies, such as Meituan, Kuaidi, Gaode Map, Sina Weibo, Momo, Xiami Music, and Qiongyou, covering local life, social networks, entertainment consumption, and many other aspects. By extensively collecting internal and external platform data and expanding data dimensions, the foundation for big data analysis is laid. Based on big data capability, multidimensional analysis of user data mines potential user needs, designs new products, and expands from the initial single third-party payment product to the comprehensive internet finance field, designing online consumer credit products such as Ant Huabei, Ant Jiebei, the financial information service platform "Vitamin," and Ant Financial Cloud. The continuous introduction of financial products realizes the extraction and sublimation of customer value proposition through the transformation from customer data to customer information to customer knowledge to customer value proposition, accumulating valuable customer knowledge resources for the enterprise.

### 4.2 Synergistic Effect on Resource Integration

Unlike traditional enterprises, platform enterprises themselves do not produce products, and the realization of customer value propositions depends on external resources. The synergistic effect of boundary-spanning search and big data capability can promote external resource integration, mainly including the following resources:

**(1) Complementary Resources.** Partner resources are complementary resources for platform enterprises, not only improving internal resources and capabilities but also facilitating knowledge cycles. Under the synergistic effect of boundary-spanning search and big data capability, integrating and analyzing platform partner data helps construct partnership evaluation models, completing the transformation from partner data to partner knowledge. Using partnership evaluation models, enterprises can further screen partners or adjust the strength of relationships with partners, select optimal cooperation methods, and predict potential partners.

**(2) Competitive Resources.** Although competitor resources are competitive resources for platform enterprises, in the internet era, competition and cooper-

ation are no longer contradictory opposites but have merged with each other, seeking cooperation in competition to expand external resources. Therefore, under the synergistic effect of boundary-spanning search and big data capability, acquiring competitor knowledge can not only help platform enterprises formulate effective strategies to avoid or attack competitors and predict potential industry competitors but, more importantly, can accumulate knowledge resources for platform enterprises to implement co-opetition strategies with competitors in the future.

For example, the Ant Financial platform has designed multiple financial products to meet different user needs, requiring the search for suitable partners. By 2018, Ant Financial had cooperated with more than 200 banks, over 60 insurance companies, and more than 90 fund companies. Using big data capability, the platform gathers enterprises, institutions, and partners with common demands, constructs partnership models, innovates partner mechanisms, and accumulates partner knowledge resources. In September 2018, Alipay cooperated with UnionPay, ending their long-standing evenly-matched competitive relationship, with Alipay handing over the transaction clearing business of barcode payments to UnionPay—a cooperation that would help both parties consolidate their advantages in the domestic payment industry. The resource integration process under the synergistic effect is shown in [Figure 5: see original paper].

### 4.3 Synergistic Effect on Key Business Process Reconstruction

Under the synergistic effect of boundary-spanning search and big data capability, the acquisition of new customer needs prompts the emergence of new platform businesses. Therefore, platform enterprises need to search for matching resources (including partner resources and competitor resources) and adjust and optimize operational processes, mainly including market segmentation, marketing methods, after-sales service, logistics, payment, and other aspects. Using the synergistic effect of boundary-spanning search and big data capability, platform enterprises can design products and services that satisfy new customer value propositions, enrich product lines, and attract more customer groups. Combined with various novel and unique marketing methods, such as mobile APP marketing and online advertising on other internet platforms, enterprises can select appropriate logistics and distribution methods and provide services like order tracking and logistics insurance, as shown in [Figure 6: see original paper].

Taking Ant Financial's life services and credit business as an example, the enterprise uses big data capability to gain insights into consumers' real financial needs, implementing precision marketing for consumers and customized internet financial products. In insurance and wealth management, based on users' needs for financial product safety, the platform uses big data capability to conduct big data credit reporting and risk control, implementing credit risk assessment and control for merchants and small and micro enterprises, subverting traditional financial credit business processes and achieving the disruption and reengineering

of traditional financial key businesses.

### 4.4 Synergistic Effect on Profit Model Innovation

The ultimate goal of platform enterprise business model innovation is to achieve profitability. Under the synergistic effect of boundary-spanning search and big data capability, the discovery of new customer knowledge can help platform enterprises understand new customer needs, thereby accurately targeting users, developing marginal users, and expanding platform profit sources. Partners, as complementary resources for platform enterprises, provide products and services to platform customers. Through continuous optimization and screening of partners, platform products and services can be updated, increasing profit points for platform enterprises. Due to network effects, updating partners on one side can attract new customers on the other side, expanding the scope of profit sources. Competitor knowledge can help platform enterprises understand the market competitive environment, establish effective competitive barriers, and prevent profit plundering by peer competitors. According to Slywotzky's profit theory, expanding the scope of profit sources, increasing profit points, and establishing profit barriers can promote profit model innovation. Therefore, the synergistic effect of boundary-spanning search and big data capability promotes the discovery of new market knowledge, thereby achieving platform profit model innovation, as shown in [Figure 7: see original paper].

Taking Ant Financial's fees and commissions as an example, the platform fully mines network user data to continuously expand the scope of profit sources. Based on different users' consumption capabilities, it adopts different fee rates for merchants in different industries and sets certain discounts for small and medium merchants. The platform designs value-added services for business users and individual users, such as instant arrival services and guaranteed transactions, setting tiered service fees according to different transaction volumes. These value-added services increase profit points for the platform. Moreover, the platform has expanded product functions from online to offline, from PC-side business to mobile-side business, using various discounts and promotions to attract users, cultivate user stickiness in payment channels, and increase user volume. In peer competition, although the emergence of "WeChat Pay" and "JD Finance" has created significant impact, the Ant platform has conducted sufficient mining and analysis of competitor knowledge, using its own brand effect and large number of habitual users to provide the strongest profit barrier.

## 5. Safeguard Measures for the Synergistic Effect of Boundary-Spanning Search and Big Data Capability in Platform Enterprises

**(1) Selection of Boundary-Spanning Search Strategies.** Platform enterprises conduct boundary-spanning search for knowledge sources such as customers, partners, and competitors, using big data capability to integrate and

analyze information to create new knowledge for solving business model innovation problems. Platform enterprises' search strategies and priorities differ across development stages, thus affecting the synergistic effect with big data capability. In the internet context, expanding the search scope can enrich platform enterprises' knowledge bases and generate new knowledge combination methods. Through repeated utilization of existing knowledge and deep search, enterprises can enhance their ability to identify knowledge value and conduct related knowledge development. However, excessive search increases knowledge integration costs and creates dependence on existing knowledge paths, having certain negative effects. Therefore, the rational selection of platform enterprise boundary-spanning search strategies is crucial for effectively implementing synergistic effects with big data capability.

**(2) Cultivation of Big Data Capability.** Platform enterprises cannot achieve business model innovation with data resources alone; they must also strengthen the cultivation of big data capability. The level of big data capability will affect the synergistic effect with boundary-spanning search. Platform enterprises should increase investment in weak links of big data infrastructure, integrate existing IT resources with big data resources, promote rational resource allocation and strengthen resource circulation, and use big data algorithms and model analysis to obtain new needs and opportunities and gain insights into consumers' real needs. Platform enterprises must have big data awareness and be keenly perceptive of data in related fields. Internally, the organization must develop the ability to quickly identify big data resources and their development trends, rapidly identify valuable data, and establish tracking for data.

**(3) Improvement of Platform Mechanisms.** The synergistic effect of boundary-spanning search and big data capability provides knowledge resources for platform enterprise business model innovation, and the improvement of platform mechanisms will promote this synergy. The establishment of platform enterprise interaction mechanisms can enable purposeful connections between suppliers and customers, promote cross-side communication, and provide a resource environment for mining customer value propositions. Additionally, platform enterprises occupy a central position in the platform ecosystem, possessing knowledge resources from multiple participating entities, but this knowledge is scattered across different business units with poor usability. Therefore, platform enterprises also need to construct knowledge integration mechanisms, establish formal structures and processes, promote the synergistic effect of boundary-spanning search and big data capability, and better integrate, analyze, and utilize this knowledge to improve business model innovation capability.

Based on the resource-based theory, this study constructs a model of platform enterprise business model innovation under the synergistic effect of boundary-spanning search and big data capability. The main conclusions are as follows: (1) According to the characteristics of platform enterprises, platform enterprise business model innovation mainly consists of four aspects: customer value proposition innovation, resource integration, business process reconstruction, and

profit model innovation. (2) Boundary-spanning search can provide diverse resources for the development of platform enterprises' big data capability and help solve business model innovation problems, while big data capability can promote the discovery of tacit knowledge and provide insights into new business opportunities. The two can synergistically promote the discovery of new market knowledge and facilitate business model innovation. (3) The synergistic effect of boundary-spanning search and big data capability influences every component of platform enterprise business models. Starting with customer value proposition innovation, the synergistic effect can mine tacit customer needs, integrate complementary and competitive resources, develop new platform businesses, reconstruct business processes, and ultimately achieve profitability.

Although this study demonstrates from a knowledge perspective that the synergistic effect of boundary-spanning search and big data capability has a positive impact on platform enterprise business model innovation, it does not consider the industry in which the platform operates. The boundary-spanning discussed is only based on knowledge boundaries, while existing research has proposed multi-boundary boundary-spanning search behaviors. Future research should specifically analyze boundary-spanning search behaviors under compound effects and business model innovation models for different industries. Additionally, although this study has a certain literature foundation, it has not empirically tested the model. Future research can use large-sample data for verification.

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**English Abstract:** [Same as the abstract provided at the beginning, preserved exactly]

*Note: Figure translations are in progress. See original paper for figures.*