Journal of Global Economy, Business and Finance (JGEBF) ISSN: 2141-5595
DOI: 10.53469/jgebf.2025.07(04).03

The Impact of Boundary-Spanning Search Ambidexterity on Innovation Performance: The Moderating Role of Strategic Flexibility

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Abstract: ***In the face of rapid changes in technology paradigms and market demands, boundary-spanning search breaks through the constraints of a firm's resources and capabilities, providing diversified channels for optimizing the structure of innovation capabilities. It serves as a powerful guarantee for firms to seize market and technology dominance and maintain competitive advantages. This paper introduces organizational ambidexterity theory into boundary-spanning search research, defining the two dimensions (matching ambidexterity and combined ambidexterity) of boundary-spanning search ambidexterity. It elucidates the unique advantages of these two dimensions on firm innovation performance and the moderating effect of strategic flexibility on these impacts. Based on this, a model of boundary-spanning search ambidexterity and firm innovation performance is constructed, and relevant propositions are proposed.***

Keywords: Boundary-spanning search ambidexterity, Innovation performance, Strategic flexibility**.**

1. Introduction

In a competitive and increasingly turbulent environment, a firm's limited internal resources struggle to sustain continuous innovation demands. The open innovation model provides an effective path for firms to acquire heterogeneous resources from external organizations. As an essential component of the open innovation process, boundary-spanning search is viewed as an effective strategy to cope with uncertain competition, playing a vital role in identifying potential market opportunities, expanding the scope of technological knowledge, and maintaining competitive advantages for firms. For instance, IBM established an Industry Solutions Lab in Zurich to observe and integrate leading global technologies, while BMW set up a technology office in Silicon Valley to search for specialized and unique technological knowledge.

Through boundary-spanning search activities, firms can acquire a significant amount of external resources, integrate, and recombine these resources to compensate for internal resource deficiencies while adapting to rapid changes in the technological and market environments, thereby promoting innovation activities. Technological knowledge and market knowledge are crucial elements for firms to engage in successful innovation activities and the primary targets of boundary-spanning search. However, these two boundary-spanning search strategies pose potential conflicts: Market knowledge is often embedded in the institutions and cultures of specific regions, exhibiting significant stickiness and implicitness, and due to variations in customer feedback and interaction levels, organizations need to construct efficient interaction mechanisms, thereby increasing search costs; Technological knowledge possesses a high degree of tacitness, not only increasing the difficulty of knowledge transfer but also bringing substantial challenges to knowledge integration and absorption. Its owners typically place considerable emphasis on protecting such knowledge, making it challenging for organizations to search for and integrate. Constrained by the scarcity of organizational resources and the fact that technological and market knowledge originate from different external channels, requiring different orientation of organizational structures and cultures, firms often struggle to efficiently balance the boundary-spanning search for both types of knowledge. Focusing on one area inevitably weakens the search in the other. Therefore, how to weigh the focus of boundary-spanning search in the market and technology domains is a managerial dilemma faced by firms.

Although boundary-spanning search has always been a focus of academic attention, existing research has shortcomings. Scholars have examined the effects of different dimensions of boundary-spanning search on firm innovation activities but have not further explored whether these dimensions need and can achieve balanced development and their impact on firm innovation performance, failing to provide guidance for firms to overcome these dilemmas. Moreover, in search activities, strategic flexibility reflects a firm's ability to identify changes in the external environment, quickly respond to these changes, and reallocate resources, which can regulate the differentiated performance brought about by different boundary-spanning search approaches. However, there is rare research on the role of strategic flexibility between boundary-spanning search and firm innovation performance. Drawing on the research paradigm of organizational ambidexterity theory, this study explores the impact mechanism of boundary-spanning search ambidexterity on firm innovation performance, specifically addressing the following three questions: (1) The impact of matching ambidexterity in technological and market knowledge boundary-spanning search on firm innovation performance; (2) The impact of combined ambidexterity in technological and market knowledge boundary-spanning search on firm innovation performance; (3) The moderating effect of firm strategic flexibility on the relationship between boundary-spanning search ambidexterity and firm innovation performance.

2. Theoretical Foundation and Proposition Formulation

2.1 Boundary-Spanning Search from the Perspective of

Ambidexterity Theory

Organizational ambidexterity refers to a firm's ability to juggle two competitive strategic activities while ensuring both efficiency and flexibility, possessing the agility to pursue both exploration and exploitation activities. This concept has been extensively applied in research fields such as organizational learning, strategic management, and managerial economics. Although the theoretical paradigm of organizational ambidexterity has not explicitly extended to the field of innovation search, many scholars' conceptual definitions and empirical studies have incorporated corresponding elements.

Nelson and Winter were among the first to propose the distinction between "remote search" and "local search" from the perspectives of search geographical scope and knowledge distance. March pointed out that a firm's search activities can be categorized into exploration and exploitation forms, but due to the tension between them, a balance needs to be struck. Subsequently, Rosenkopf & Nerkar built upon the concept of exploratory search to propose boundary-spanning search, classifying four forms of search strategies from the perspectives of organizational boundaries and technological boundaries and empirically examining the impact of these search strategies on subsequent technological evolution. Subsequent classifications of boundary-spanning search have primarily focused on organizational boundaries, technological boundaries, and temporal boundaries. Technological knowledge and market knowledge are crucial elements for firms to engage in successful innovation activities and the primary targets of boundary-spanning search. Technological knowledge boundary-spanning search refers to searching for knowledge related to new technologies, production processes, and methods across an organization's existing technological boundaries; Market knowledge boundary-spanning search refers to searching for market knowledge related to new market segments, product designs, distribution channels, and business models across an organization's existing business boundaries. These two boundary-spanning search activities require different organizational structures and resource support, and there is a certain tension between them since market knowledge boundary-spanning search focuses on customer interaction and market trends, while technological knowledge boundary-spanning search emphasizes technology and efficiency.

Ambidexterity theory provides new insights and directions for balancing the paradox of boundary-spanning search for market and technological knowledge. We define boundary-spanning search ambidexterity as a firm simultaneously executing market knowledge boundary-spanning search and technological knowledge boundary-spanning search while maintaining a moderate balance between them. Thus, boundary-spanning search ambidexterity is divided into two dimensions: matching ambidexterity and combined ambidexterity. Matching ambidexterity indicates the degree of relative balance maintained by a firm in both boundary-spanning search activities; Combined ambidexterity reflects the combined magnitude of the degrees of the firm's two boundary-spanning search activities. Based on this, the study further explores the impact of the two dimensions of boundary-spanning search ambidexterity on firm innovation performance and the moderating effect of strategic flexibility on the relationship between boundary-spanning search ambidexterity and firm innovation performance.

2.2 Matching Ambidexterity in Boundary-Spanning Search and Firm Innovation Performance

In market knowledge boundary-spanning search activities, organizations can grasp consumer demands and preferences by searching for the latest market knowledge related to new market segments, product designs, distribution channels, and business models. When technological knowledge boundary-spanning search surpasses market knowledge boundary-spanning search, the commercialization phase of innovative products (e.g., marketing strategy formulation, distribution channel establishment, customer interaction) may not reach the desired level, and the products developed and produced by the firm may face obstacles during the friction period with consumers, impeding market expansion. Although technological knowledge boundary-spanning search can help firms acquire complementary technological knowledge from the outside and avoid the "familiarity" trap of relying on existing technologies, new products and services must satisfy customer preferences to succeed, and customer needs and market scenarios are dynamically changing. Firms lacking corresponding information often struggle to respond quickly, thereby failing to build and maintain robust technological competitiveness and even leading to capability dependence or core rigidity, hindering organizational learning and technological innovation activities.

Conversely, when firms emphasize market knowledge boundary-spanning search without correspondingly engaging in technological knowledge boundary-spanning search, market searching and customer interaction can prompt firms to obtain innovation-conducive demands and feedback, thereby inspiring innovation inspiration, aiding in the development and continuous improvement of new products, and launching innovative products and services that meet consumer demands into the market. However, focusing excessively on the market without paying attention to searching for external complementary technological knowledge, resources, and capabilities may lead to short-sighted R&D activities, making it difficult for firms to fully understand and absorb the market resources they acquire, let alone transform these resources into innovative products or services to satisfy consumer demands. This will result in inefficient technological innovation by the firm and expose it to the risk of outlays exceeding income in market knowledge boundary-spanning search activities. Franco et al.'s research on the relationship between forward-looking market capabilities and firm survival rates also supports the above viewpoint, showing that firms with weak technological capabilities do not have an advantage when entering the market first and may even lag behind later entrants. Christensen and Bower's research similarly indicates that incumbent firms face the risk of losing their industry dominance due to excessive focus on customers. Therefore, excessive focus on either technological knowledge or market knowledge can adversely affect firm innovation performance; conversely, when neither is excessive, the firm's innovation activities may yield better results. Thus, in boundary-spanning search activities, excessive focus on either market knowledge

or technological knowledge is detrimental to firm innovation performance. Based on this, we propose the following proposition:

Proposition 1: Matching ambidexterity in boundary-spanning search is positively correlated with firm innovation performance.

2.3 Combined Ambidexterity in Boundary-Spanning Search and Firm Innovation Performance

Combined ambidexterity in boundary-spanning search focuses on the potential complementarity between technological and market knowledge. We apply the research approach in the field of organizational ambidexterity on firms' exploratory and exploitative processes to the field of boundary-spanning search. We believe that combined ambidexterity in boundary-spanning search will contribute to the complementarity and synergy between the two types of boundary-spanning search, thereby improving firm innovation performance.

Market knowledge boundary-spanning search helps firms obtain market consumption feedback from existing customers, perceive and predict demand evolution, and reduce market uncertainties faced during innovation commercialization. This perception and prediction are crucial foundations for technological knowledge boundary-spanning search, indicating directions for technological exploration, enabling firms to drive the R&D of new technologies based on market feedback. Moreover, the exchange and interaction between technological and market knowledge facilitate the firm's ability to integrate knowledge. Furthermore, successful technological knowledge boundary-spanning search activities can provide strategic guidance for market knowledge boundary-spanning search, filtering out noise and interference in market knowledge boundary-spanning search, and improving search activity efficiency. As technological knowledge boundary-spanning search deepens, firms will further deepen their understanding, grasp, and utilization of existing technological knowledge, correspondingly enhancing their meaning construction abilities, enabling them to more accurately predict and grasp market trends. More importantly, in this process, firms will become clearer about which new users can be included in their service targets, thereby simplifying and guiding the processes and routines of searching for relevant information and selecting new customers in market knowledge boundary-spanning search. Lastly, market knowledge boundary-spanning search and technological knowledge boundary-spanning search activities can share the external resources acquired, and the mining and integration of these resources can help firms achieve economies of scale in technological innovation through boundary-spanning search, promoting the enhancement of firm innovation performance. Accordingly, we propose the following proposition:

Proposition 2: Combined ambidexterity in boundary-spanning search is positively correlated with firm innovation performance.

2.4 The Moderating Role of Strategic Flexibility

Strategic flexibility refers to a firm's dynamic capability to actively or reactively respond quickly to market opportunities or threats, adjust strategic decisions in a timely manner, flexibly reorganize resources, and overcome path dependence to achieve firm goals, serving as an important guarantee for organizational survival and development. Most scholars generally believe that strategic flexibility comprises resource flexibility and coordination flexibility, and the following dimensions will also study the moderating role of strategic flexibility in the relationship between boundary-spanning search ambidexterity and firm innovation performance based on this division.

Resource flexibility helps shorten the dynamic response time for changes in firm strategic system elements, and imbalances between the two boundary-spanning search activities do not severely reduce firm innovation performance. The reason is that flexible resources can be quickly reconfigured for other purposes, allowing firms to quickly adjust and deploy innovation activities, compensating for the limitations caused by imbalances in boundary-spanning search and making it easier for firms to control the commercialization risks and R&D risks induced by these imbalances.

Boundary-spanning search activities require firms to maintain external organizational relationships, screen information, and integrate knowledge, and resource conflicts brought about by simultaneously implementing the two boundary-spanning search activities are inevitable. Resource flexibility can alleviate resource conflicts between market knowledge and technological knowledge boundary-spanning search, providing the possibility for resource transfer between the two boundary-spanning search activities. The broad scope of resource use ensures that the same resources can be applied to different types of boundary-spanning search, reducing the time, labor, and financial costs required when resources are applied to different types of boundary-spanning search. Based on this, the study proposes the following propositions:

Proposition 3a: Resource flexibility positively moderates the relationship between matching ambidexterity in boundary-spanning search and firm innovation performance.

Proposition 3b: Resource flexibility positively moderates the relationship between combined ambidexterity in boundary-spanning search and firm innovation performance.

Coordination flexibility reflects a firm's ability to utilize resources, influencing the degree of interaction between the firm and external innovation subjects, the degree of resource utilization, and the firm's adaptability to the environment. High levels of coordination flexibility can reduce organizational routine conflicts brought about by balanced boundary-spanning search and enhance the synergistic effects of market knowledge and technological knowledge boundary-spanning search. Market knowledge and technological knowledge boundary-spanning search originate from different channels and require different organizational structures and cultures. Restricted by thinking modes and organizational structures, it is easy for departments within a firm to lack coordination and communication, resulting in the formation of information silos between departments. Coordination flexibility makes it possible to establish

organizational structures and processes within the firm that simultaneously support the two different search activities, mitigating conflicts between different functional departments within the firm by flexibly utilizing resources and re-configuring processes.

High levels of coordination flexibility can strengthen the complementary effects of combined boundary-spanning search. Combined boundary-spanning search emphasizes the dual high orientation of market knowledge and technological knowledge boundary-spanning search, placing higher demands on organizational capabilities. Firms with high coordination flexibility can quickly and accurately allocate various resources for different types of boundary-spanning search, building resource exchange links and transfer pathways between the two boundary-spanning search activities. When a firm has strong coordination flexibility, its ability to allocate and utilize resources is also strong. For the substantial resources acquired through combined boundary-spanning search, the firm can efficiently and quickly identify their usage through comprehensive analysis and recognition of the internal and external environments, realizing the rational combination of heterogeneous resources and maximizing the effectiveness of limited resources. Based on this, the study proposes the following propositions:

Proposition 4a: Coordination flexibility positively moderates the relationship between matching ambidexterity in boundary-spanning search and firm innovation performance.

Proposition 4b: Coordination flexibility positively moderates the relationship between combined ambidexterity in boundary-spanning search and firm innovation performance.

3. Discussion and Implications

Existing innovation search theory has pointed out that boundary-spanning search activities can influence innovation performance. This study extends the organizational ambidexterity theory to the field of innovation search, aiming to explore the logical relationships between boundary-spanning search ambidexterity, strategic flexibility, and firm innovation performance. Through analysis, the following conclusions are drawn: (1) The balance between market knowledge boundary-spanning search and technological knowledge boundary-spanning search can effectively control a firm's commercialization and R&D risks, and maintaining them in a balanced state can improve firm innovation performance; (2) Combined ambidexterity in boundary-spanning search embodies the complementary effects of the two search approaches. Market knowledge boundary-spanning search uncovers market information distinct from current demands, deeply understanding potential consumer demands and driving firms to develop forward-looking products and services. Technological knowledge boundary-spanning search prompts firms to continuously engage in revolutionary innovation activities to participate in market competition, achieving technological and market breakthroughs through the full application of cutting-edge and high-end technologies. Firms can achieve higher innovation performance by simultaneously enhancing both activities; (3) Strategic flexibility (resource flexibility and coordination flexibility) has a significant positive moderating effect on the relationship between the two dimensions of boundary-spanning search ambidexterity and firm innovation performance. Strategic flexibility enables firms to better coordinate and allocate resources, improve resource utilization efficiency, reduce boundary-spanning search costs, and effectively support the balance and combination of market knowledge and technological knowledge boundary-spanning search, serving as an accelerator for firms to enhance the efficiency and effectiveness of boundary-spanning search activities.

The research conclusions answer the question of how firms should weigh the focus of boundary-spanning search in the market and technology domains. Additionally, this study points out that the impact of boundary-spanning search ambidexterity on firm innovation performance also depends on its own strategic flexibility, adding theoretical explanations for the boundary conditions of how boundary-spanning search ambidexterity affects firm innovation performance, enriching technological innovation theory and related research on strategic flexibility, and providing important references for firms to effectively conduct and manage external search activities.

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