

# The Impact of Open Innovation Models on Innovation Performance

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**Abstract:** *This academic paper aims to investigate the effects of the open innovation model on enterprise innovation performance. The open innovation model, considered a contemporary approach to managing innovation, aims to create a more porous boundary between the enterprise and its external environment. This transformation turns the traditional solid boundary into a "semi-permeable membrane" boundary, facilitating increased interaction and collaboration between various stakeholders across different industries. This paper provides a comprehensive analysis of the different open innovation modes, namely inbound, outbound, and coupled, and explores their impact on enterprise innovation performance. Moreover, it examines various factors that influence the performance of innovation within organizations. Finally, the study sheds light on the mechanisms through which different open innovation models can affect enterprise innovation performance.*

**Keywords:** *Open Innovation Models; Enterprise Innovation; Innovation Performance*

## 1. Introduction

In the 21st century, various factors have brought about significant changes that have disrupted the traditional closed innovation process adopted by enterprises. The social and industrial environment has undergone transformations leading to a gradual erosion of the boundaries around the innovation process. Consequently, external sources of ideas have garnered more importance than internal sources. Enterprises fixated on internal resources have faced the risk of missing out on numerous opportunities, as many of these opportunities would lie outside their current business scope or necessitate integration with external technologies to unlock their potential.

The open innovation model has emerged as the novel paradigm for modern innovation management and has become a widely discussed topic in the literature on innovation management in the 21st century<sup>[1]</sup>.

The increasing globalisation of economic activities and markets has significantly expedited the innovation process. To remain competitive and foster growth, enterprises must continuously enhance their innovation performance and actively seek new avenues for innovation and commercialisation. Consequently, a considerable number of enterprises have embraced the "open innovation" model in their R&D management, harnessing diverse external players and resources to facilitate and sustain innovation. Unlike conventional vertically integrated innovation models, the open innovation perspective places a greater emphasis on the collaboration of external players in the generation and commercialisation of innovation. This approach enhances the capacity to create, utilize, and reorganise both new and existing knowledge.

## 2. Open innovation models and enterprise innovation performance

### 2.1 Open innovation models

The open innovation (OI) model is a highly effective approach that capitalizes on the exchange of knowledge to enhance internal innovation and establish new markets for the external application of innovative ideas. It operates under the fundamental belief that organizations have both the ability and the obligation to leverage external and internal sources of ideas, as well as internal and external market channels, in order to foster technological advancements<sup>[2]</sup>.

The OI model is known for its inclusive innovation process and the high level of collaboration between businesses and their surroundings<sup>[1]</sup>. It offers a structured method for acquiring, reorganizing, and leveraging knowledge during the innovation process, both within and beyond the boundaries of an organization. While the concept of the OI model acknowledges the importance of inter-organizational innovation models<sup>[3]</sup>, internal activities are also vital to its success.

The OI model is a multidimensional structure that builds on a range of OI activities. However, in a simplified form, the OI model can be considered a two-dimensional structure, as enterprises can open up their innovation processes along two dimensions: inbound and outbound<sup>[4]</sup>.

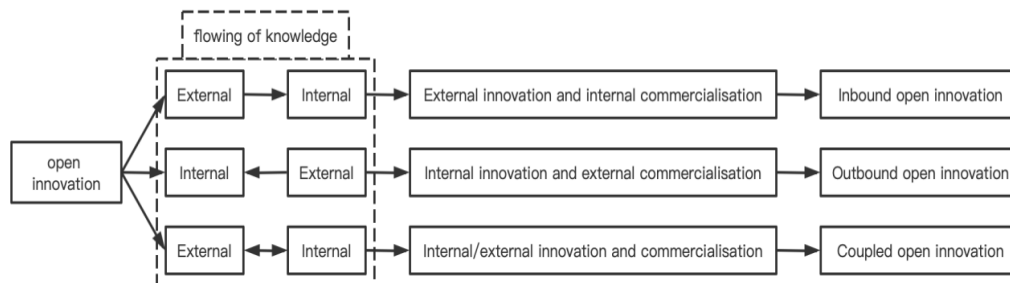


Figure 1: Innovation pathways and commercialisation processes for each type of open innovation model

The inbound Open Innovation (OI) model, as depicted in Figure 1, encompasses the internal utilization of external knowledge. This model comprises three distinct processes, namely knowledge exploration, retention, and development, which transpire both within and outside the confines of the enterprise<sup>[4]</sup>. By adopting this approach, organizations can leverage insights and breakthroughs from external sources rather than solely depending on their own Research and Development (R&D) endeavors<sup>[2]</sup>.

The outbound Open Innovation (OI) model involves the external utilization of internal knowledge<sup>[4]</sup>, as depicted in Figure 1. This model highlights the possibility for enterprises to seek out external organizations with appropriate business models for either commercializing technology or utilizing it within their own operations<sup>[2]</sup>. Consequently, the outbound OI model encompasses the proactive pursuit of external technology development and encompasses the dissemination of technological knowledge for commercial purposes, extending beyond its internal applications<sup>[5]</sup>.

The coupled Open Innovation (OI) model represents the collaborative activities among various stakeholders in an innovation ecosystem. This model encompasses a coupling process that connects the inbound orientation, which involves sourcing external knowledge and resources, with the outbound orientation that focuses on commercializing innovations. This connection is facilitated through cooperation with complementary enterprises, as depicted in Figure 1. In order for this coupling process to yield positive results, it is crucial for all participants to engage in mutual exchange and collaboration<sup>[6]</sup>.

## 2.2 Dominant factors of the open innovation model affecting enterprise innovation performance

### 2.2.1 Absorptive capacity

Enhanced academic writing: Absorptive capacity, also known as open innovation (OI), is contingent upon an enterprise's capability to effectively utilize external resources. If an organization lacks sufficient absorptive capacity, the process of exploring external knowledge will prove to be inefficient<sup>[7]</sup>. Considering the current scenario in which enterprises exhibit a high ability for independent innovation but a low capacity for absorbing technological knowledge, Chen and Wang propose that enhancing the ability to absorb knowledge through an OI model is imperative for augmenting enterprise innovation performance<sup>[8]</sup>, as demonstrated in Figure 2.

### 2.2.2 Relational capability

The field of innovation research has witnessed a significant shift towards an open and interactive approach, reflecting a new trend in the study of enterprise behavior. Extensive studies have indicated that in open innovation (OI) models, the network of relationships between an enterprise and its external environment plays a critical role in fostering enterprise innovation performance<sup>[9]</sup>, as shown in Figure 2.

### **2.2.3 Knowledge transfer**

According to Figure 2, effective knowledge transfer plays a crucial role in driving resource sharing and enhancing innovation performance in an Open Innovation (OI) model. Hence, it is imperative for enterprises to adopt multiple measures and utilize diverse channels in order to gain access to resources<sup>[10]</sup>.

### **2.2.4 Innovation Surge**

The proliferation of innovation plays a crucial role in the Open Innovation (OI) model and is a significant factor in attaining increased returns, as depicted in Figure 2. By expanding the network of partners who adopt the technology in their products, and consequently increasing the pool of potential customers for these products, the overall value derived from innovation is elevated<sup>[6]</sup>.

## **2.3 Mediating factors of open innovation models affecting enterprise innovation performance**

### **2.3.1 Knowledge learning**

According to previous research<sup>[11]</sup>, the inbound open innovation (OI) model has a positive relationship with technological learning, as illustrated in Figure 3. On the other hand, external activities that solely rely on the existing internal knowledge of the enterprise do not contribute significantly to the acquisition of new technological information<sup>[4]</sup>. Consequently, such activities do not promote technological learning.

The outbound open innovation (OI) model has been found to have a positive correlation with managerial learning<sup>[11]</sup>, as illustrated in Figure 4. When enterprises allocate time and resources towards engaging in external activities, these activities create added managerial pressures on the enterprise. Consequently, enterprises are compelled to learn more in order to cope with these pressures, ultimately leading to an elevation in their level of managerial expertise. This, in turn, facilitates their innovation activities<sup>[12]</sup>.

### **2.3.2 Organisational capability**

The relationship between the inbound open innovation (OI) model and exploration capabilities has been found to be significantly positive<sup>[11]</sup>, as indicated in Figure 3. A key aspect in building exploration capabilities lies in the acquisition of adequate knowledge<sup>[13]</sup>. This is essential due to the abundance of information that can be accessed from external sources through the inbound OI model. Consequently, organizations are encouraged to utilize their discovery capabilities to effectively leverage new information in order to explore novel knowledge, skills, and processes<sup>[14]</sup>.

The outbound OI model is positively associated with exploration capabilities<sup>[11]</sup>, as illustrated in Figure 4. Enterprises must prioritize the utilization of existing knowledge when engaging in external activities<sup>[4, 15]</sup>. This is emphasized by the fact that leveraging internal knowledge allows enterprises to enhance their innovation performance through various means, such as selling or licensing technology, establishing research and development (R&D) alliances, or providing technical and scientific services<sup>[15]</sup>.

### **2.3.3 Technological capability**

Enhanced academic writing: Technological capabilities are defined as dynamic and internal abilities that allow enterprises to achieve technological innovation and enhance their profitability. These capabilities play a vital mediating role in the relationship between Open Innovation (OI) and enterprise innovation performance. Large enterprises, benefiting from their accumulated tradition and extensive resources, possess the necessary knowledge and resources to effectively turn inventions into marketable products. On the other hand, small and medium-sized enterprises (SMEs), though faced with limited resources, are often more agile and innovative in emerging fields. Consequently, when large enterprises collaborate with SMEs, it results in a synergistic integration of technology, resource, and innovation, ultimately leading to enhanced enterprise performance<sup>[16]</sup>.

## **2.4 Moderating factors of the open innovation model affecting enterprise innovation performance**

### **2.4.1 Degree of product modularity**

A crucial characteristic essential for enhancing enterprise innovation performance through an Open Innovation (OI) model, as depicted in Figure 2, is a high level of product modularity. Certain

manufacturing enterprises that have a modular structure can significantly enhance their innovation capacities by embracing an open approach to their innovation processes. Nonetheless, chemical enterprises with a low level of modularity may experience limited benefits from the implementation of the OI model<sup>[6]</sup>.

#### 2.4.2 Industry speed

Industry speed is a crucial factor to consider when determining whether an enterprise can effectively utilize the Open Innovation (OI) model to enhance its innovation performance in Figure 2. Enterprises operating in fast-paced industries have a distinct advantage in leveraging external knowledge and engaging in collaborative innovation with partners. This allows them to stay ahead of the curve and gain significant benefits. Conversely, enterprises operating in slower-paced industries may not require the same level of emphasis on rapid innovation processes<sup>[6]</sup>.

#### 2.4.3 Tacit knowledge and the complexity of external cooperation

The acquisition and utilization of tacit knowledge, along with the intricate nature of collaborating with external entities, are significant aspects that contribute to the competitive edge of an open innovation (OI) strategy, as illustrated in Figure 2. Organizations that possess a substantial amount of tacit knowledge necessary for innovation and engage in complex external cooperation can effectively leverage the OI model to enhance their innovation capabilities<sup>[6]</sup>.

#### 2.4.4 Exclusivity

A crucial requirement for enterprises when selecting a partner is exclusivity, which is also considered a significant advantage, as illustrated in Figure 2. Companies that are implementing new technologies and innovative functionalities for the first time must engage in bilateral partnerships that ensure exclusivity. The incorporation of external knowledge into an inbound Open Innovation (OI) model plays a vital role in enhancing the innovation capabilities of enterprises. Additionally, the OI model, whether pursued through bilateral or multilateral partnerships, offers a promising avenue for enterprises to fulfill the necessary characteristics<sup>[6]</sup>.

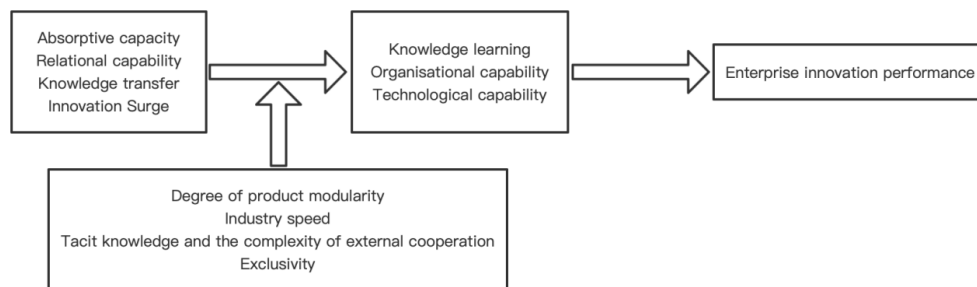


Figure 2: Mechanisms of the impact of open innovation models on enterprise innovation performance

### 3. Impact of Inbound Open innovation Model on Enterprise Innovation Performance

#### 3.1 External environmental characteristics

One of the most evident aspects of the external environment is the industry in which a firm operates. Several Open Innovation (OI) studies have concentrated on specific industries, such as consumer electronics<sup>[17]</sup> and food<sup>[18]</sup>. Gassman suggests that, in addition to the industry, OI models are better suited for environments characterized by globalization, technology intensity, technology convergence, new business models, and knowledge leveraging<sup>[6]</sup>. However, further systematic empirical research is necessary to determine the impact of these and other external environmental characteristics. The way individual firms utilize different sources of knowledge is influenced, to some extent, by the external environment factors, including the availability of technological opportunities, the level of volatility in the environment, and the search activities of other firms within the industry<sup>[15]</sup>.

#### 3.2 The process of the inbound open innovation model

The inbound OI model represents a comprehensive approach to incorporating external ideas into an organization and transforming them into novel products and processes. By engaging in these activities, companies are able to effectively harness external technological advancements and capitalize on them

through measures such as licensing, selling knowledge, and divestment of certain segments of the business<sup>[19]</sup>.

The concept of absorptive capacity in innovation is intricately connected to the inbound open innovation (OI) model, as depicted in Figure 3. The processes involved in generating and applying technological knowledge have become more intricate, extensive, and costly. Moreover, for enterprises to innovate successfully, it is crucial for them to possess the capability to recognize the value of external information, assimilate it efficiently, and employ it effectively for their business objectives<sup>[20]</sup>. Unfortunately, many organizations struggle in their capacity to attentively listen to the external environment and process the signals they receive.

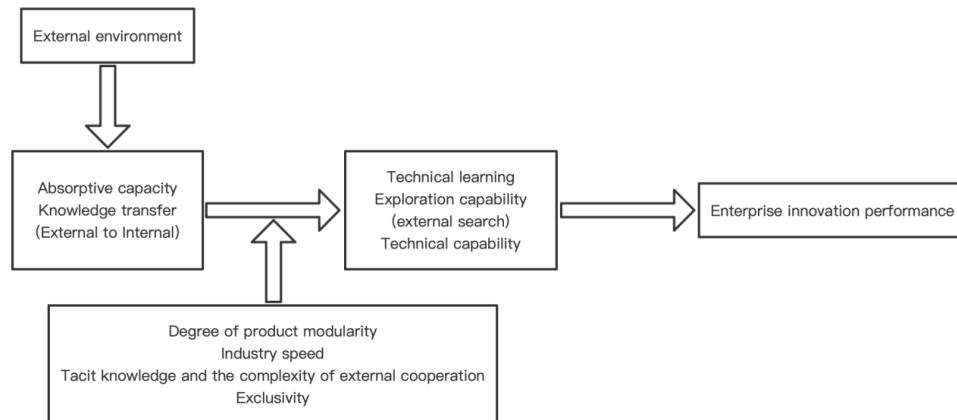


Figure 3: Mechanisms of influence of inbound open innovation models on enterprise innovation performance

### 3.3 Impact of external search breadth and depth on enterprise innovation performance

Katila and Ahuja conducted a study examining the impact of search breadth and depth on innovation performance. They discovered that the level of innovation performance by an enterprise is to some extent influenced by its search behavior. Their findings revealed a curvilinear relationship between breadth and depth of search and innovation performance, displaying an inverted U-shape pattern. This implies that certain enterprises tend to engage in excessive searching<sup>[21]</sup>. In a separate study, Laursen and Salter also observed an inverted U-shape relationship between the breadth and depth of external search and innovation performance. Additionally, they found that the impact of external search breadth on innovation performance decreases as the level of innovation becomes more aggressive. Conversely, the impact of external search depth on innovation performance increases with greater aggressiveness in innovation endeavors<sup>[9]</sup>.

Laursen and Salter also concenterise Katila and Ahuja's finding that 'over-searching' may indeed hinder innovation performance. It seems to suggest that openness may have a negative impact on innovation performance in terms of breadth and depth at certain moments or after a turning point. The possibility of over-searching contributes to a more nuanced view of the role of openness, search and interaction. An optimistic view of search suggests that it is important for enterprises to be open to external resources when developing new innovation opportunities. Our research supports this view, but it suggests that enthusiasm for openness needs to be tempered by an understanding of the costs of such search efforts<sup>[9]</sup>.

### 3.4 The impact of inbound open innovation models on enterprise innovation performance

A multitude of empirical studies have consistently demonstrated that the degree of novelty in an innovation significantly affects the factors that dictate innovation performance<sup>[22]</sup>. In their work, Anderson and Tushman delineate radical innovation as either "capability enhancement" or "capability disruption", highlighting the distinct ways in which new paradigm innovations alter competition among businesses within an industry<sup>[23]</sup>. To attain radical innovation, organizations typically must make a substantial investment in research and development, with the likelihood of success diminishing as the returns escalate<sup>[24]</sup>.

Regarding the level of uniqueness in innovation, Hwang and Lee contend that the extent of revolutionary innovation cannot be accounted for solely by the scope or depth of seeking external

knowledge. However, it is worth noting that the breadth of external knowledge search does have a significant nonlinear association with the achievement of revolutionary innovation<sup>[25]</sup>. Taking into consideration the perspective of innovative novelty, Parida et al. discover that models incorporating open innovation from external sources have a positive and noteworthy impact on both minor and radical innovation performance<sup>[26]</sup>. Additionally, Cheng and Shiu determine that a focus on open innovation models utilizing external knowledge enhances the attainment of radical innovation, but impairs incremental innovation performance<sup>[11]</sup>.

### ***3.5 A typical inbound open innovation model: procurement***

Procurement refers to the process of acquiring knowledge or solutions through market-based methods<sup>[27]</sup>. This practice has the potential to significantly enhance the innovation capacity of enterprises. In recent times, the adoption of open search and sourcing strategies within organizations, coupled with stricter intellectual property rights regulations, has facilitated the commercialization of external technologies<sup>[28]</sup>. Moreover, licensing offers a unique opportunity for organizations to pool their resources and capabilities. By establishing a new venture as a means of commercializing these external technologies, companies can leverage external sources of funding to mitigate their own risks, all while retaining the option to internalize the venture at a later stage<sup>[29]</sup>.

## **4. Impact of Outbound Open innovation Model on enterprise Innovation Performance**

### ***4.1 Internal environmental characteristics***

#### ***4.1.1 Enterprise size***

One of the most noticeable and extensively researched characteristics of enterprises is their size. Small enterprises often engage in open innovation (OI) due to their limited resources and market reach. Moreover, these enterprises already prioritize external focus in their innovation efforts, making OI models a familiar concept to them<sup>[30]</sup>. Nevertheless, small enterprises face challenges in building and sustaining collaborative networks, as well as establishing and protecting intellectual property rights. Various empirical studies conducted in different countries corroborate the notion that larger enterprises are more likely to adopt OI models. It has also been observed that size effects are particularly evident in outbound OI models<sup>[31]</sup>.

#### ***4.1.2 Strategic orientation***

The strategic orientation of an organization, such as its market orientation or resource orientation, can significantly influence the focus and level of outbound open innovation (OI) activities. In organizations that prioritize inbound OI, a lack of alignment with the OI model may hinder its effectiveness. Research conducted by Lichtenthaler and Ernst revealed that technological advancements had a detrimental effect on the inbound OI model but a positive impact on the outbound OI model. Other elements of an organization's innovation strategy, such as the emphasis on incremental innovation, various stages of the innovation process, and different stages of the product life cycle, may also play a significant role. Some argue that the impact of the inbound OI model is particularly pronounced in the early stages of the innovation process, as the potential cost and time savings are greater during this phase<sup>[31]</sup>.

### ***4.2 The process of the outbound open innovation model***

The outbound open innovation (OI) process encompasses various approaches that involve leveraging an enterprise's knowledge by removing the boundaries and facilitating the flow of ideas externally. This process, considered a key component of an OI strategy, offers substantial benefits to enterprises that fulfill certain criteria<sup>[6]</sup>.

The capacity for innovation is significantly heightened through the utilization of the outbound Open Innovation (OI) model, as depicted in Figure 4. The incorporation of external knowledge into an organization and the subsequent enhancement of the organization's knowledge is intricately connected to its capacity to effectively transfer that knowledge to the external environment. The capacity for innovation to flourish depends on the external utilization of resources, and an organization's success in transferring knowledge is strongly influenced by its selection of appropriate partners. The successful commercialisation of innovation hinges on the enterprise's ability to effectively document and

disseminate its knowledge to external entities. Moreover, partners who are strategically willing and able to enable the proliferation of new technologies are also an important factor in a enterprise's ability to proliferate innovation<sup>[6]</sup>.

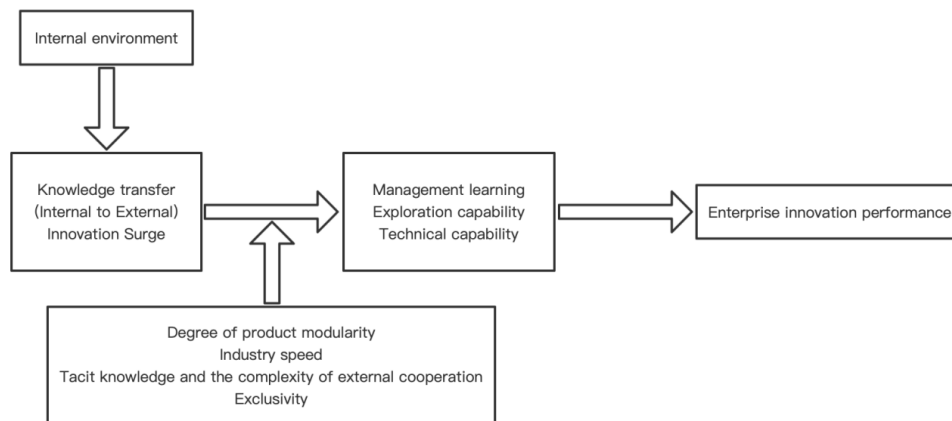


Figure 4: Mechanisms of influence of outbound open innovation models on enterprise innovation performance

#### 4.3 The impact of outbound open innovation models on enterprise innovation performance

Greater openness in the outbound OI model leads to higher enterprise innovation performance. External involvement, such as alliances and joint ventures, allows organizations to access new production methods and technologies. By collaborating with partners and competitors, organizations can enhance their processes, acquire improved technologies, and gain a competitive edge. This external involvement fosters innovation, increases efficiency, and drives overall productivity. Overall, the outbound OI model enables organizations to tap into external knowledge and resources, driving their innovation performance<sup>[32]</sup>. Ju et al. found that process is positively correlated with both financial performance and innovation performance in open innovation models for SMEs, regardless of whether the approach is inward or outward-oriented. This highlights the importance of efficient processes and a strong entrepreneurial orientation for successful implementation. Improving coordination and communication internally can optimize outcomes. The study emphasizes the significance of process in open innovation and offers practical implications for SMEs<sup>[33]</sup>. The findings of Lichtenthaler, also found a direct positive impact of outbound OI models on enterprise performance<sup>[4]</sup>. Cheng and Shiu found that a focus on outbound OI models increased incremental innovation performance, but hindered radical innovation performance<sup>[11]</sup>.

#### 4.4 A typical outbound open innovation model: outsourcing

Outsourcing goes beyond the confines of one's own industry or market, as it serves as a tool to commercialize ideas and channel knowledge into external environments. This strategic approach offers a myriad of advantages, such as gaining access to new realms of expertise, optimizing management capabilities, concentrating on core competencies, expediting time to market, and slashing costs<sup>[34]</sup>. The desire to establish technology standards can serve as a motivating factor for outsourcing the commercialization of a technology or for opting to become a partner in the value chain that supports the new technology or knowledge. Additionally, spillover effects, which are positive secondary outcomes resulting from innovation, can be effectively capitalized on in other industries. This serves as a key characteristic of outbound open innovation (OI) processes as a strategy for fostering innovation<sup>[6]</sup>.

### 5. Impact of the Coupled Open innovation Model on the Enterprise Innovation Performance

#### 5.1 The process of the coupled open innovation model

The coupling process involves both internal to external and external to internal processes in which firms collaborate with external partners to acquire complementary assets and internalize knowledge spillovers. Collaboration depth represents a high level of cooperation with specific partner types, while collaboration breadth refers to the variety of partners a firm collaborates with. This process allows

firms to enhance their capabilities, innovate, and gain a competitive advantage in an interconnected business environment<sup>[29]</sup>.

Relational capabilities are crucial for driving innovation and gaining a competitive advantage. They involve forming and maintaining relationships with partners through strategic alliances. These partnerships provide access to expertise and resources, promoting mutual development and innovation. They also help organizations adapt to market changes and share knowledge. Strong partnerships foster trust and cooperation, leading to long-term success. Relational capabilities are vital for thriving in today's business landscape<sup>[35]</sup>.

The relational capacity of the innovation is related to the coupling process, as shown in Figure 5. Connecting with networks, partnerships, and alliances is crucial for an enterprise's success and the implementation of an open innovation strategy. Joining industry networks provides access to resources and attracts partners, investors, and customers. Collaborating with complementary enterprises through alliances maximizes resources and opportunities. Cooperative relationships with competitors foster innovation and shared costs. These connections enhance competitiveness and drive growth. Building strong relationships is key to harnessing the benefits of network and alliance-driven open innovation strategies<sup>[6]</sup>.

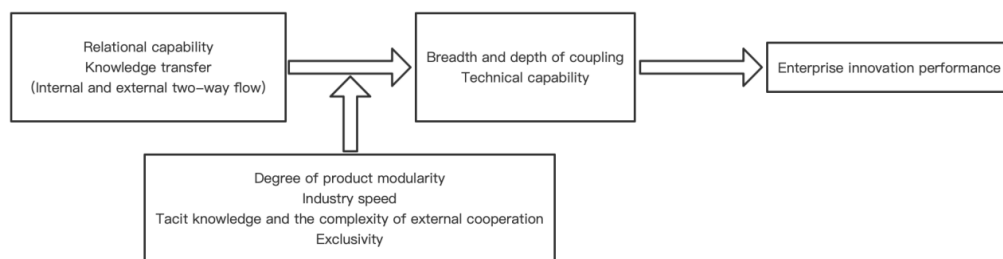


Figure 5: Mechanisms of influence of coupled open innovation models on enterprise innovation performance

### 5.2 Impact of coupled open innovation models on enterprise innovation performance

Coupling actions in process innovation, where there is close cooperation with partners, have several advantages. They enhance knowledge sharing and the creation of new knowledge, leading to valuable innovations. Coupled OI models improve product and process innovation performance. However, they require significant resources and time due to complex interactions. Despite this, the benefits of coupling actions outweigh the costs. Managers should consider embracing coupled OI models for innovation and growth<sup>[36]</sup>.

### 5.3 A typical coupled open innovation model: collaboration

Collaboration is a process in which knowledge is developed through partnerships with specific entities like competitor alliances<sup>[37]</sup>, joint ventures and alliances<sup>[38]</sup>, as well as universities and research institutions<sup>[39]</sup>. In order for collaboration to be successful, there needs to be a high level of interaction and sharing of knowledge, which requires trust among the collaborating parties. Moreover, mechanisms are often necessary to manage opportunistic behavior and ensure consensus on the goals to be achieved<sup>[40]</sup>. As such, collaboration can be seen as a more targeted aspect of open innovation compared to search and can be comparatively easier to identify and engage in<sup>[29]</sup>.

## 6. Conclusion

In recent years, the traditional model of relying solely on internal research and development (R&D) activities to drive innovation has become less effective. Companies have encountered diminishing returns from their internal R&D investments, and have faced challenges in properly controlling and managing these investments. As a result, the Open Innovation (OI) model has emerged as a crucial element in the innovation process of enterprises across various industries. This model emphasizes the integration of external sources of innovation into the organization, as well as the identification of external pathways for commercializing internal innovations.

The purpose of this paper is to synthesize current research on OI models and examine their impact



on enterprise innovation performance. By doing so, this paper aims to enhance our understanding of this research area.

While there is ongoing debate regarding the relationship between OI models and innovation performance, it is evident that the majority of innovative enterprises today have adopted the OI model as their preferred approach. This shift is a response to the complex changes occurring in the business environment, which have compelled companies to embrace openness and actively seek external resources and knowledge to strengthen their own innovation capabilities and core competencies.

In conclusion, the OI model has become a vital component in the innovation strategies of enterprises. By integrating external sources of innovation and leveraging external knowledge, companies are able to enhance their overall innovation performance. As research in this area continues to evolve, it is essential to further explore the relationship between OI models and innovation performance, in order to guide and inform future organizational practices and strategies.

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