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Ambidexterity in External Knowledge Search Strategies and Innovation Performance: Mediating Role of Balanced Innovation and Moderating Role of Absorptive Capacity

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Abstract: The importance of external knowledge acquisition for innovation by firms is well established. In particular, there has been an increasing focus on the two distinct modes of firms' external search strategies, which have a differential effect on their learning and innovation: *search breadth* and *depth*. By applying organizational ambidexterity lens, we hypothesize that pursuing high levels of both external search strategies is beneficial to achieve a balance between exploitative and explorative innovation, which, in turn, has a positive impact on the firm's innovation performance. We also hypothesize that, even among the firms that maintain high levels of both search strategies, firms with higher absorptive capacity better achieve a balance between both modes of innovation, thereby producing higher performance. The findings on a multi-industry sample of Korean manufacturing firms confirm our hypotheses and imply that it is essential for firms to develop capabilities for different modes of external search activities in conjunction with internal absorptive capacity for superior innovation performance.

Keywords: external search strategies; organizational ambidexterity; a balance between explorative and exploitative innovation; absorptive capacity

1. Introduction

The literature on organizational ambidexterity emphasizes that the sustainability and superior performance of a firm depends on its ability to achieve a balance between exploitative innovation aimed at refining existing products for the current market and explorative innovation aimed at introducing new products for the future market—which we term “*ambidexterity in innovation*” [1–3]. Given the growing interest in ambidexterity, the most prominent body of studies has long focused on firms' learning activities as organizational antecedents of balancing the two types of innovation [4–6]. Particularly, scholars in this field have devoted to investigating how organizations can simultaneously pursue high levels of both exploitative and explorative learning activities despite their conflicting nature—which we term “*ambidexterity in learning*”.

Though earlier scholars argue that synchronizing both learning activities within an organization is not achievable due to resource constraints faced by organizations and the contradictory nature of the two learning activities [4,7,8], later studies reveal that firms can maximize both learning activities simultaneously by externalizing either one of them through outsourcing or strategic alliances [9–11]. Most notably, a combination of external exploration and internal exploitation in the inter-organizational context is attracting scholarly attention as a viable way to achieve organizational ambidexterity [12–14].

This perspective is insightful but still limited in its theoretical and practical aspects as follows. First, scholars confine a firm's external search activities to explorative learning by assuming that firms' exploitative learning occurs within an organization via repeated use of prior knowledge accumulated by the firm. This assumption is partially erroneous as firms actively seek not only explorative knowledge but also exploitative knowledge in their external environment [15,16]. Moreover, firms' reliance on external knowledge resources is becoming increasingly important in sustaining competitive advantage in the current market. Given such importance of external exploitative learning, exploitative learning exclusively relying on the internal knowledge to the exclusion of external one may not be sufficient to improve performance in the current market.

Second, although a causal relationship between ambidexterity in learning and innovation has long been highlighted [17], there is a lack of studies that examine the intermediary role of ambidexterity in innovation in the relationship between ambidexterity in learning and performance. Therefore, it remains unclear whether the simultaneous pursuit of the two learning activities (i.e., ambidexterity in learning) indeed leads to a balance between exploitative and explorative innovation (i.e., ambidexterity in innovation) that consequently results in superior performance.

In this regard, we argue that the concept of external knowledge search strategies presented by research on open innovation can shed light on a new perspective on inter-organizational ambidexterity. Studies on open innovation classify firms' strategies of acquiring external knowledge into two different dimensions—external search breadth and depth—and suggest that these search strategies are involved not only in inducing different modes of organizational learning, but also in having differing impacts on the degree of novelty of innovation (i.e., exploitative versus explorative innovation) [18–20].

Although scholars in this field overlook the combined impact of the two search strategies on a firm's innovation performance in the context of ambidexterity, it is likely that high levels of both learning strategies can be achieved without significant trade-offs because the amount of knowledge that firms can acquire through their external environment is practically unlimited [5]. Extending logic mentioned above, we first suggest that maintaining high levels of both external search strategies is mutually beneficial for a firm's product innovation performance, by defining organizational ambidexterity as a firm's ability to pursue high levels of external search breadth and depth simultaneously. To assert so, we will integrate two dimensions of organizational ambidexterity into a unified mediation model to provide greater theoretical clarity to the performance implications of organizational ambidexterity. More specifically, through a mediated moderation analysis, we establish and test a mechanism where high levels of both search strategies (i.e., ambidexterity in learning) result in a balance between exploitative and explorative innovation (i.e., ambidexterity in innovation), which consequently has a positive impact on a firm's innovation performance. There is no recognized existing research that applies an ambidexterity perspective to a firm's external search activities to date.

Additionally, in line with the existing findings on absorptive capacity suggesting that the efficiency of knowledge creation depends on the degree of interaction between external knowledge acquisition and internal absorptive capacity—defined as “a firm's ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends” [21] (p. 128), we further introduce a moderated mediation model to investigate how the combined effect of search breath and search depth on a firm's innovation performance through balanced innovation varies depending on its absorptive capacity.

For the 612 Korean innovative manufacturers extracted from the National Innovation Survey of Korea, our finding points to the necessity of integrating different modes of external search capabilities in conjunction with internal absorptive capacity to achieve superior innovation performance.

2. Literature Review

2.1. Organizational Ambidexterity

2.1.1. Ambidexterity in Learning

Despite varying interpretations of the construct of organizational ambidexterity across disciplines, there exists a broad recognition that it consists of two distinct but related dimensions: ambidexterity in learning and innovation [5]. Whereas ambidexterity in learning pertaining to the strategic input dimension of ambidexterity refers to a firm's efforts to excel at both exploitative and explorative learning activities simultaneously [6,22], ambidexterity in innovation pertaining to the output dimension of ambidexterity refers to a firm's efforts to generate both exploitative and explorative innovation [1,2,23]. The two dimensions are interrelated and play essential roles in improving the firm's performance together [22,24]. Accordingly, numerous prior studies have paid attention to integrating and synchronizing the contradictory nature of exploitative and explorative learning as an antecedent of implementing both modes of innovation. From the learning perspective, they are differentiated by the type of learning [5,6,25]. Exploitative learning refers to an organization's local search efforts to acquire knowledge for the refinement of existing products [26], whereas explorative learning refers to non-local search efforts departing from existing knowledge bases to acquire new knowledge for creating new products and services [27].

The central question related to ambidexterity in learning has long been whether both explorative and exploitative learning are simultaneously achievable at a high level or incompatible. Ambidexterity research focuses on how organizations can synchronize both types of learning simultaneously and internally [17,28]. Subsequently, several mechanisms such as structural separation [1,2] and temporal cycling [7,29] that help firms maximize both learning activities internally have been introduced.

Several scholars, however, argue that the simultaneous pursuit of high levels of both types of learning within firm boundaries may be unachievable because they compete for scarce resources due to their fundamentally different organizational structures, strategies, and routines [5,13,25], and the self-reinforcing nature of learning from past experiences fortifies the tendency to sustain and augment current learning [7,10]. In this view, explorative and exploitative learning are perceived as two mutually exclusive ends of a continuum in which a high level of one learning implies a low level of the other [4].

However, emergent research on knowledge processes and innovation, which stresses the importance of external exploration, introduces the notion of domain separation in inter-organizational context [9,11,13,14,22]. A fundamental assumption is that the inherent trade-offs can be overcome by achieving an overall balance between exploration and exploitation across loosely connected but different domains, each of which specializes in either exploration or exploitation within a given domain [10]. In this context, explorative and exploitative learning are conceptualized as orthogonal to each other, such that firms can pursue high levels of both learning activities concurrently, resolving constraints in resource allocation [5,6,22,30].

Notably, a combination of external exploration and internal exploitation has drawn much attention in the research on strategic alliance [9,11] and absorptive capacity [13,14]. For instance, Lavie and Rosenkopf [9] found that, over time, firms seek to synchronize exploration and exploitation across domains rather than within a domain in their alliance portfolios. Further, Rosenkopf and Nerkar [12] found empirical evidence that exploration beyond organizational boundaries had more influence than exploration within organizations. In a similar vein, Rothaermel and Alexandre [13] reveal that the combination between external sourcing of new technologies and internal sourcing of known technologies has a positive impact on a firm's innovativeness (i.e., the total number of patents), whereas a firm's external exploitation is negatively related to innovativeness.

Extending this line of works, studies on process-based absorptive capacity emphasize the mutually supportive effect of external explorative and internal exploitative. They define organizational

ambidexterity as the complementarities between the two learning processes by distinguishing a firm's learning processes into external explorative learning processes for acquiring external knowledge and internal exploitative learning processes for converting externally acquired knowledge into new products [14,16,31]. Lichtenthaler [14], for example, found that the complementarity of external explorative and internal exploitative learning has a positive effect on a firm's new product development.

Although these studies reveal that high levels of both exploitative and explorative learning may coexist across different and loosely coupled domains, they are still limited in two aspects, one of which is that they overlook the importance of external exploitative learning while emphasizing that of external explorative learning. Most studies on inter-organizational ambidexterity view exploration as an external search for new knowledge, while exploitation as an internal search for the refinement of existing products based on the repeated use of preexisting knowledge within a firm. However, this classification is oversimplified as exploitation involves not only reusing existing knowledge within firms but also learning from others through search activities beyond firms' boundary [15,22].

Firms are likely to suffer from obsolescence when they source all relevant knowledge within their organizational boundaries [32,33]. Particularly in today's business environment where a convergence of diverse inter-industry knowledge is important [34–36], exploitation relying exclusively on prior knowledge within a firm may result in a competitive disadvantage in the current market. Indeed, many firms are searching for and acquiring valuable knowledge through distant search beyond their industrial boundaries to ensure their current viability [18,37]. For example, the automotive industry could increase the value of existing products and customer convenience by adopting head-up display technology that has long been used in the aerospace industry. Given such importance of external exploitative learning, it is unlikely that sole dependence on exploitative learning within a firm is sufficient to fully satisfy the needs of customers in the current market. Exploitation also has a significant influence on firms' future viability because it produces income that can be invested in future explorations [10]. Thus, successful exploitation can be a necessary condition for sustainable competitive advantage in the future market as well as in the current market.

Overall, despite the consensus on the idea that the two types of learning are orthogonal and simultaneously pursuable, research on domain separation is sparse and mostly limited to the context of external exploration and internal exploitation. Further research, therefore, is needed to identify relevant domains across which the simultaneous pursuit of both explorative and exploitative learning is achievable.

2.1.2. The Relationship between Ambidexterity in Learning and Innovation

Another limitation of existing studies on domain separation is the severe paucity of empirical studies on the relationship between two different dimensions of organizational ambidexterity. Concerning the relationship between ambidexterity in learning and innovation, Benner and Tushman [2] suggest that firms seeking to create both exploitative and exploratory innovation need to develop and implement ambidextrous strategies. Further, Colbert [38] claims that the interaction between exploitation and exploration provides each innovation with additional value. He and Wong [25] also find that firms that score high on both explorative and exploitative strategies achieve significantly higher sales growth from launching new and improved products. It is, therefore, logical to conclude that they are linked by a causal mechanism; ambidexterity in learning results in both modes of innovation, which consequently have a positive impact on firm's performance.

However, despite the importance of the intermediary role of ambidexterity in innovation, most prior empirical studies in domain separation are limited to tests of partial relationships: relationship of ambidexterity in learning to (1) financial performance [13,25], (2) overall innovation performance [25], and (3) explorative innovation performance [14]. This is largely because they assume that "ambidexterity is not a direct observable construct. Enhanced performance, therefore, would be an observable consequence of the unobservable construct of ambidexterity" [13] (p. 763). This view obscures the search for specific mechanisms through which ambidexterity in learning affects a firm's performance.

As a result, it is still unclear whether superior performance is achieved through ambidexterity in innovation or specialization in exploration in the context of inter-organizational ambidexterity.

Therefore, in order to empirically test the ambidexterity hypothesis for given learning activities, researchers need to examine whether the high-level pursuit of both activities contributes to the creation of both modes of innovation, which, in turn, improves firm performance. This also leads to the necessity to develop more fine-grained research designs reflecting the mediators and moderators that may affect the ambidexterity in learning - performance relationships [17].

To summarize the limitations of prior research, while organizational ambidexterity is comprised of two distinct but causally related dimensions - ambidexterity in learning and innovation - studies that distinguish them at the conceptual level are considerably scant. More importantly, relatively little is known with regards to the applicable domains across which firms can concurrently pursue high levels of both learning activities that can be antecedents of balancing exploitative and explorative innovation [10].

2.2. External Search Activities

Although earlier research argues that scarcity of resources prevents the pursuit of both exploitative and explorative learning within an organization, more recent studies suggest that access to external resources such as knowledge considerably eases resource constraints because resources in external environments are potentially unlimited [5,22]. Indeed, firms cannot acquire all relevant technological knowledge internally and, thus, intensively interact with their environment in diverse ways to access knowledge beyond their organizational boundaries [29]. Particularly, firms' external knowledge search activities play an essential role in promoting innovation as a part of a learning mechanism [39–41]. These are often highlighted as mechanisms to foster firms' dynamic capability that enables firms to reconfigure existing resources and learn new capabilities to both explore and exploit [26,33].

Firms interact with a myriad of external knowledge sources, such as suppliers, customers, competitors, universities, and research organizations through various forms of collaboration [42]. Research on open innovation distinguishes a firm's openness to external knowledge into external search breadth and depth based on the scope and intensity of interactions with external actors. External search breadth is defined as the number of external sources that the firm relies upon in its innovative activities. Thus, it represents the diversity of partners' types. On the other hand, external search depth, defined as the extent to which the firm draws deeply from different sources of innovative ideas, represents the intensity of collaboration with these partners [18–20,43]. While search breadth reflects the horizontal dimension related to acquiring heterogeneous knowledge, search depth reflects the vertical dimension related to acquiring unique, complex, within-field knowledge [44].

This taxonomy is in line with the knowledge acquisition mechanisms proposed in the literature on knowledge creation. These studies categorize a firm's R and D knowledge acquisition in collaborative R and D alliances into a primary and secondary knowledge creation process [40,45]. The primary knowledge creation process refers to the process to acquire explicit knowledge from an array of external partners through collaboration such as formal license agreements and R and D alliances, while the secondary knowledge creation process involves expanding the primary knowledge creation processes by establishing mutual trust and informal ties based on intensive interactions with partners. Firms successfully engaged in the secondary knowledge creation processes can extract partners' tacit knowledge embedded in their thinking, actions, and judgments [40,45].

Research on external search activities suggests that, although both search activities are essential in identifying and acquiring new knowledge, they have different effects on the novelty of innovation and a firm's innovation performance [18–20]. Using a large-scale sample of industrial firms from the UK, Laursen and Salter [18], for example, find that, while search breadth is related to both incremental and radical innovation, search depth is only associated with radical innovation. Chen et al. [19] distinguish between two modes of innovation: (1) Science-technology innovation based on codified technological knowledge and (2) innovation by doing, using, and interacting based on tacit knowledge embedded

in individuals' experience. They found empirical evidence that search breadth and depth positively affect both modes of innovation.

However, although the two distinct search dimensions are likely to affect both modes of innovation differently as discussed in the previous studies, little attention has been paid to the combined effect of the two learning strategies on ambidexterity in innovation and performance from the perspective of ambidexterity. Moreover, given that organizational knowledge-creation mechanisms comprise not only external but also internal learning process, and their interaction is critical in creating knowledge [41,46], It is crucial to investigate how the combined effect of both search strategies on a firm's innovation performance varies depending on the level of its internal learning process.

3. Hypotheses

3.1. External Search Breadth

The scope of knowledge required for the development of new products has been continuously expanded due to the shortened product lifecycle and frequent changes in customer needs. Therefore, acquiring a variety of knowledge from diverse external sources becomes crucial for the development of the firm's innovation systems [15]. A search for a wide range of external knowledge prevents firms from submitting to organizational inertia caused by excessive reliance on its existing knowledge and therefore allows them to seize opportunities for innovation [7,13].

In particular, searches for a wide range of external knowledge enhance firms' *combinative capabilities* that help them create distinctive new variations by recombining external knowledge and their own knowledge [47]. They, in turn, speed the pace of innovation and increases the number of new products [48]. Based on the arguments presented, we propose the following hypothesis:

Hypothesis 1. *A firm's external search breadth is positively related to its innovation performance.*

3.2. External Search Depth

External search depth is a learning process in which a firm can gain a deeper understanding of its partners' expertise through intensive interaction with them. The repeated use of partners' knowledge in specific fields leads to more reliable relationships with them. Such relationships, based on mutual trust and commitment, allow the firm to communicate more effectively [49]. Improved communication further advances the firm's ability to understand and acquire experience and expertise from its partners; it helps the firm accumulate a deep knowledge base [44]. The repeated use of the same knowledge domains can, thus, contribute to efficient product development and the commercial success of new products by enabling firms to better understand the requirements that new products should meet. It helps reduce the risk of failure in developing new products [7].

Moreover, a deeper understanding of partners' tacit knowledge embedded in their experiences can enhance the firm's capabilities to create distinctive knowledge by combining its established knowledge base and newly acquired knowledge [29,50]. Additionally, investment in relation-specific assets based on mutual trust can reduce the transaction cost related to the acquisition of external knowledge by mitigating the other party's opportunistic behaviors [41]. Based on the discussion above, we propose the following hypothesis:

Hypothesis 2. *A firm's external search depth is positively related to its innovation performance.*

3.3. Interaction between External Search Breadth and Depth

Firms engaged in primary knowledge creation processes can obtain useful explicit knowledge from various external knowledge sources [40,45]. Although diverse explicit knowledge can stimulate a variety of ideas, it is by no means easy to combine them into new ones because the new knowledge that

firms acquire is likely to be a collection of fragmented knowledge [22]. Without a full understanding of the fragments, firms might be able to only access surface-level knowledge, not the essence of new knowledge [18].

To substantially enhance their capabilities to combine various types of knowledge: *combinative capability*, firms need further efforts to extend their partner-specific relationships to secondary knowledge creation processes across diverse domains [40,45]. In-depth relationships with external sources based on mutual trust help firms understand the underlying principles and real opportunities hidden in the fragmented knowledge across diverse domains [50] and consequently integrate them into completely new patterns [31,44]. Therefore, firms will be more likely to create new, unique combinations of ideas to capitalize on if they build a deep knowledge base across a wide range of domains by pursuing both primary and secondary knowledge-creation processes. This implies that search depth can positively moderate the effects of search breadth on firms' innovation performance by enhancing their *combinative capabilities* [22,39,47].

In an analogous manner, the effect of external search depth on innovation performance can be enhanced via a complementary role of search breadth. Although deep relationships with a narrow range of external sources can facilitate the acquisition of professional expertise and breakthrough ideas in specific fields, the self-reinforcing nature of learning may lead firms to organizational myopia, and competency traps over time by constraining its learning activities to the current market [7,51]. We argue that the complementary role of search breadth can mitigate such risks. By integrating new knowledge from various domains into their deep understanding of specific fields, firms can discover opportunities to update and renew their problem-solving approaches and routines [14] and apply their expertise in specific fields to entirely different industries or new markets. This allows firms to overcome organizational inertia and path dependencies, and thereby discover unique ideas not only for refinements in the existing products line-up but also for breakthrough products [18,44].

Overall, the interaction between two search activities can contribute to the evolution of the firm's knowledge base over time because these activities are mutually complementary. More importantly, the two activities are orthogonal and pursuable together. External search breadth refers to an *ex ante* learning process through which firms can gain explicit knowledge from different external knowledge channels via formal collaborations, whereas external search breadth refers to an *ex post* learning process through which firms acquires tacit knowledge from external partners by extending the collaborative relationship they are already engaged in [18]. Therefore, they may occur sequentially in different periods and, thus, exist in different domains where they do not need to compete for scarce resources. We, therefore, posit that firms that pursue high levels of both search breadth and depth can achieve superior innovation performance. Based on the above discussion, the following hypothesis is proposed:

Hypothesis 3. *The interaction of external search breadth and depth is positively related to a firm's innovation performance.*

3.4. Role of Balanced Innovation (Mediated Moderation)

Extending the argument made in Hypothesis 3, we further suggest that it is through a close balance of exploitative and explorative innovation that the positive effect of pursuing high levels of both search activities on the firm's innovation performance can be achieved. More specifically, we argue that pursuing high levels of both learning activities facilitates a balance between exploitative and explorative innovation outcomes, which, in turn, positively affects firms' innovation performance.

3.4.1. Ambidexterity in Learning—Ambidexterity in Innovation Relationship

A one-sided focus on search breadth at the expense of search depth is more likely to lead to the incremental improvement, but not to the development of true breakthroughs. As knowledge spillover significantly increases after the emergence of a dominant design [44], a variety of proven technologies are widely distributed in the relevant industry. Firms engaged in the primary knowledge-creation

process can acquire diverse explicit knowledge from many external actors. Explicit knowledge is particularly useful in meeting the existing needs of the current market, thereby contributing to the incremental improvement of existing products [18,45,52]. Search breadth may involve novel recombination that results in explorative innovation [26]. However, combinative capabilities cannot be easily developed without an in-depth understanding of the relevant knowledge [44]. Similarly, excessive focus on search depth in a narrow range of specialized fields may also result in exploitative innovation over time [7]. Although search depth facilitates the acquisition of highly specialized competencies, it may also accelerate core rigidity over time, which makes it preferable to focus on refined expertise, deteriorating the ability to explore new ideas from other fields [5].

In contrast, pursuing high levels of both search strategies can contribute to creating both streams of exploitative and explorative innovation. Firms dedicated to high-level primary knowledge-creation processes can acquire explicit knowledge across diverse domains. However, firms successfully engaged in the subsequent secondary knowledge-creation process can upgrade their knowledge base into tacit knowledge across diverse fields. A deeper understanding of knowledge in various fields considerably enhances firms' combinative capabilities, which provides an opportunity to recombine fragmented knowledge bases across diverse fields into completely new patterns to generate breakthrough ideas for explorative innovation [31]. Thus, firms engaged in both search activities at a high level are likely to produce both exploitative and explorative innovation. Moreover, given mutually supportive nature of search breadth and depth that helps each leverage the effect of the other [30], we expect that high levels of both search strategies are likely to have a similar impact on the performance of each innovation type and thus contribute to achieving a close balance between exploitative and explorative innovation.

3.4.2. Ambidexterity in Innovation—Performance Relationship

While excessive orientation in either exploitative or explorative innovation leads to a *competency trap* [51] or a *failure trap* [53], a balance between exploitative and explorative innovation can enhance firms' innovation [4]. Such a balance can attenuate the risks stemming from the bias toward one or the other by allowing *cross-fertilization* among units in an organization [23]. Similarly, Cao et al., [30] found that the closer the balance between exploitative and explorative innovation, the stronger the leverage potential between them.

A balance between the two types of innovation enables explorative units to share important resources from exploitation units. For instance, firms that maintain such a balance can increase their market performance and competitive advantage of breakthrough products by applying competencies acquired from the current market such as manufacturing, marketing, service, and distribution capabilities, while preventing failure trap. Similarly, successful exploration can enhance exploitative efforts in the current market. Firms can mitigate the risk of obsolescence and, thus, sustain competitive advantage in the current product market by adopting unique expertise and routines gained through their explorative efforts to develop breakthrough products [3].

Consistent with the above argument, in a study of fifteen business units in nine different industries, O'Reilly and Tushman [23] found that firms that place equal emphasis on exploitative and explorative innovation achieve significantly superior market performance not only in breakthrough products but also in existing products than those specializing in either explorative or exploitation innovation. Their finding indicates that the closer the balance is, the higher innovation performance firms are likely to achieve.

Taken all together, we argue that high levels of both external search breadth and depth are likely to contribute to achieving a balance between exploitative and explorative innovation, which in turn positively affects firms' innovation performance. We, therefore, formulate the following hypothesis:

Hypothesis 4. *The positive interaction effect of external search and breadth on innovation performance is mediated through a balance between exploitative and explorative innovation outcomes.*

3.5. Role of Absorptive Capacity (Moderated Mediation)

Innovation refers to a series of knowledge creation processes that help solve problems faced by an organization [40]. The literature on knowledge process suggests that the knowledge creation process comprises both external and internal processes [16,40]. The external knowledge-creation process denotes firms' efforts to identify and acquire necessary knowledge beyond their organizational boundaries, while the internal knowledge-creation process denotes firms' efforts to convert novel ideas into commercial products through assimilation, accumulation, and application of the acquired knowledge [32]. The knowledge process literature terms such an internal knowledge integration mechanism as the firm's absorptive capacity [21]. Absorptive capacity determines the extent to which externally acquired knowledge is converted into new products [31]. A high level of absorptive capacity thus increases the speed and frequency of both exploitative and explorative innovation [16].

Firms' internal R and D capabilities play a crucial role in determining their absorptive capacity [13,18,20]. Research on absorptive capacity, therefore, argues that the efficiency of knowledge creation (i.e., innovation) is dependent on the interactive processes between firms' external search activities and internal R and D efforts by emphasizing the need to pursue high levels of both learning processes [16,31]. Hence, we suggest the following hypothesis:

Hypothesis 5. *The positive interaction effect of external search breadth and depth on a firm's innovation performance through balanced innovation is stronger in the presence of higher levels of absorptive capacity.*

4. Methodology

4.1. Data Sample and Data Collection

The research setting for our study is the manufacturing sector in Korea. To test our hypotheses empirically, we collected data from the Korea Innovation Survey 2014 (KIS 2014) [54], which was conducted in 2014 by the Science and Technology Policy Institute in Korea. Additionally, KIS Value, a corporate intelligence database of NICE Information Service Corp. and DRAT (Data Analysis, Retrieval, and Transfer System) from the Financial Supervisory Service of Korea's were also used.

The Korea Innovation Survey is a questionnaire on innovation activities of manufacturing and service firms in Korea. It is implemented to establish national innovation policies as well as to obtain primary data required in innovation research. It was developed based on the definition of innovation activities in the internationally recognized OECD Oslo Manual and designated as 'National Accreditation Statistics No. 39501' by the National Statistical Office in 2003. Of all the manufacturing firms under Korean Standard Industrial Classification (KSIC 10–33), the population in KIS 2014 included firms with ten or more full-time employees and which had carried out business activities for the three years (2011–2013) before 2014.

Firms that launched at least one innovative product (new or improved) during the survey period (2011–2013) were selected as the sample of our study. Furthermore, a careful selection of data such as firms' product innovation activities and performance, external knowledge sources used for innovation, and other relevant items were employed to finalize the sample of 612 firms from a total of 4075 Korean manufacturing firms that responded to KIS 2014.

4.2. Operational Definition and Measurement of Variables

4.2.1. Dependent Variable

Previous studies proxies a firms' innovation performance by the number of patents [22,55], the number of newly launched products [56], the percentage of sales revenue derived from new products [18,57], and the self-evaluation on the market share of innovative products [20,58]. However, patents have a drawback as an indicator of innovation performance because only a few patents are

commercialized into actual new products [18]. The percentage of revenue coming from new products within the firm also may not accurately reflect the competitive position of new products in the markets.

We, therefore, relied on a scale for perceptual performance used in many prior studies to capture the multidimensional construct of innovation performance [14,15,20,28,30]. We measured a firm's innovation performance, the dependent variable of this study, as a composite index of four items that include market share growth, reduction of obsolescence risk, product diversification, and quality improvement in products [25,30]. In KIS 2014, respondents were asked to rate how new products they launched in the period 2011–2013 affected on performance on a four-point scale ranging from "0" (no impact) to "3" (strong impact) for each of these items. By aggregating the individual scores of multiple Likert items, we produced a Likert scale that can be taken to be interval scales ($\alpha = 0.702$) [59–64]. Thus, the maximum value of our dependent variable is 12, while the minimum value is 0.

In addition, skewness and kurtosis were used to check the normality of the composite index. Both values for skewness (-0.131) and kurtosis (-1.075) fall within the acceptable range of -2 to $+2$ for normal distribution [65], indicating that the distribution is approximately normal and the basic assumption of parametric testing is fulfilled.

4.2.2. Independent and Mediating Variables

External Search Breadth and Depth

Following the operational definition in previous studies, we measured the breadth and depth of external knowledge search activities of sample firms from the responses to "information sources and collaborative activities for product innovation" in KIS 2014. We first identified a total of ten external knowledge sources: suppliers; competitor and other enterprises in the same industry; consultants; universities or other higher education institutes; government or private non-profit research institutes; clients or customers in public sector; clients or customers in private sector; professional conferences or fair; professional publications or technical press; professional associations or committees.

Firms that responded to KIS 2014 were asked to report whether each of the sources was used for their product innovation. For each knowledge source, we assigned a score of 1 when the firm used the given source and 0 when the firm did not use the given source; the sum of the scores from the ten sources was used to measure the firm's external search breadth [18–20].

Firms participating in KIS 2014 also responded to the intensity of relationship with the external sources used in their innovation activities ranging from "1" (low intensity) to "3" (high intensity). Following prior studies [43,66], We measured each firm's external search depth by calculating the ratio of the total score of actual responses to the maximum possible total score firms can get from the external sources they used.

Absorptive Capacity

Following the operational definition from prior research [13,21,22], we measured a firm's absorptive capacity by the natural logarithm of the annual average R and D spending for three years (2011–2013).

Innovation Balance

Following previous studies, we classify product innovation into exploitative and explorative innovation. Exploitative innovation is defined as radical innovation designed to meet the needs of emerging customer and markets, whereas explorative innovation is defined as incremental innovation designed to meet the needs of existing customers and market [2] (p. 243). Building on these definitions, we calculated "innovation balance" by the relative proportion between explorative innovation measured by new-to-the-market products and exploitative innovation measured by "new-to-the-firm products, which were launched as a result of three years of innovation activities, in a firm's total sales in 2013. Following the equation from previous studies [13], the innovation scores ranged from 0.5 to 1; firms that maintained the same proportion of sales between the two types of innovation have a value of 1,

while firms that had either exploitative or explorative product innovation in sales have a value of 0.5. The formula can be expressed as follows:

$$1 - \left| \frac{\text{Proportion of exploitative innovation in sales}}{\text{Proportion of exploitative innovation in sales} + \text{proportion of explorative innovation in sales}} - 0.5 \right|$$

4.2.3. Control Variables

We controlled for several industrial and organizational factors that could potentially affect the novelty or performance of innovation. As firms' innovation strategies, novelty, and performance vary depending on the industry's dynamics [14,15], we controlled for the effects of different industries to which firms belonged under Korean Standard Industrial Classification by creating a set of dummies.

The second variable, firm size, may affect a firm's willingness to invest in innovation and account for performance differences between firms [67]. To control the effects of firm size, we included the natural logarithm of the number of employees in the firm. In a similar vein, a firm's listing status was also operationalized as a dummy and included in the estimated models.

In addition, as aging firms are more likely to focus on improving existing products due to organizational inertia, while start-up firms inherently pursue a first-mover advantage due to a lack of resources and customers [10], we control the effects of firm's age measured by the number of years from its incorporation and start-up status operationalized as a dummy.

5. Analyses and Results

5.1. Research Model

We first hypothesized that pursuing high levels of both external search breadth and depth is likely to lead to better innovation performance than pursuing either one or the other. This is denoted as (1) and (2) in the research model (Figure 1).

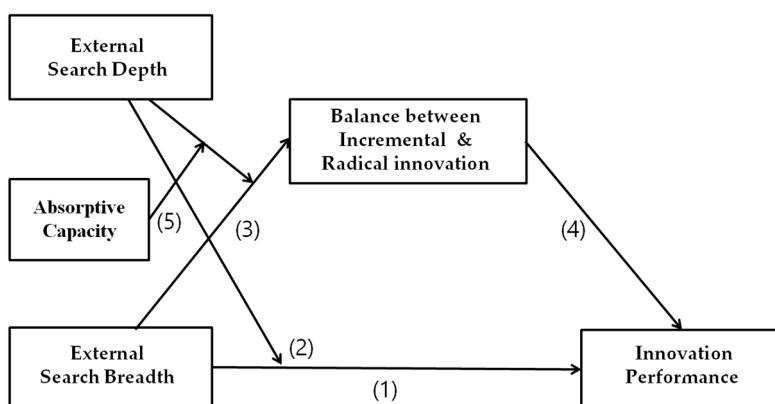


Figure 1. Research model.

Second, we tested the hypothesis that pursuing high levels of both search strategies contributes to achieving a balance between exploitative and explorative innovation, denoted as (3), which, in turn, has a positive impact on the firm's innovation performance, denoted as (4) (mediated moderation model). Finally, we hypothesized that a firm's absorptive capacity positively moderates the interaction effect of external search breadth and depth on innovation performance through balanced innovation (moderated mediation model). These relationships are denoted as (5).

5.2. Methodology

Mediated moderation and moderated mediation analysis were conducted using SPSS 24 [68] and PROCESS macro for SPSS v. 2.16 [69] based on the ordinary least squares regression-based path analysis suggested by Muller et al. [70]. This approach integrated the mediated moderation model suggested by Baron and Kenny [71] and the moderated mediation model suggested by James and Brett [72] into a unified analytical model to test each model's effect in accordance with causal steps.

The bootstrap confidence interval approach was applied to test the statistical significance of indirect effects (mediation effect) [69,73]. We calculated the lower limit (LLCI) and upper limit (ULCCI) of a 95% bootstrap confidence interval for indirect effects, using 5000 bootstrap samples. For conditional effect (moderation effects) analyses, all pertinent independent variables were mean-centered to minimize possible collinearity [74].

5.3. Results

5.3.1. Interaction between External Search Breadth and Depth

Table 1 presents the descriptive statistics and correlations of the key variables.

Table 2 provides the results of the hierarchical multiple regression analysis conducted to examine the effects of moderation (conditional effect), mediation (indirect effect), mediated moderation (conditional indirect effect), and moderated mediation (conditional indirect effect) presented in the hypotheses. The results of Model 1 reveal that, among other control variables, FIRM SIZE ($b = 0.460$, $p < 0.01$) and absorptive capacity measured by R and D intensity ($b = 0.405$, $p < 0.001$) have significant positive relations with firms' innovation performance. In Model 3, the coefficients for BREADTH ($b = 0.156$, $p < 0.05$) and DEPTH ($b = 1.649$, $p < 0.001$) are positive and significant, supporting Hypotheses 1 and 2.

Table 1. Descriptive statistics and correlation matrix (N = 612).

Variables	M	SD	1	2	3	4	5	6	7	8	9
1. INNO_PERFORM	7.01	3.59	1.00								
2. STARTUP	0.49	0.50	-0.016	1.00							
3. LISTED FIRM	0.17	0.37	0.043	-0.161 **	1.00						
4. FIRM SIZE (log)	4.37	1.29	0.196 **	-0.284 **	0.493 **	1.00					
5. FIRM AGE	18.85	13.17	0.049	-0.192 **	0.287 **	0.459 **	1.00				
6. R and D (log)	5.89	2.07	0.2530 **	-0.051	0.358 **	0.579 **	0.269 **	1.00			
7. BREADTH	2.37	2.55	0.2230 **	-0.017	0.085 *	0.177 **	0.059	0.152 **	1.00		
8. DEPTH	0.58	0.39	0.271 **	-0.035	0.083 *	0.115 **	0.067	0.144 **	0.420 **	1.00	
9. INNO_BALANCE	0.52	0.08	0.236 **	-0.035	0.131 **	0.241 **	0.160 **	0.163 **	0.172 **	0.136 **	1.00

* p < 0.05; ** p < 0.001.

Table 2. Hierarchical multiple regression for innovation performance and innovation balance.

Variables	Innovation Performance (Model 1–5)					Innovation Balance (Model 6–8)			Innovation Performance			
	Model 1		Model 2		Model 3	Model 4		Model 5	Model 6	Model 7	Model 8	Model 9
	B	B	B	B	B	B	B	B	B	B	B	Innovation Performance
<i>Control Variables</i>												
STARTUP	0.243 (0.299)	0.205 (0.294)	0.235 (0.290)	0.160 (0.289)	0.090 (0.290)	0.002 (0.007)	-0.001 (0.007)	-0.004 (0.007)	0.168 (0.286)			
LISTED FIRM	-0.886 * (0.436)	-0.841 (0.429)	-0.901* (0.422)	-0.887* (0.420)	-0.937 * (0.421)	0 (0.010)	0.001 (0.010)	-0.001 (0.010)	-0.893 * (0.415)			
FIRM SIZE (Log)	0.460 ** (0.161)	0.415 ** (0.158)	0.418 ** (0.156)	0.436 ** (0.155)	0.476 ** (0.156)	0.011 ** (0.004)	0.012 ** (0.004)	0.013 *** (0.004)	0.359 * (0.155)			
FIRM AGE	-0.006 (0.012)	-0.008 (0.012)	-0.009 (0.012)	-0.011 (0.012)	-0.014 (0.012)	0.001 (0)	0 (0)	0 (0)	-0.014 (0.012)			
R and D (Log)	0.405 *** (-0.085)	0.373 *** (0.084)	0.358 *** (0.083)	0.366 *** (0.083)	0.285 ** (0.105)	0 (0.002)	0.001 (0.002)	-0.004 (0.003)	0.361 *** (0.082)			
<i>Independent Variables</i>												
BREADTH		0.263 *** (0.057)		0.156 * (0.061)		0.075 (0.067)	0.119 (0.070)	0.003* (0.002)	0 (0.002)	0.002 (0.002)	0.073 (0.066)	
DEPTH			1.649 *** (0.382)		3.244 *** (0.667)		2.919 *** (0.683)	0.014 (0.009)	0.075 *** (0.016)	0.067 *** (0.016)	2.758 *** (0.671)	
INNO_BALANCE											6.489 *** (1.690)	
<i>Interaction</i>												
BREADTH × DEPTH			0.930 ** (0.319)		0.813 * (0.324)			0.035 *** (0.008)	0.032 *** (0.008)	0.700 * (0.321)		
BREATH × R and D					-0.065 * (0.031)				-0.002 * (0.001)			
DEPTH × R and D						0.630 (0.344)			0.032 *** (0.008)			
<i>Three-way interaction</i>												
Breadth × DEPTH × R and D				0.219 (0.155)					0.013 ** (0.004)			

Table 2. *Cont.*

Variables	Innovation Performance (Model 1–5)					Innovation Balance (Model 6–8)			Innovation Performance								
	Model 1		Model 2		Model 3	Model 4		Model 5	Model 6		Model 7	Model 8		Model 9			
	B	B	B	B	B	B	B	B	B	B	B	B	B				
<i>Model</i>																	
F-Statistics	3.975 ***		4.730 ***		5.345 ***		5.516 ***		5.180 ***		2.498 ***		3.193 ***		3.433 ***		4.752 ***
R ²	0.155		0.185		0.210		0.222		0.228		0.111		0.142		0.164		0.241
Adjusted R ²	0.116		0.146		0.171		0.181		0.184		0.066		0.097		0.116		0.200
Changes in R ²	.		0.030 ***		0.025 ***		0.011 **		0.007				0.031 ***		0.022 **		

Note: The table provides parameter estimates; standard errors are in parentheses. The estimated effects of industry dummies on dependent variables are not reported in Table 2 due to limitations of space. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The interaction effect of BREATH and DEPTH in Model 4 is positive and significant ($b = 0.930$, $p < 0.01$) and significantly improves the model fit ($\Delta R^2 = 0.011$, $p < 0.01$). Thus, *Hypothesis 3* is supported.

To present how the positive effect of BREATH on INNO_PERFORMANCE varies depending on the level of DEPTH, we identified regions of significance for interaction effects across the entire range of the moderator by employing the Johnson–Neyman technique [75]. The point of transition (value of DEPTH) that demarcates the regions where the interaction effects are significant and not significant is 0.607 ($M = 0.630$). When $M > 0.630$ (JNM1), the interaction effect between BREADTH and DEPTH is significant, but not when $M < 0.630$ (JNM1). That is, the effect of BREADTH on INNO_PERFORMANCE is positive among those who have a high level of depth ($M > 0.630$), but not significant among those who have a low level of depth ($M < 0.630$). These results provide strong evidence that firms pursuing high levels of both search breadth and depth achieve a higher innovation performance than those that are not. Johnson–Neyman (JN) Plot presented in Figure 2 shows this conditional effect of BREADTH on INNO_PERFORMANCE at values of the DEPTH.

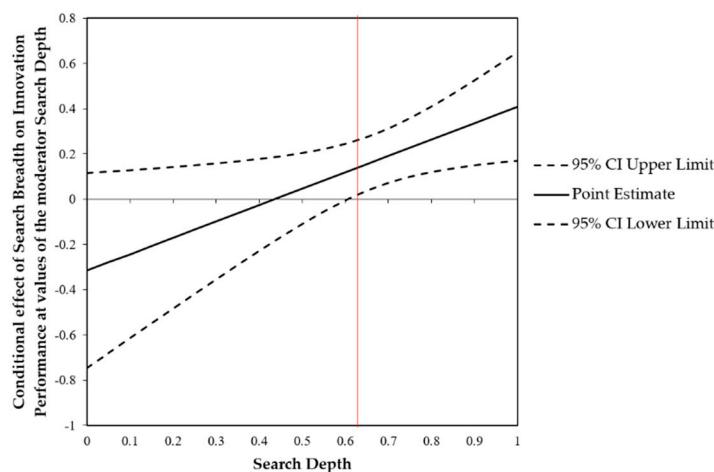


Figure 2. Conditional effect of search breadth on innovation performance at values of depth.

5.3.2. Mediated Moderation Analysis

To examine the mechanism through which the interaction of BREATH and DEPTH positively affects INNO_PERFORMANCE (Hypothesis 4), we conducted mediated moderation analysis by inserting INNO_BALANCE as a mediating variable. The findings in Model 7, reported in Table 2, show that the interaction of breath and depth has a positive effect on INNO_BALANCE ($b = 0.035$, $p < 0.001$). Using the Johnson–Neyman technique, we identified two regions in which the effect of BREADTH on INNO_BALANCE is significant along the values of DEPTH. The effect of BREADTH on INNO_BALANCE is significantly negative when $M \leq 0.450$ (JNM1) and significantly *positive* when $M > 0.651$ (JNM2). However, when $0.450 \leq M \leq 0.651$ (JNM2), the effect of BREADTH is not significant. These results suggest that firms maintaining high levels of both breadth and depth better achieve a balance between exploitative and explorative innovation outcomes than those that do not. The JN plot presented in Figure 3 illustrates this conditional effect of BREADTH on INNO_BALANCE at values of the DEPTH.

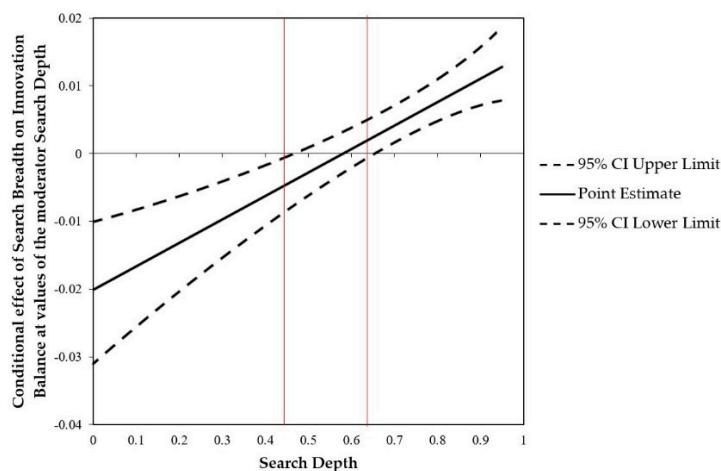


Figure 3. Conditional effect of search breadth on innovation balance at values of search depth.

As the next step for mediation analysis, in Model 9, we examined the effect of INNO_BALANCE on INNO_PERFORMANCE after controlling for the interaction effect of BREATH and DEPTH on INNO_PERFORMANCE. Whereas INNO_BALANCE has a positive effect on INNO_PERFORMANCE ($b = 6.489, p < 0.001$), the interaction effect of BREATH and DEPTH on INNO_PERFORMANCE (direct moderating effect) is still significant ($b = 0.700, p < 0.05$). This result demonstrates that INNO_BALANCE partially mediates the interaction effect of BREATH and DEPTH on INNO_PERFORMANCE. Table 3 reports the results of the bootstrap significance test for total, indirect, and direct moderating effects. We found that the indirect moderating effect (mediated moderating effect) ($b = 0.230, CI = 0.068–0.460$) is significant. This is consistent with the findings in hierarchical multiple regression analysis.

Table 3. Bootstrap significance test for total, direct, and indirect effects of BREADTH and DEPTH on INNO_PERFORMANCE.

	Effects (B)	Boot SE	Boot LLCI	Boot ULCI
Total Moderating Effect of BREADTH and DEPTH on INNO_PERFORMANCE	0.930	0.319	0.303	1.557
Direct Moderating Effect of BREADTH and DEPTH on INNO_PERFORMANCE	0.700	0.321	0.069	1.331
Indirect Moderating Effect of BREADTH and DEPTH on INNO_PERFORMANCE through INNOVATION BALANCE	0.230	0.099	0.068	0.460

Additionally, to examine how the mediation effects of INNO_BALANCE on the relationship between BREADTH and INNO_PERFORMANCE vary depending on the level of DEPTH, we calculated the conditional indirect effects of BREADTH on INNO_PERFORMANCE through INNOVATION BALANCE at the different values of DEPTH (+1 SD, 0, -1 SD), while testing their statistical significance by bootstrap confidence interval approach.

As reported in Table 4, the conditional indirect effect of BREADTH on INNO_PERFORMANCE through INNO_BALANCE (mediation effects of INNO_BALANCE) is significantly positive among those who have a high level of DEPTH ($b = 0.093, CI = 0.028–0.183$), but significantly negative among those with a low level of DEPTH ($b = -0.088, CI = -0.187–-0.023$). The results indicate that firms pursuing a high level of both external search breadth and depth achieve a balance between exploitative and explorative innovation, which consequently leads to superior innovation performance. Thus, Hypothesis 4 is supported.

Table 4. Conditional indirect effect of BREADTH on INNO_PERFORMANCE through INNOVATION BALANCE at the values of DEPTH.

Moderator (DEPTH)	Conditional Indirect Effects	Boot SE	Boot LLCI	Boot ULCI
Mediator (INNO_BALANCE)	0.187	-0.088	0.041	-0.187
	0.580	0.002	0.012	-0.024
	0.972	0.093	0.039	0.028

5.3.3. Moderated Mediation Analysis

Hypothesis 5 posits that the interaction effects of BREADTH and DEPTH on INNO_PERFORMANCE through INNO_BALANCE vary depending on the level of additional moderating variable, absorptive capacity (R and D). This means that “mediated moderation is once again moderated” (moderated mediated moderation) [69]. Therefore, the moderated mediation testing procedure was applied to examine Hypothesis 5 [70].

As the moderated mediation model assumes that the moderating effect should occur only in indirect paths [70,72], we first tested the three-way interaction effect of BREATH, DEPTH, and R and D (absorptive capacity) on INNO_PERFORMANCE (direct path). Because the three-way interaction effect on INNO_PERFORMANCE is not significant (Model 5 in Table 2), the first criterion of the moderated mediation analysis was met.

For the second step, by introducing an additional moderating variable, R and D to the first stage of the indirect path (BREADTH – INNOV_BALANCE), we examined how the interaction effects of BREADTH and DEPTH on INNO_BALANCE vary depending on the level of R and D. The three-way interaction term has a significantly positive effect on INNO_BALANCE ($b = 0.013, p < 0.01$) (Model 8 in Table 2). These results indicate that absorptive capacity does not affect the direct relationship between external search activities and innovation performance but the relationship between external search activities and innovation outcomes. The finding is consistent with the theoretical argument that absorptive capacity is the firm’s ability to convert externally acquired knowledge into new products [21].

Additionally, we examine how the interaction effect between BREADTH and DEPTH on INNO_BALANCE depends on the level of R and D by employing the Johnson–Neyman technique. While the interaction effect of BREADTH and DEPTH on INNO_BALANCE is not significant when $M \leq 4.738$ (JNM1), the interaction effect is significantly positive when $M > 4.738$ (JNM1). These findings suggest that, even among the firms that pursue high levels of both search strategies, firms with higher absorptive capacity better achieve a balance between exploitative and explorative innovation than those with lower absorptive capacity. Figure 4 is the JN plot that presents the conditional effect of the interactions between BREADTH and DEPTH on INNO_BALANCE at values of R and D.

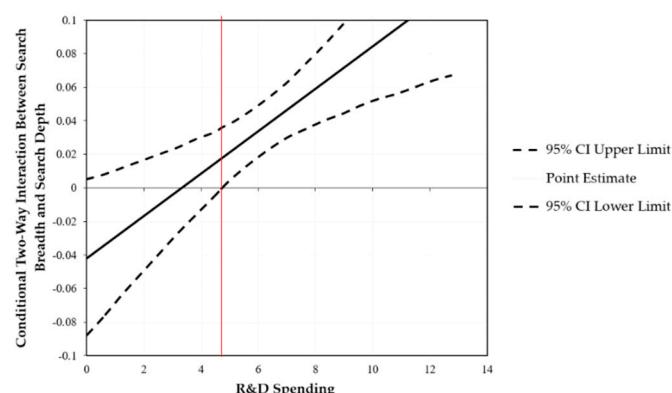


Figure 4. Conditional two-way interaction between search breadth depth as a function of R and D spending.

The three-way interaction presents a significant positive impact on INNO_BALNACE in the first stage of the mediation model, and subsequently, INNO_BALANCE presents a positive impact on INNO_PERFORMANCE. Additional bootstrap significance test for “moderated mediated moderation” also shows statistically significant results ($b = 0.083$ CI = 0.012–0.180).

Finally, in the given mediation process, we examined how the indirect effect (mediating effect of INNO_BALANCE) varies depending on the different levels of both DEPTH and R and D (+1 SD, 0, -1 SD) (Table 5). Even within the same group with a high level of DEPTH (0.972), we found that the indirect effects are different depending on the level of R and D: The indirect effect is significant in the group with medium (5.892) and high absorptive capacity (7.964), but not significant in the group with low absorptive capacity (3.820). Therefore, Hypothesis 5 is supported.

Table 5. Conditional indirect effect of BREADTH on INNO_PERFORMANCE through INNO_BALANCE at the values of moderators.

Mediator	Moderator (DEPTH)	Moderator (R and D)	Conditional Indirect Effects	Boot SE	Boot LLCI	Boot ULCI
INNO_BALANCE	0.187	3.820	0.016	0.040	-0.077	0.090
	0.187	5.892	-0.073	0.038	-0.171	-0.015
	0.187	7.964	-0.162	0.065	-0.318	-0.054
	0.580	3.820	0.033	0.018	0.001	0.071
	0.580	5.892	0.011	0.012	-0.015	0.033
	0.580	7.964	-0.010	0.017	-0.051	0.018
	0.972	3.820	0.049	0.038	-0.022	0.131
	0.972	5.892	0.095	0.039	0.026	0.184
	0.972	7.964	0.141	0.063	0.027	0.273

The results indicate that, even among firms pursuing a high level of both external search strategies, firms with high absorptive capacity are more likely to achieve a balance between exploitative and explorative innovation than those with low absorptive capacity, and subsequently, such a balance has a positive effect on their innovation performance. These results are consistent with the argument made in the organizational learning literature—that is, a firm’s knowledge creation mechanisms comprise of both external and internal learning processes, and the interactive mechanism between the two processes determines the efficiency of the entire knowledge-creation process [14,32,57].

6. Discussion

To bridge the gap between the research on inter-organizational ambidexterity and external knowledge search, we integrated their theoretical views and proposed a new perspective of organizational ambidexterity based on the firm’s external search activities. We classified firms’ external search behaviors into breadth and depth based on the scope and density of the relationship with firms’ external knowledge sources. A series of subsequent empirical tests indicate that the pursuit of a high-level in both modes of learning contributes to a well-balanced creation of both exploitative and explorative innovation, which, in effect, translates to better innovation performance. These findings provide strong evidence that a parallel pursuit of high levels of both breadth and depth can be an effective alternative to organizational ambidexterity. Although previous studies have examined the role of external search strategies in shaping firms’ innovation performance [18,19], no existing research has applied an ambidexterity perspective to a firm’s external search strategies to date.

In addition, we also found that the firms’ absorptive capacity works as a mechanism that plays an essential part in converting externally acquired knowledge into new products, thereby contributing to the creation of both types of innovation.

Our findings have the following theoretical implications that can contribute to furthering the research on organizational ambidexterity. First, we found that the breadth and depth of external searches are orthogonal to each other; they can be pursued concurrently at high levels without causing

trade-offs. Moreover, their interaction can yield a synergistic effect on the firms' innovation performance by creating additional values for their distinctive effects. These findings are consistent with those of previous studies that there is a time lag between the two learning activities [18] and that access to external knowledge can considerably alleviate resource constraints [5]. Despite the extant research findings that domain separation allows a high-level, parallel pursuit of exploitation and exploration, there is little known about the applicable domains across which firms can concurrently pursue high levels of both learning activities without trade-offs [10]. In this regard, our findings can guide future research on strategic antecedents of organizational ambidexterity.

Second, we integrated input (ambidexterity in learning) and output factors (ambidexterity in innovation) into a mediated moderation model to explore the mechanism through which ambidexterity in learning affects a firm's performance. The findings indicate that the two ambidexterity notions are, in fact, not independent of, or disjointed from, each other. They form a causal relationship and can together contribute to performance enhancement.

Third, we found empirical evidence to reveal that balancing exploitative and explorative innovation contributes to performance enhancement. Although previous research highlights the importance of a balance between the two types of innovation [76], most empirical studies therein heavily focus on the ambidexterity in learning—performance relationship, while excluding the role of ambidexterity in innovation. Our results, however, provide empirical evidence that firms that place an equal emphasis on creating the two types of innovative products achieve superior performance in both product markets than those who overcommit either explorative or exploitative innovation.

Lastly, we provide important implications regarding the role of absorptive capacity as an internal knowledge-creation process. The results of moderated mediation analysis reveal that, even among the firms that pursue both external search strategies at high levels, the interaction effect of breadth and depth on balanced innovation is only observed among those with a high absorptive capacity. In addition, consistent with the arguments in prior studies [21], we found that the absorptive capacity has a significant influence on converting externally acquired knowledge into commercial products (the first stage of the mediation process in our model), which, in turn, ensures the creation of both modes of innovation. Prior research on absorptive capacity and knowledge process has focused on the relationship between external search breadth and internal absorptive capacity while ignoring the role of external search depth, but our results suggest that the interaction effect of external search breadth and absorptive capacity is significantly positive only among those with high levels of external search depth. These findings point to the need for future research to introduce the notion of external search depth in the research setting for inter-organizational learning.

Our findings have practical implications for managers. Firms need to build relationships to collaborate with a wide number of external channels. In doing so, they can identify and acquire valuable knowledge to make significant refinements and new inventions [77]. However, they require further efforts to advance these relationships based on mutual trust and commitment so that firms can acquire partners' core competence. These relationships carry particular salience since they can offer combinative capabilities, that is, the ability to recombine various types of external and internal knowledge to create breakthrough capabilities. Firms are also encouraged to invest their effort into internal R and D to build their absorptive capacity. This can be an instrumental factor in identifying necessary knowledge from external sources, assimilating externally acquired knowledge, and converting it into new products. In sum, our findings suggest that firms need to develop both modes of external search capabilities in conjunction with internal absorptive capacity to realize organizational ambidexterity and subsequent superior innovation performance.

In terms of practical aspects of implementing ambidexterity, the literature on strategic alliance highlights the importance of establishing dedicated boundary spanning units that are separated from daily running business [78]. The scope and intensity of boundary spanning activities with external partners have a significant impact on learning and trust among partners. A broader scope of boundary

spanning activities in different domains allows individuals involved in alliances to identify various learning opportunities [15].

However, if individuals involved in an alliance handle many other tasks simultaneously within their organization, they cannot focus exclusively on the interaction with external partners. Such barriers may undermine the firms' capacity to collaborate and learn partners' best practices [79]. Firms can overcome such limitations by establishing dedicated alliance units within organizations [78]. Structurally separated, dedicated units allow their team members to spend more time with alliance partners and facilitate inter-organizational socialization [80]. Socialization plays a vital role in developing informal ties and inter-personal trust with external partners [39]. Competence-based trust can improve firms' capacity to understand partners' ways of thinking and, thus, facilitates the extraction of partners' tacit knowledge embedded in an individual's thinking and experience [45]. Therefore, the broader and the more intense firms' external ties, the more likely the firms are to identify creative ideas and learn how to integrate and leverage partners' intangible resources [81].

On the other hand, firms' boundary spanning units also have to build a strong "intra-organizational ties" with their internal specialists [78]. These ties are crucial to alliance learning as they connect the alliance activities back to firms' internal knowledge base that creates values in an alliance by identifying, diffusing, and leveraging partners' knowledge resources [14]. Hence, firms need to extend their effort to strengthen their internal knowledge base as it is an important necessary condition for establishing successful inter-organizational learning.

7. Limitations and Future Research

Our study is subject to several limitations that may also suggest future research. First, due to the specificity of the research sample selected for our analysis, we advise caution in generalizing our findings. The analysis involved 612 manufacturing firms in 23 industry sectors of Korea that produced outcomes through innovation in 2011–2013. Korea's socio-cultural peculiarities and the unique features of the manufacturing sector may have thus influenced our findings. Future research endeavors may be able to overcome such a limitation by validating the proposed analysis model in firms from various countries and industry sectors.

Second, as suggested above, external search breadth denotes an *ex-ante* learning process, while depth represents an *ex-post* learning process. This implies a potential time lag between the two learning processes. However, our study focused on search and innovation performance in one given period, and this remains a limitation. Future research endeavors on the impact of changes in search strategies overtime on a balance between innovation types and market performance may be able to present more meaningful implications.

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