

Article

A Study on the Mechanisms Linking Environmental Dynamism to Innovation Performance

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Abstract: The purpose of our study is to examine the mechanisms that link environmental dynamism to firms' innovation performance. Although there have been extensive studies on the effect of environmental dynamism on innovation performance, they have focused primarily on its direct effect and have resulted in rather inconsistent research findings. Thus, to explain the relationship between environmental dynamism and innovation performance more clearly, we intend to investigate the mechanisms through which environmental dynamism influences innovation performance in this study. Specifically, we aim to examine the mediation effects of strategic prospecting, absorptive capacity, and combined strategic prospecting–absorptive capacity on the relationship between environmental dynamism and innovation performance. Based on data collected from 266 small and medium-sized firms in Korea, our study has found that, assuming a causal interdependence between the mediators, both strategic prospecting and combined strategic prospecting–absorptive capacity mediate the relationship between environmental dynamism and innovation performance. It has also been found, however, that absorptive capacity alone does not mediate the relationship between environmental dynamism and innovation performance, while absorptive capacity mediates the relationship when it is linked to strategic prospecting. The results of our study further reveal that no direct effect of environmental dynamism on innovation performance exists, implying that the significant effect of environmental dynamism on innovation performance demonstrated in previous studies may be spurious in nature. Based on the findings, we present conclusions, theoretical and practical implications, and limitations with future research directions.

Keywords: environmental dynamism; strategic prospecting; absorptive capacity; innovation performance

1. Introduction

Under the context of dynamic changes in the environment with the trend of the Fourth Industrial Revolution, firms have exhibited great interest in innovation as a means of responding to environmental changes effectively for their sustainable competitive advantage [1]. Firms are naturally required to create or adopt something new to sustain their development or growth under the dynamic business environment [2]. Thus, many business scholars have been actively conducting research on the impact of environmental dynamism on firms' innovation or innovation performance [3–16].

A review of the literature reveals that existing studies on this issue tend to focus primarily on the direct effect of environmental dynamism on innovation or innovation performance. For example, Martinez-Conesa, Soto-Acosta, and Carayannis [8] have examined whether environmental dynamism has a direct influence on open innovation for small and medium-sized manufacturing companies in Spain. Pervan, Al-Ansaari, and Xu [11] have also studied the direct impact of market dynamism on innovation for SMEs in Dubai. Similarly, Turulja and Bajgoric [14] have examined whether environmental turbulence has a direct effect on product and process innovation for companies in

Europe, and Soto-Acosta, Popa, and Martinez-Conesa [15] have also studied the direct influence of this factor on radical and incremental innovation for SMEs in Spain. Besides, with respect to the results of these existing studies, many studies have revealed a significantly positive direct effect of environmental dynamism on innovation or innovation performance [5,8,12,14], while some studies have shown no significant direct effect [6,13]. A summary of the literature review is provided in Appendix A.

However, according to the literature, little research has been conducted examining the mechanisms through which environmental dynamism enhances firms' innovation performance, with the exception of research by Dhir, Aniruddha, and Mital [4] and Kim, Li, Yoo, and Kim [6]. Dhir et al. [4] have conceptually argued that environmental dynamism influences innovation performance positively through alliance network heterogeneity. Kim et al. [6] have empirically demonstrated that environmental dynamism improves innovation through external knowledge acquisition. While it may be important for managers to understand whether environmental dynamism has a direct positive impact on innovation performance, it is more important to understand how (i.e., through which mechanisms) environmental dynamism enhances innovation performance. Understanding "how" this occurs can provide firms with important implications regarding the improvement of innovation performance. In particular, given the lack of coherence, as noted above, among existing findings on the relationship between environmental dynamism and innovation or innovation performance, a study of the ways in which environmental dynamism affects innovation or innovation performance is required for a better understanding of that relationship.

Thus, we attempt to address the gap in the literature by identifying the mechanisms that link environmental dynamism to innovation performance effectively, based on theories in strategic management, and by analyzing the indirect effect of environmental dynamism on innovation performance through these mechanisms. In this study, we propose the following mechanisms for the first time in the literature that connect environmental dynamism with innovation performance: (1) strategic prospecting [17], based on the industrial organization theory that argues for an alignment between the environment, strategy, and performance (in the order environment > strategy > performance) [18]; (2) absorptive capacity [19], based on the dynamic capability theory that claims that there is an alignment between the environment, capability, and performance (environment > capability > performance) [20]; and (3) strategic prospecting–absorptive capacity, based on the strategic fit perspective that argues for an alignment between the environment, strategy, capability, and performance (environment > strategy > capability > performance) [21].

It is important to note that we take a mediation approach to the issue of fit or alignment in this study. According to Venkatraman [22], fit can be approached either by moderation (fit as moderation) or by mediation (fit as mediation), and it is believed that adopting the "fit as mediation" approach makes more sense here, as we intend to focus our analysis on the mediation effects of the mechanisms on the relationship between environmental dynamism and innovation performance.

Specifically, our study intends to investigate (1) the direct effect of environmental dynamism on innovation performance (direct effect), (2) the indirect effect of environmental dynamism on innovation performance through strategic prospecting (mediation effect), (3) the indirect effect of environmental dynamism on innovation performance through absorptive capacity (mediation effect), and (4) the indirect effect of environmental dynamism on innovation performance through the sequential path of strategic prospecting and absorptive capacity (double sequential mediation effect). In this regard, we address the following original research questions: (1) does environmental dynamism have a direct effect on innovation performance? (2) Does strategic prospecting mediate the relationship between environmental dynamism and innovation performance? (3) Does absorptive capacity mediate that relationship? (4) Does strategic prospecting–absorptive capacity mediate that relationship?

For empirical analysis, we utilized 266 valid questionnaires obtained by mail surveys from small and medium-sized firms engaged in 15 four-digit manufacturing industries in Korea. Our results about the direct effect showed that a total effect of environmental dynamism on innovation performance did exist, but when the mediators were considered, the direct effect of environmental dynamism

on innovation performance disappeared completely. This suggests that the relationship between environmental dynamism and innovation performance is completely mediated by the intervening mechanisms. Furthermore, according to our results about the mediation effect, strategic prospecting and absorptive capacity, respectively, mediated the relationship between environmental dynamism and innovation performance when they were assumed to be independent. However, assuming a causal interrelationship between these mediators, strategic prospecting still mediated that relationship, while absorptive capacity alone did not, but absorptive capacity in conjunction with strategic prospecting (strategic prospecting–absorptive capacity) mediated the relationship.

Our paper is structured as follows. The next section discusses the theoretical background of our research. The following section presents a research model and hypotheses for the direct effect of environmental dynamism on innovation performance and the indirect effect of environmental dynamism on innovation performance through strategic prospecting, absorptive capacity, and strategic prospecting–absorptive capacity. The subsequent section discusses the methodology of our study, followed by a section providing the results of our study. The final section presents the conclusions, implications, and limitations of our study with potential future research directions.

2. Theoretical Background

2.1. Environmental Dynamism

The external environment within which firms continue to interact for their survival and success has become more dynamic in the context of the Fourth Industrial Revolution. Environmental dynamism generally refers to the rate of change in environmental factors over time, including technologies, markets, competitors, suppliers, and customers [9,23]. The higher the rate of change in the environment, the more dynamic the environment becomes. Furthermore, the rate of change in the environment comes from the speed and strength of change in the environment, depending on how fast and strong environmental change is [24]. As such, Volberda and Van Buggen [24] define environmental dynamism as the frequency and intensity of change in the environment. In addition, environmental dynamism makes it difficult for firms to predict the environment due to environmental instability and uncertainty [24]. Therefore, as the environment becomes more dynamic, firms tend to experience more unpredictable, unstable, and uncertain environments. For this reason, the literature tends to view environmental dynamism as being equivalent to environmental instability, variability, and turbulence [25]. Based on the literature, we define environmental dynamism as the rate of change in the environment over time in terms of its speed and strength.

2.2. Innovation Performance

According to the literature, innovation can be defined as an interactive process of generating new products, knowledge, and technologies by utilizing capabilities and knowledge inside and outside a firm [26]. Such innovation can play a significant role in helping firms to achieve sustainable growth in response to their uncertain environment [27]. In addition, innovation performance refers to the outcome of innovation, and it may appear in the form of the development of new products, gaining new market opportunities, and gaining competitive advantage through innovation activities [28]. In other words, innovation performance can include patents, product development, product launches, and increases in sales, profits, or market shares due to product launches [29]. In a similar vein, innovation performance can also be conceptualized as the degree of success of a firm's new product development program in achieving its objectives [30]. Furthermore, the literature reveals that innovation performance can be measured based on the various definitions above. For example, innovation performance can be measured either by new technology development, new product development, and new product launches [31], by the sales or profit contribution of new products [28], or by how successful a firm's new product development program is from an overall profitability standpoint [30]. In accordance

with the existing literature, innovation performance is defined as the degree of success of a firm's new product development program in terms of achieving its objectives in this study.

2.3. Strategic Prospecting and Mediation Role, Based on Industrial Organization Theory

Miles and Snow [17] argue that firms face the following three decision-making issues regarding coping with their external environment: (1) an entrepreneurial issue—decisions on specific product- and market-related scope; (2) an engineering issue—decisions on a technology or method for producing and distributing products; and (3) an administrative issue—decisions on approaches to coordinate and implement strategies. They further argue that firms can pursue different strategies depending on how sensitively they respond to their external environment with respect to these decision-making issues. Thus, following Miles and Snow's rationale, we propose a concept of strategic prospecting in this study [32], which refers to firms' strategic orientation towards sensitively exploring and responding to the initial signals of environmental changes by pursuing new products, markets, and technologies in relation to the decision-making issues mentioned above. Thus, firms with a higher level of strategic prospecting will be more willing to proactively explore and respond to the early signals of market needs and opportunities and aggressively expand into new products and markets. As Shortell and Zajac [33] suggest, the level of strategic prospecting as a continuum can be matched with the different types of strategies proposed by Miles and Snow [17]. Pursuing higher levels of strategic prospecting is equivalent to pursuing a strategy closer to the prospector strategy, while pursuing lower strategic prospecting is equivalent to pursuing a strategy closer to the defender strategy. In other words, the higher a firm's strategic prospecting, the more offensive their strategic orientation, and the lower a firm's strategic prospecting, the more defensive their strategic orientation.

The industrial organization theory in strategic management argues, based on the traditional structure–conduct–performance paradigm, that the industry structure or environment affects firms' strategic behavior, which in turn influences their economic performance [34]. The theory suggests that firms develop and execute a strategy in line with their industrial environment, and the strategy has an influence on their economic performance. As such, the industrial organization theory proposes strategy as a mechanism (in the order environment > strategy > performance) that links the external environment to performance. From this viewpoint, it is believed that strategic prospecting can serve as a mediator (environmental dynamism > strategic prospecting > innovation performance) of the relationship between environmental dynamism and innovation performance.

2.4. Absorptive Capacity and Mediation Role, Based on Dynamic Capability Theory

Cohen and Levinthal [35] have initially defined absorptive capacity as “the ability of a firm to recognize the value of new, external knowledge, assimilate it, and apply it to commercial end” (p. 128). Based on this, Zahra and George [19] have further conceptualized absorptive capacity as a dynamic capability that creates and utilizes knowledge to enhance a firm's ability to gain and sustain a competitive advantage, and these researchers have argued that absorptive capacity consists of the four innovative processes of acquiring, assimilating, transforming, and exploiting new external knowledge. Specifically, these processes include acquisition for identifying and acquiring useful external knowledge, assimilation for analyzing and interpreting new external knowledge in comparison with existing knowledge, transformation for combining new external knowledge with existing knowledge, and exploitation for commercializing and utilizing new knowledge. Based on the literature, we define absorptive capacity as a firm's ability to acquire, assimilate, transform, and exploit new external knowledge.

The dynamic capability theory in strategic management argues that dynamic capability, which refers to a firm's ability to develop new knowledge and capabilities through the process of integrating and reconfiguring internal and external knowledge to adapt to changes in the environment, is a critical source of competitive advantage [22]. The theory suggests that, in response to environmental changes, firms need to enhance dynamic capability to create new knowledge and skills, through which

they can improve performance. As such, the dynamic capability theory proposes dynamic capability as a mechanism (in the order environment > capability > performance) to link the external environment to performance. In addition, the literature further suggests that environmental dynamism is a preceding factor which leads to the development of absorptive capacity [36]. Therefore, it is expected that absorptive capacity can play a role as a mediator (environmental dynamism > absorptive capacity > innovation performance) of the relationship between environmental dynamism and innovation performance.

2.5. Strategic Prospecting–Absorptive Capacity and Mediation Role, Based on Strategic Fit Perspective

The strategic fit perspective in strategic management argues that strategic fit or alignment, which means that environment, strategy, and capability are all linked, improves firms' economic performance [21]. This perspective suggests that firms can improve performance through both external fit, which aligns strategy with the environment by devising a strategy in line with the environment, and internal fit, which aligns capability with strategy by developing a firm's capability to support their strategy [37]. Besides, the strategic management perspective also suggests that firms can align the environment, strategy, and capability through the process of strategy formulation and implementation, thereby improving performance [9]. Thus, the strategic fit perspective proposes strategy and capability as a double sequential mechanism (in the order environment > strategy > capability > performance) that links the external environment to performance. Based on this perspective, strategic prospecting and absorptive capacity are expected to serve as a double sequential mediator (environmental dynamism > strategic prospecting > absorptive capacity > innovation performance) of the relationship between environmental dynamism and innovation performance.

3. Model and Hypotheses

The theoretical model of our study with all hypotheses is presented in Figure 1. In the first subsection, we theorize the effect of environmental dynamism on innovation performance in relation to the first research question. In the next subsection, we theorize the mediation effect of strategic prospecting on the relationship between environmental dynamism and innovation performance to deal with the second research question. In the following subsection, we theorize the mediation effect of absorptive capacity on the relationship between environmental dynamism and innovation performance in relation to the third research question. In the final subsection, we theorize the double sequential mediation effect of strategic prospecting and absorptive capacity on the relationship between environmental dynamism and innovation performance by addressing the last research question.

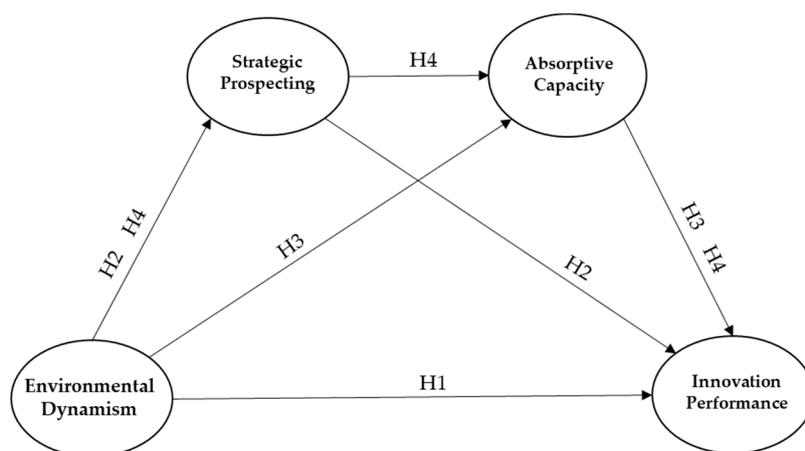


Figure 1. Theoretical model.

3.1. Environmental Dynamism and Innovation Performance

Environmental dynamism refers to the rate of change of various environmental factors over time [9]. Under a dynamic environment, firms will encounter a shift in technology and the market, a shorter product life cycle, unexpected competitor behavior, and other factors. In this circumstance, firms will be faced with the threat of the obsolescence of their existing products and markets, thereby requiring them to develop new products, markets, and technologies to cope with the threat [38]. Thus, when operating in a dynamic environment, firms are likely to focus on the innovation process of developing new products and markets [39], through which they can achieve improved innovation performance. Besides, prior studies have shown that environmental dynamism has a positive impact on innovation performance [10–12]. Therefore, it is expected that environmental dynamism is positively associated with innovation performance.

Hypothesis 1 (H1). *Environmental dynamism has a positive relationship with innovation performance.*

3.2. Mediation Effect of Strategic Prospecting

The industrial organization theory claims that the industrial structure or the environment shapes firms' strategy, which subsequently influences performance [18,34]. This theory suggests that firms' strategies can link the external environment to performance. Following the rationale of this theory, we argue that strategic prospecting can mediate the relationship between environmental dynamism and innovation performance (environmental dynamism > strategic prospecting > innovation performance). First, environmental dynamism is expected to have a positive effect on strategic prospecting. As firms operate in a dynamic environment, they are bound to experience significant environmental changes, such as a shift in customer needs, technology, products, and the market, a reduced product life cycle, and unexpected competitor behavior [25]. Under this circumstance, firms tend to be motivated or willing to sensitively explore and respond to the initial signals of the new market needs and opportunities posed by environmental changes by pursuing new technologies, products, and markets more aggressively [17]. Thus, facing a dynamic environment, firms are likely to pursue a higher level of strategic prospecting to cope with environmental changes. Raubitschek [40] also argues that, under a dynamic environment, firms not only seek to explore and understand environmental changes but also tend to choose a strategic direction that will increase the likelihood of success of new products and markets required to respond to environmental changes effectively.

Next, strategic prospecting is expected to have a positive effect on firms' innovation performance [32]. As firms pursue a higher level of strategic prospecting, they need to become more responsive to environmental changes by offering new products, markets, and technologies more proactively. Thus, firms with a higher level of strategic prospecting need to focus on the innovation process of developing new products, markets, and technologies, through which they eventually achieve enhanced innovation performance. For example, Apple, with a high level of strategic prospecting, pursues innovation aggressively by making large investments, thereby achieving a higher level of innovation performance as a result. Similarly, previous studies have revealed that firms that adopt the prospector strategy tend to produce improved innovation and innovation performance [32].

In summary, under a dynamic environment, firms are likely to pursue higher levels of strategic prospecting as a means of responding to environmental changes effectively, through which they are likely to eventually generate a higher level of innovation performance by enhancing the innovation process of developing new products, markets, and technologies. Based on the discussions above, we propose the following hypothesis.

Hypothesis 2 (H2). *Strategic prospecting will mediate the relationship between environmental dynamism and innovation performance.*

3.3. Mediation Effect of Absorptive Capacity

The dynamic capability theory suggests that, to respond to environmental changes effectively, firms need to improve their dynamic capability to create valuable new knowledge and skills through which they can enhance their competitive advantage and performance. According to this theory, we argue that absorptive capacity, as with dynamic capability [19], can mediate the relationship between environmental dynamism and innovation performance (environmental dynamism > absorptive capacity > innovation performance). First, environmental dynamism is expected to increase firms' absorptive capacity. Facing a dynamic environment, firms need to enhance their ability to absorb external knowledge to develop the new knowledge and skills required by the changes in the environment [36]. Operating in a dynamic environment, firms need to create new knowledge, skills, products, and markets to deal with the risk of the obsolescence of existing knowledge, skills, products, and markets due to environmental changes [39]. However, since firms will have difficulty in securing all the necessary knowledge internally [41], they tend to need to acquire new external knowledge through interactions with environmental factors [41]. Thus, under a dynamic environment, firms are likely to enhance absorptive capacity through investment to gain and utilize more external knowledge [19].

Next, it is further expected that absorptive capacity will contribute to improving innovation performance. Absorptive capacity is likely to promote innovation activities, such as developing new products, by successfully adding externally acquired knowledge to an existing knowledge base [42] and ultimately will have a positive influence on innovation performance [43]. According to the literature, a firm's search for external knowledge generally seems to have a greater impact on their innovation or innovation performance than their search for internal knowledge [28,41]. This suggests that an absorptive capacity to acquire, assimilate, transform, and exploit new external knowledge will play a critical role in enhancing innovation or innovation performance [19]. In addition, with an increase in absorptive capacity, firms are more able to secure the external knowledge required to cope with environmental changes, and with new external knowledge, firms can renew and reinforce their accumulated knowledge base [44] and eventually improve their innovation performance [35].

In summary, operating in a dynamic environment, firms are likely to be motivated or willing to enhance their absorptive capacity to secure the new external knowledge required to deal with environmental changes, through which they can enhance their innovation performance by strengthening innovation activities with new external knowledge. Based on the discussions above, the following hypothesis is proposed.

Hypothesis 3 (H3). *Absorptive capacity will mediate the relationship between environmental dynamism and innovation performance.*

3.4. Mediation Effect of Strategic Prospecting–Absorptive Capacity

According to the strategic fit perspective, firms can improve their competitive advantage and performance by achieving a strategic fit or alignment between the environment, strategy, and capability [35]. This suggests that firms can enhance their performance by aligning their strategy with the external environment and aligning internal capability with their strategy. Following this perspective, we argue that strategic prospecting and absorptive capacity can have a double sequential mediation effect on the relationship between environmental dynamism and innovation performance (environmental dynamism > strategic prospecting > absorptive capacity > innovation performance). First, as discussed in Hypothesis 2, environmental dynamism will have a positive effect on firms' strategic prospecting. Operating in a dynamic environment, firms tend to experience significant changes in products, technologies, and customer needs [25] and be motivated or willing to sensitively explore and respond to the initial signals of these environmental changes by pursuing new products, markets, and technologies, thereby pursuing higher levels of strategic prospecting [17]. Second, strategic prospecting will have a positive influence on firms' absorptive capacity. Firms with higher

strategic prospecting levels tend to explore and respond to environmental changes more proactively by developing new products and markets. To do this, they are likely to need new knowledge and skills to develop new products and technologies, but they may not be able to secure all of them internally [41]. Thus, firms tend to rely on external knowledge and skills and strengthen their absorptive capacity [19]. Lastly, as described in Hypothesis 3, absorptive capacity will have a positive effect on firms' innovation performance. Firms with enhanced absorptive capacity can create new knowledge and skills based on the external knowledge acquired, and they can reinforce their innovation activities with inputs of newly created knowledge and capabilities, thereby subsequently improving their innovation performance.

In summary, facing a dynamic environment, firms are likely to pursue higher levels of strategic prospecting by responding to environmental changes more proactively with the pursuit of new products and markets; then, firms with higher strategic prospecting levels tend to enhance their absorptive capacity to secure the new knowledge and skills needed to support their offensive strategic orientation; finally, firms with enhanced absorptive capacity, in turn, can improve their innovation performance with new knowledge and skills as critical inputs into the innovation process. In other words, it is expected that environmental dynamism will have a positive influence on firms' innovation performance through the double sequential mediation of strategic prospecting and absorptive capacity. Based on these discussions, we propose the following hypothesis.

Hypothesis 4 (H4). *Strategic prospecting and absorptive capacity will sequentially mediate the relationship between environmental dynamism and innovation performance.*

4. Methodology

4.1. Sample and Data Collection

The impact of environmental dynamism on firms' innovation or innovation performance varies across firm sizes and industries [6], although innovation activities are carried out in firms of all sizes and are widely conducted in small and medium-sized firms [45]. We, therefore, collected data from small and medium-sized manufacturing firms with 20 to 299 employees listed in the Directory of Korean Enterprises by the Korea Economic Daily in 2019. In line with recommendations in Oslo Manual 2019 [45], we selected 15 four-digit manufacturing industries from the directory in consideration of the diversity of their average R&D intensity as reported in the Korea Innovation Survey 2018 [46] and classified them into seven three-digit industries related to food, chemical, fabricated metal products, communications equipment, precision equipment, electrical equipment, and special purpose machinery. Out of these industries, 1706 firms were chosen as our effective target population after firms with incorrect contact information, less than four years of operation, and no product development activities were excluded.

A survey questionnaire was used to collect data for our study. We first drafted a questionnaire based on the literature. We then pretested the questionnaire on five senior executives of SMEs in relevant industries to assess the clarity and appropriateness of the questions and revised it based on their feedback. We further conducted a pilot test of the revised questionnaire on 14 senior executives of SMEs in relevant industries to assess the distribution or pattern of their responses and amended the questionnaire accordingly. Before mailing out the finalized questionnaire for our main study, we confirmed the names and addresses of our target respondents—the heads of our target population—by phone. Based on Nunally's [47] proposal for data collection, we sent mails to the heads of our target population three times with intervals of four weeks, followed by phone calls each time to ask for their participation in the survey. As a result, a total of 288 responses were retrieved, and 266 responses remained usable, with an effective response rate of 15.6%, after 22 substantially incomplete or insincerely filled-out surveys were excluded.

Regarding the characteristics of our sample firms, 23 (8.7%) had less than 5 million dollars in sales, 70 (26.3%) had 5–9.9 million dollars in sales, 146 (54.9%) had 10–49.9 million dollars in sales,

and 27 (10.2%) had 50 million dollars and above in sales. Of our sample firms, 15%, 17.7%, 15%, 12%, 10.9%, 16.2%, and 13.2% were in the food, chemical, fabricated products, communications equipment, precision equipment, electrical equipment, and special purpose machinery industries, respectively. In addition, with respect to the characteristics of our respondents, 52.8% were presidents or vice presidents, 18.2% were directors, and 29% were department heads or below. Our respondents had been in their current positions for 12.7 years on average. Considering these characteristics, we believe that our respondents were in a position to provide accurate information for our questionnaire.

We checked for common method bias as our study relied on a single respondent from each company to collect data to measure both dependent and independent variables in our study at the same time [48]. For this purpose, we conducted the Harman's one-factor test through a principal components analysis of all the variables included in our study, based on the work of Podsakoff and Organ [49]. This analysis derived a total of four factors with an eigenvalue of 1 or higher, and their distributed explanatory power was also shown evenly. Thus, it was very unlikely that our research results would be distorted by notable common method bias.

Furthermore, to examine non-response bias in our study, we performed a t-test to compare the two groups of early and late responses in terms of sales and the number of employees [50]. Early responses were those received from the first round of mailing, whereas late responses were those from the second and third rounds of mailing. As a result, no significant difference between the two groups in terms of sales ($p = 0.555$) and the number of employees ($p = 0.454$) was found. Thus, it was concluded that the possibility of non-response bias was very low in our study.

4.2. Measurement

4.2.1. Environmental Dynamism

Environmental dynamism, which means the rate of change in various environmental factors over time, was measured with a scale adapted from Jansen, Van Den Bosch, Volberda [51]. To measure this variable, we asked respondents to indicate the extent (1 = "strongly disagree" to 7 = "strongly agree") to which they agreed or disagreed with each of the following items on a seven-point Rickert scale: "product technologies in our industry change quickly", "environmental changes in our industry are intense", "the tastes and preferences of customers in our industry change quickly", "new products are frequently introduced in our industry", and "the rate of change in our competitors' strategic and tactical behavior in the market is very high".

4.2.2. Strategic Prospecting

Strategic prospecting refers to a firm's strategic orientation towards exploring and responding quickly and sensitively to the initial signals of the external environment by pursuing new products, markets, and technologies through risk-taking [17]. To measure this variable, we relied on a scale modified from Dyer and Song [52] and Conant, Mokwa, and Varadarajan [53]. Specifically, the question items included in this scale were as follows: "our firm spends significant amounts of time continuously monitoring the marketplace for changes and trends", "the products we provide to our customers are innovative and continually changing", "our organization has an image in the marketplace as a firm with a reputation for being innovative and creative", "one of our firm's key goals is the availability of the people, resources, and equipment required to develop new products and markets", "our managerial employees exhibit competencies (skills) that are entrepreneurial, diverse, and flexible, enabling change to be created", "the one thing that protects our organization from its competitors is that we are able to consistently develop new products and new markets", "our management staff concentrates on developing new products, new markets, and new market segments more than many of our competitors", "my organization identifies marketplace trends and opportunities that can result in product offerings new to the industry or able to reach new markets", and "the structure of our organization is product or market-oriented". For this measure, respondents were asked to indicate the

extent (1 = “strongly disagree” to 7 = “strongly agree”) to which they agreed or disagreed with each of the items listed above.

4.2.3. Absorptive Capacity

Absorptive capacity refers to a firm’s ability to acquire, assimilate, transform, and exploit new external knowledge [19]. To measure this variable, we relied on a scale adapted from Pavlou and El Sawy [54]. Specifically, respondents were asked to indicate the extent (1 = “strongly disagree” to 7 = “strongly agree”) to which they agreed or disagreed with each of the following items: “we have the ability to effectively identify and acquire external technical and market knowledge/information”, “we can successfully identify, evaluate, and acquire new external technical and market knowledge/information”, “we can effectively analyze technical and market knowledge/information obtained externally”, “we have the ability to assimilate new technical and market knowledge/information acquired externally”, “we can successfully integrate our existing knowledge with the new technical and market knowledge/information acquired externally”, “we have the ability to transform existing knowledge into new technical and market knowledge”, “we can successfully exploit internal and external technical and market knowledge/information into concrete applications”, and “we have the ability to effectively utilize technical and market knowledge for new products”.

4.2.4. Innovation Performance

Based on the existing literature, innovation performance is defined as the degree of success in achieving corporate goals through a new product development program [30]. To measure this variable, we adopted the scale used by Song, Dyer, and Thieme [30] and Lichtenthaler [55]. Specifically, for this measure, we asked respondents to indicate the extent (1 = “strongly disagree” to 7 = “strongly agree”) to which they agreed or disagreed with each of the following items: “the overall performance of our new product development program has met our objectives”, “from an overall profitability standpoint, our new product development program has been successful”, and “compared with our major competitors, our overall new product development program is far more successful”.

4.2.5. Control Variables

We included industry type, firm size, firm age, R&D intensity, and venture certification as control variables in our model and controlled their effects on strategic prospecting, absorptive capacity, and innovation performance. Since the type of industry is likely to influence corporate innovation performance [56], we controlled for industry type by dummy-coding seven industries. Larger firms with more resources may have a higher investment capacity for corporate innovation performance than smaller firms with fewer resources [57], and so firm size was controlled for and measured as the number of employees. Older firms can accumulate knowledge and experiences that may improve corporate innovation performance more than younger firms [58], and so firm age was controlled for in our study and measured as the number of years of operation. Since R&D investment can influence corporate innovation performance, we controlled for R&D intensity in our study and measured it as R&D expenses as a percentage of sales. Venture-certified firms tend to focus on corporate innovation performance more than other firms [59], and so we controlled for venture certification and dummy coded venture-certified firms as “1” and other firms as “0”.

5. Results

5.1. Reliability and Validity

We performed a confirmatory factor analysis, using AMOS 25, to assess the reliability and validity of the measurement in our study based on factor loading, average variance extracted (AVE), composite reliability (CR), Cronbach’s Alpha, and discriminant validity. We first evaluated construct reliability using CR and Cronbach’s Alpha, and the results, as shown in Table 1, demonstrated a fairly high level

of reliability that exceeded the recommended minimum value of 0.7 for both CR [60] and Cronbach's Alpha [61]. The unidimensionality of our constructs was then evaluated based on their convergent and discriminant validity. As shown in Table 1, all the items were significantly loaded on their corresponding factors, with factor loadings greater than the cutoff value of 0.60, and the AVE for each scale was higher than the threshold of 0.5. These results indicated an adequate level of convergent validity [62]. We further evaluated the discriminant validity of our constructs with the inter-construct correlation matrix presented in Table 2. As shown in the matrix, the square root of AVE for each factor was greater than any of its correlations with other factors, and this confirmed satisfactory discriminant validity for all the factors [63]. Lastly, as noted in Table 2, the goodness-of-fit results for our CFA model showed an acceptable level of fit, with $\chi^2 = 404.551$, $df = 183$, $p < 0.001$, $\chi^2/df = 2.211$, CFI = 0.939, TLI = 0.929, RMSEA = 0.068 [62,64].

Table 1. Results of confirmatory factor analysis. AVE: average variance extracted; CR: composite reliability.

Factors	Items	β	Factor Loading	S.E.	t-Value (C.R.)	SMC	AVE	CR	Cronbach's α
Environmental Dynamism	D1	1.000	0.701 ***			0.491	0.587	0.876	0.874
	D2	1.086	0.736 ***	0.099	10.959	0.542			
	D3	1.275	0.850 ***	0.103	12.407	0.722			
	D4	1.290	0.799 ***	0.109	11.809	0.639			
	D5	1.157	0.737 ***	0.105	10.975	0.543			
Strategic Prospecting	S2	1.000	0.731 ***			0.534	0.545	0.905	0.904
	S3	0.995	0.709 ***	0.088	11.361	0.502			
	S4	0.837	0.656 ***	0.080	10.474	0.430			
	S5	0.940	0.693 ***	0.085	11.090	0.480			
	S6	0.971	0.696 ***	0.087	11.152	0.485			
	S7	1.058	0.783 ***	0.084	12.616	0.613			
	S8	1.059	0.837 ***	0.078	13.531	0.701			
	S9	1.013	0.783 ***	0.080	12.607	0.612			
Absorptive Capacity	AC3	1.000	0.788 ***			0.621	0.725	0.929	0.929
	AC5	1.062	0.833 ***	0.070	15.215	0.694			
	AC6	1.161	0.872 ***	0.072	16.166	0.760			
	AC7	1.128	0.889 ***	0.068	16.605	0.791			
	AC8	1.163	0.872 ***	0.072	16.183	0.761			
Innovation Performance	IN1	1.000	0.715 ***			0.511	0.659	0.852	0.846
	IN2	1.283	0.870 ***	0.101	12.702	0.756			
	IN3	1.282	0.842 ***	0.103	12.481	0.709			

$\chi^2 = 404.551$, $df = 183$, $p < 0.001$, $\chi^2/df = 2.211$, CFI = 0.939, TLI = 0.929, RMSEA = 0.068. *** $p < 0.01$.

Table 2. Analysis of discriminant validity.

	CR	AVE	1	2	3	4
1. Environmental Dynamism	0.876	0.587	<i>0.766</i>			
2. Strategic Prospecting	0.905	0.545	0.435	<i>0.738</i>		
3. Absorptive Capacity	0.929	0.725	0.263	0.732	<i>0.852</i>	
4. Innovation Performance	0.852	0.659	0.216	0.674	0.594	<i>0.812</i>

Note: Diagonal elements in italics are the square roots of AVEs; off-diagonal elements are correlations between the constructs in the inner model.

5.2. Tests of Hypotheses

5.2.1. Descriptive Statistics and Correlations

Means, standard deviations, and correlations among the variables are shown in Table 3. As expected, all correlations among latent variables were significant and positive, which was consistent with the presumed direction of the relationships between relevant variables presented in our hypotheses. More specifically, correlations were higher in the direct relationships between variables than in the

indirect relationships, as hypothesized in our models. We calculated the variance inflation factor (VIF) for each of the regression equations to determine the presence of multicollinearity. The maximum VIF value in the models was 2.20, which was lower than the rule-of-thumb cutoff point of 10.

Table 3. Descriptive statistics and Correlations.

	Variables	Mean	SD	1	2	3	4	5	6	7
1	Innovation Performance	4.76	0.92	1	0.232 **	0.601 **	0.543 **	−0.134 *	0.055	0.154 *
2	Environmental Dynamism	4.87	1.06		1	0.419 **	0.258 **	−0.178 **	0.041	0.059
3	Strategic Prospecting	5.14	0.88			1	0.664 **	−0.105 **	0.018	0.092
4	Absorptive Capacity	5.09	0.90				1	−0.115	0.016	0.162 **
5	Firm age	21.66	13.45					1	0.205 **	0.091
6	Firm size	70.04	59.70						1	0.056
7	R&D Intensity	8.20	7.19							1

SD: Standard deviation; * $p < 0.05$; ** $p < 0.01$.

5.2.2. Parallel Multiple Mediator Model

Hierarchical Multiple Regression Analysis

Model 1 in Table 4 provides the results of the multiple regression analysis that examined the total effect of environmental dynamism on innovation performance, including all the control variables. As expected, the coefficient for environmental dynamism was positive and significant ($b = 0.232$, $p = 0.000$), thereby supporting Hypothesis 1. Among the control variables in Model 1, R&D intensity ($b = 0.021$, $p = 0.014$) and venture certification ($b = 0.619$, $p = 0.000$) had a significantly positive relationship with innovation performance, while firm size and firm age had no relationship with innovation performance.

Models 2, 3, and 4 in Table 4 present the results of the regression analysis, based on the causal step approach proposed by Baron and Kenny [65], for the mediation effects of strategic prospecting and absorptive capacity on the relationship between environmental dynamism and innovation performance, assuming that the two mediators are independent from each other. Models 2 and 3 revealed that environmental dynamism had a significantly positive effect on strategic prospecting ($b = 0.432$, $p = 0.000$) and absorptive capacity ($b = 0.273$, $p = 0.000$), respectively. As a final step of the mediation analysis, Model 4 showed that the effects of both strategic prospecting ($b = 0.381$, $p = 0.000$) and absorptive capacity ($b = 0.241$, $p = 0.000$) on innovation performance were still positive and significant after controlling for the effect of environmental dynamism on innovation performance. However, the direct effect of environmental dynamism on innovation performance was no longer statistically significant. These results suggested that strategic prospecting and absorptive capacity completely mediated the relationship between environmental dynamism and innovation performance [65].

Table 4. Results of multiple regression analyses.

Dependent Variables	Model 1	Model 2	Model 3	Model 4
	Innovation Performance	Strategic Prospecting	Absorptive Capacity	Innovation Performance
Variables	B(SE)	B(SE)	B(SE)	B(SE)
Firm age	−0.007 (0.004)	−0.002 (0.004)	−0.005 (0.005)	−0.005 (0.004)
Firm size	0.002 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 * (0.001)
R&D intensity	0.021 ** (0.008)	0.012 (0.008)	0.020 * (0.009)	0.011 (0.007)
Venture certification	0.619 *** (0.126)	0.459 *** (0.122)	0.192 (0.132)	0.397 *** (0.108)
Environmental Dynamism	0.232 *** (0.060)	0.432 *** (0.058)	0.273 *** (0.062)	0.001 (0.055)
Strategic Prospecting				0.381 *** (0.069)
Absorptive Capacity				0.241 *** (0.064)
R ²	0.206	0.262	0.133	0.455
Adj-R ²	0.172	0.230	0.095	0.427
F	5.995 ***	8.178 ***	3.542 ***	16.171 ***

Note: The table provides parameter estimates; standard errors are in parentheses. The estimated effects of six industry dummies on dependent variables are not reported in Table 2 due to limitations of space. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Statistical Inference about Mediation Effects

The causal step approach for mediation analysis proposed by Baron and Kenny [65] neither formally quantifies the indirect effect nor requires any kind of inferential test. Therefore, in order to statistically estimate and compare the indirect effects presented in our parallel multiple mediator model, we applied the bootstrap confidence interval approach by calculating the lower limit confidence interval (LLCI) and upper limit confidence interval (ULCI) of a 95% bootstrap confidence interval for indirect effects from 5000 bootstrap samples, using a path analysis modeling tool, PROCESS Macro for SPSS v. 3.14 [66].

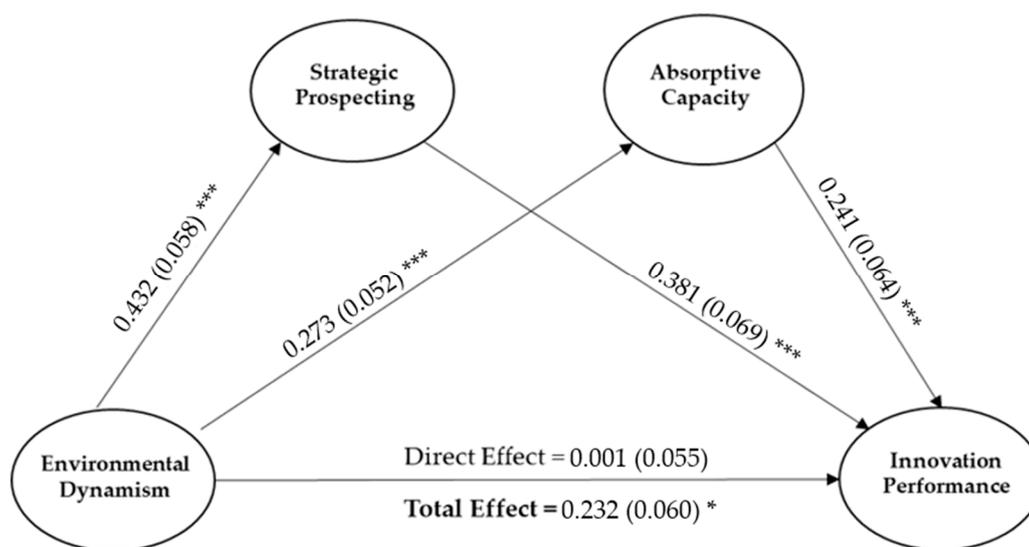
Table 5 reports the results of the bootstrap significance test for total, indirect, and direct effects, respectively. The total effect ($b = 0.232$, $CI = 0.114\sim 0.349$), indirect effect through strategic prospecting ($b = 0.165$, $CI = 0.096\sim 0.254$), and indirect effect through absorptive capacity ($b = 0.066$, $CI = 0.027\sim 0.124$) were all positive and significant, except the direct effect ($b = 0.001$, $CI = -0.107\sim 0.110$). These results were consistent with the findings in hierarchical multiple regression analysis. Therefore, Hypotheses 2 and 3 were both supported. Strategic prospecting and absorptive capacity were found to be the effective mechanisms or mediators through which environmental dynamism influenced innovation performance positively, assuming no interrelationship between the two mechanisms. All these results are summarized in Figure 2.

In addition, we conducted pairwise comparisons for the two indirect effects presented in our model to determine whether one effect was statistically different from the other in terms of strength. As indicated in Table 5, by generating bootstrap confidence intervals for all possible pairwise contrasts between two indirect effects, we found that the indirect effect of strategic prospecting was stronger than the indirect effect through absorptive capacity, and the difference in strength was statistically significant ($\Delta b = 0.099$, $CI = 0.007\sim 0.208$).

Table 5. Bootstrap significance test for the parallel multiple mediator model.

Effect	Path	b	Boot SE	p	Boot 95% CI	
					LLCI	ULCI
Total Effect (H1)	Environmental dynamism–innovation performance	0.232	0.060	0.000	0.114	0.349
Direct Effect	Environmental dynamism–innovation performance	0.001	0.055	0.981	−0.107	0.110
Total Indirect Effect		0.230	0.042		0.156	0.325
Indirect Effect 1 (H2)	Environmental dynamism–strategic prospecting–innovation performance	0.165	0.040		0.096	0.254
Indirect Effect 2 (H3)	Environmental dynamism–absorptive capacity–innovation performance	0.066	0.024		0.027	0.124
Pairwise Comparisons	Indirect effect 1–indirect effect 2	0.099	0.051		0.007	0.208

Note: Parallel multiple mediation analysis including all the control variables. Bootstrap samples: 5000.

**Figure 2.** Parallel multiple mediation analysis. * $p < 0.10$; *** $p < 0.01$.

5.2.3. Serial Multiple Mediator Model

The parallel multiple mediation analysis conducted above was based on the assumption that the two mediators had no causal interrelationship. In reality, however, strategic prospecting and absorptive capacity are bound to form a causal interrelationship, as discussed in Hypothesis 4. In fact, they were found to be highly correlated in our study ($0.664, p < 0.005$). Therefore, we established a serial multiple mediator model (environmental dynamism > strategic prospecting > absorptive capacity > innovation performance) to test Hypothesis 4, assuming a causal association between the two mediators, that represents the reality much better. As reported in Table 6, the indirect effect through both strategic prospecting and absorptive capacity in series was significantly positive ($b = 0.070$, $CI = 0.031\sim 0.122$), providing support for Hypothesis 4, which posits that strategic prospecting and absorptive capacity will sequentially mediate the relationship between environmental dynamism and innovation performance.

The serial multiple mediator model presented in Table 6 contains two additional indirect effects and one direct effect estimated as products of regression coefficients linking environmental dynamism to innovation performance. While the indirect effect through strategic prospecting was still statistically significant ($b = 0.165$, $CI = 0.095\sim 0.259$), both the indirect effect through absorptive capacity ($b = -0.004$, $CI = -0.034\sim 0.023$) and the direct effect of environmental dynamism on innovation performance

($b = 0.001$, $CI = -0.107 \sim 0.110$) were no longer significant. Thus, we could conclude that the impact of environmental dynamism on innovation performance was completely mediated by two different mechanisms in the serial multiple mediator model, namely indirect effect 1 and indirect effect 3—a new path identified from the strategic fit perspective. All these results are summarized in Figure 3.

In addition, pairwise comparisons between two indirect effects further demonstrated that the difference in strength between indirect effect 1 and indirect effect 3 was not statistically significant ($\Delta b = 0.095$, $CI = -0.003 \sim 0.202$). This suggests that indirect effect 3 (through strategic prospecting–absorptive capacity) is as important a path as indirect effect 1 (through strategic prospecting) in connecting environmental dynamism with innovation performance. This further implies that absorptive capacity is a critical internal factor for supporting firms’ increased strategic prospecting.

Table 6. Bootstrap significance test for the serial multiple mediator model.

Effect	Path	B	Boot SE	p	Boot 95% CI	
					LLCI	ULCI
Total Effect (H1)	Environmental dynamism–innovation performance	0.232	0.060	0.000	0.114	0.349
Direct Effect	Environmental dynamism–innovation performance	0.001	0.055	0.981	−0.107	0.110
Total Indirect Effect		0.230	0.042		0.156	0.325
Indirect Effect 1 (H2)	Environmental dynamism–strategic prospecting–innovation performance	0.165	0.041		0.095	0.259
Indirect Effect 2 (H3)	Environmental dynamism–absorptive capacity–innovation performance	−0.004	0.014		−0.034	0.023
Indirect Effect 3 (H4)	Environmental dynamism–strategic prospecting–absorptive capacity–innovation performance	0.070	0.023		0.031	0.122
Pairwise Comparisons	Indirect 1–indirect 3	0.095	0.052		−0.003	0.202
	Indirect 1–indirect 2	0.169	0.042		0.095	0.265
	Indirect 3–indirect 2	0.074	0.030		0.028	0.152

Note: Parallel multiple mediation analysis including all the control variables. Bootstrap samples: 5000.

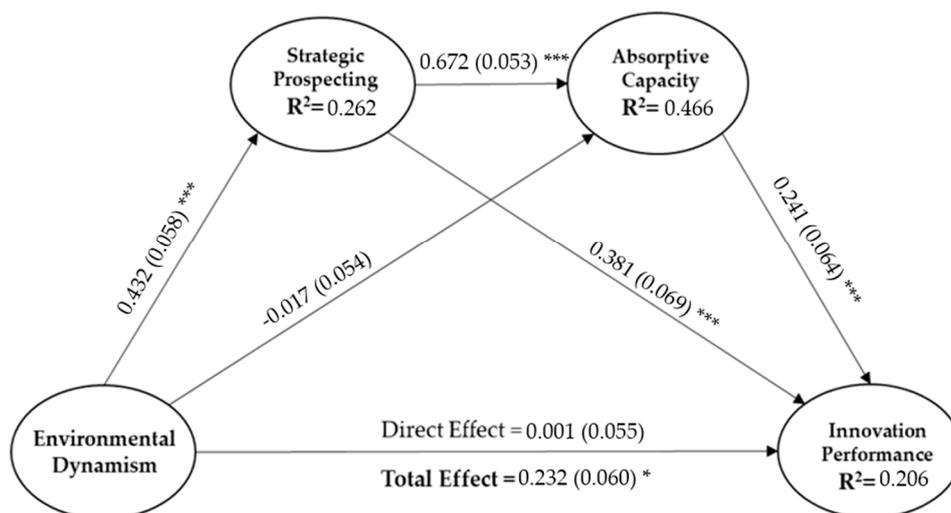


Figure 3. Serial multiple mediation analysis. * $p < 0.10$; *** $p < 0.01$.

6. Conclusions and Implications

6.1. Conclusions

Our study has focused on investigating the mechanisms linking environmental dynamism to innovation performance for firms’ sustainable growth. Specifically, based on theories of strategic management, we have identified strategic prospecting, absorptive capacity, and strategic prospecting–absorptive capacity as

mediating mechanisms and examined their mediation effects on the relationship between environmental dynamism and innovation performance. For this purpose, we first analyzed the total and direct effects of environmental dynamism on innovation performance and then analyzed the mediation effects of strategic prospecting, absorptive capacity, and strategic prospecting–absorptive capacity on that relationship. Our key conclusions are as follows.

Our results show that a total effect of environmental dynamism on innovation performance exists, meaning that a dynamic environment tends to motivate or lead firms to improve their innovation performance. However, the direct effect does not exist when mediating variables are controlled. Thus, these findings suggest that the relationship between environmental dynamism and innovation performance is completely mediated by the intervening mechanisms.

Assuming an independent relationship between the mediators (strategic prospecting and absorptive capacity), strategic prospecting is found to mediate the relationship between environmental dynamism and innovation performance. This indicates that a dynamic environment tends to increase the level of strategic prospecting, which subsequently enhances innovation performance. This finding supports the argument of the industrial organization theory. Likewise, absorptive capacity is also found to mediate that relationship. Namely, a dynamic environment tends to motivate or force firms to enhance their absorptive capacity for external knowledge acquisition and utilization, which in turn improves innovation performance. This finding is consistent with the rationale of the dynamic capability theory.

Under the more realistic assumption that the mediators are causally interrelated, strategic prospecting still has a mediation effect on the relationship between environmental dynamism and innovation performance, while absorptive capacity does not, in contrast to the situation when the mediators are assumed to be independent. In addition, strategic prospecting–absorptive capacity has a double sequential mediation effect on that relationship. This means that, to respond to a dynamic environment effectively, firms are likely to exhibit higher levels of strategic prospecting, which tends to reinforce their absorptive capacity to secure and utilize external knowledge, and enhanced absorptive capacity is likely to improve innovation performance. Therefore, assuming a causally interdependent relationship between the mediators, strategic prospecting individually mediates the relationship between environmental dynamism and innovation performance, while absorptive capacity does not individually do so, but rather mediates that relationship only when it is linked to strategic prospecting (strategic prospecting–absorptive capacity) as suggested by the strategic fit perspective. This further suggests that, as a mechanism linking environmental dynamism to innovation performance, strategic prospecting is primarily important, whereas absorptive capacity in conjunction with strategic prospecting is secondarily important. As such, assuming an interrelationship between the mediators, our study has developed two effective paths that connect environmental dynamism with improved innovation performance: (1) facing a dynamic environment, firms can improve innovation performance through the pursuit of higher-level strategic prospecting, and (2) facing a dynamic environment, firms can further improve innovation performance through the enhancement of absorptive capacity in support of higher-level strategic prospecting.

6.2. Implications

Our study has the following important theoretical contributions. First, unlike existing studies that have primarily examined the direct effect of environmental dynamism on firms' innovation performance, our study investigates the indirect effect of environmental dynamism on innovation performance through such mechanisms as strategic prospecting, absorptive capacity, and strategic prospecting–absorptive capacity. Namely, our study makes an original contribution to the literature by examining whether these mechanisms mediate the relationship between environmental dynamism and innovation performance to aid in the creation of a firm's sustainable competitive advantage. Second, our study suggests that the industrial organization theory and the strategic fit perspective can explain the indirect effect of environmental dynamism on innovation performance better than the

dynamic capability theory. This is inferred from our results that strategic prospecting, based on the industrial organization theory, and strategic prospecting–absorptive capacity, based on the strategic fit perspective, have a strong mediation effect on the relationship between environmental dynamism and innovation performance, while absorptive capacity, based on the dynamic capability theory, does not. Third, existing studies argue for a direct effect of environmental dynamism on innovation performance [3,5,7–16], but our study suggests that this may not be necessarily the case. Our study reveals that strategic prospecting and strategic prospecting–absorptive capacity completely mediate the relationship between environmental dynamism and innovation performance, as a significant direct effect of environmental dynamism on innovation performance is eliminated when the mediators are considered. This further suggests that the direct effect of environmental dynamism on innovation performance shown in many existing studies may be spurious in nature and may not in fact have been present.

In addition, our study provides important practical implications for firms under a dynamic environment regarding how to improve their innovation performance for their sustainable competitive advantage. By revealing the lack of a direct effect of environmental dynamism on innovation performance, our study demonstrates to managers that dynamic changes in the environment, such as the market [67], technology [68], and government policy [69], are not necessarily or naturally linked to improved innovation performance. Rather, our study clearly shows that firms operating in a dynamic environment need to intentionally identify and utilize specific mechanisms through which they can enhance innovation performance for their sustainable growth. Specifically, our results suggest to managers that, facing dynamic environmental changes, firms can choose two specific paths to improve innovation performance required for their sustainability. The first path is through strategic prospecting: facing a dynamic environment, firms need to pursue higher levels of strategic prospecting, namely a more offensive strategic orientation, through which to improve innovation performance. The second path is through strategic prospecting–absorptive capacity: facing dynamic changes in the environment, firms need to pursue higher levels of strategic prospecting and sequentially strengthen their absorptive capacity, which is associated with a more offensive strategic orientation to further improve their innovation performance. Our results also show that firms in a dynamic environment need not reinforce absorptive capacity alone, but instead need to strengthen absorptive capacity in conjunction with higher-level strategic prospecting in order to further improve their innovation performance for their sustainable competitive advantage.

6.3. Limitations and Future Research Directions

Our study has the following limitations, which may suggest the need for possible future research. First, since our study targeted small and medium-sized manufacturing firms as a research context, this might limit the generalization of our results. Thus, it seems desirable to expand the research context to services and larger firms to verify the generalizability of our results in future studies. Second, since our study collected data related to independent and dependent variables from a single respondent in each sample firm, the possibility of common method bias may exist. To check for this potential bias, we employed Harman’s one-factor test, which showed little evidence of this bias. However, since Harman’s one-factor test has its own limitations [45], the possibility of common method bias might not be completely ruled out. It therefore seems desirable to obtain data from multiple respondents in future studies. Third, although absorptive capacity was measured as a single construct in our study, it would be meaningful to measure it multidimensionally and consider how the roles of subdimensions like potential and realized absorptive capacity [17] might vary in linking environmental dynamism to innovation performance. Fourth, our study examined absorptive capacity (in connection with strategic prospecting) as a mechanism for mediating between environmental dynamism and innovation performance, but it would also be meaningful for future studies to investigate other potentially intervening internal factors such as organizational structure, culture, and leadership

(in conjunction with strategic prospecting); namely, strategic prospecting–organizational structure, strategic prospecting–organizational culture, and strategic prospecting–strategic leadership.

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Appendix A

Table A1. Literature reviews on the relationship between environmental dynamism and innovation or innovation performance. SMEs: small and medium-sized enterprises.

Author(s)	Dependent Variable(s)	Independent Variable(s)	Mediating Variable(s)	Result	Sample
Calantone, Harmancioglu & Droge [3]	New product innovation	Environmental turbulence: - Market (+) - Technological (+)		+ x	Meta-analysis
Dhir, Aniruddha & Mital [4]	Innovation performance	Environmental dynamism (+)	Alliance network heterogeneity		Conceptual
Khan & Manopichetwattana [5]	Product innovation	Environmental dynamism (+)		+	211 manufacturing firms
Kim, Li, Yoo, and Kim [6]	Innovation	Environmental dynamism	External knowledge acquisition (EKA)	x	220 manufacturing SMEs in China
Lee [7]	Product innovation	Environmental turbulence: - Market (+) - Technological (+)		x +	140 multinational firms in China
Martinez-Conesa, Soto-Acosta & Carayannis [8]	Open innovation	Environmental dynamism (+)		+	429 SMEs manufacturing in Spain
Miller & Friesen [9]	Innovation	Environmental dynamism (+)		+	128 Canadian & US firms
Mohammad, Idris, & Moh'd AL-Ferokh [10]	Innovation performance	Environmental turbulence (+)		+	150 responses from 13 five-star hotels in Jordan,
Pervan, Al-Ansaari & Xu [11]	Innovation	Market dynamism (+)		+	200 SMEs in Dubai
Thornhill [12]	Innovation	Industry dynamism (+)		+	41,030 firms in Canada
Tuominen et al. [13]	Innovation–new product development–commercialization	Environmental dynamism: - Technology-based (+,+) - Market-based (+,+)		+, x x, x	140 manufacturing firms in Finland
Turulja & Bajgoric [14]	Innovation: Product–process	Environmental turbulence (+,+)		+, +	427 firms in Europe
Soto-Acosta, Popa, & Martinez-Conesa [15]	Innovation: Mari–radical–incremental	Environmental dynamism (+)		+	429 SMEs in Spain
Tsuja & Marino [16]	Technical innovation	Environmental dynamism		+	104 service firms in Peru

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