Heliyon 10 (2024) e40540

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

# Performance expectation fallout, knowledge search, and corporate dual innovation

Li Zheng [a], Yuanyuan Wang [a,*], Kang Fang [b]

[a] Qingdao University, Department of Business Administration, College of Business, Qingdao, China
[b] Ocean University of China, Applied Economics, School of Economics, Qingdao, China

ARTICLE INFO

*Keywords:*
Performance fallout
Exploratory innovation
Exploitative innovation
Breadth search
Depth search

ABSTRACT

How do firms determine their approach to dual innovation about performance expectations? This paper analyzes the decision-making process known as "assessment-search-innovation" that businesses use in response to performance feedback. Furthermore, the research investigates the function of knowledge search in the relationship between the gap in performance expectations and dual innovation. The study sample consists of 827 A-share high-tech firms from 2010 to 2022. Analyzed data from the car and input databases yield 2975 occurrences of imbalanced panel data. Utilizing Stata software for empirical research (Data analysis methods encompass descriptive statistics, correlation analysis, baseline regression analysis, robustness test, and endogeneity test), regression analysis revealed that the fallout of performance expectations stimulates firms' search for a wide range of knowledge and hinders their search for in-depth knowledge. In addition, there is a strong and positive correlation between the extent of knowledge sought and exploratory innovation. At the same time, the intensity of knowledge sought is also significantly and positively correlated with exploitative innovation. An investigation of the mechanism shows that the disparity in performance expectations impacts exploratory innovation by encouraging companies to search for a wide range of knowledge and impacts exploitative innovation by inhibiting companies from searching for in-depth knowledge. Moreover, it has been discovered that when companies face a decrease in their performance, they prioritize exploring a wide range of knowledge rather than focusing on in-depth knowledge. This is especially true when there is a high risk of bankruptcy or financial loss, in contrast to the low risk of bankruptcy or profit status. Moreover, it has been shown that doing a cross-industry search for knowledge enhances the positive correlation between searching for a wide range of knowledge and engaging in exploratory innovation. Similarly, searching for knowledge within the same sector amplifies the positive correlation between searching for in-depth knowledge and engaging in exploitative innovation. The study uncovers the inherent mechanism via which the disparity in performance expectations impacts the process of dual innovation by influencing information search. This paper offers theoretical justification and empirical proof for the process by which companies seek external knowledge and execute dual innovation strategies.

* Corresponding author.
*E-mail addresses:* esterzheng@163.com (L. Zheng), asterwangyy@163.com (Y. Wang), f13006366036@163.com (K. Fang).

https://doi.org/10.1016/j.heliyon.2024.e40540
Received 27 June 2024; Received in revised form 13 November 2024; Accepted 18 November 2024
Available online 19 November 2024

## 1. Introduction

The survival and growth of organizations heavily rely on innovation. The 20th Party Congress report explicitly underscored the need to expedite the execution of an innovation-driven development strategy and achieve a state of advanced scientific and technological self-sufficiency and self-improvement. Nevertheless, several categories of technical innovation exist, and alternative approaches impose distinct demands on firms' resource requirements and risk tolerance. Consequently, enterprises must carefully consider their decisions about innovation [1]. Certain firms adhere to a "maintaining stability" strategy, which involves integrating and enhancing current technologies to strengthen their competitive advantages. Conversely, other organizations adopt a strategy of "seeking innovation," aiming to explore new domains and achieve significant technological advancements. Specifically, a distinction exists between applied and exploratory innovation within technological innovation [1]. Due to the dual nature of innovation activities, enterprises are presented with a wide range of choices for decision-making. Hence, organizations are currently faced with the urgent task of effectively managing various forms of technology innovation to tackle performance challenges.

According to the idea of corporate behavior, a company might use the difference between its actual performance and expected performance as a benchmark for judging innovation [2]. A performance-expectation gap occurs when actual performance falls below projected performance. This signifies a problem in corporate operations and prompts the enterprise to innovate to improve the current situation [3]. Nevertheless, research has shown that firms tend to avoid innovative behavior in the face of falling performance expectations [4]. Scholars have conducted more inquiries due to the discrepancies in the research findings. Some scholars have divided the innovation approach to examine the impact of performance expectation fallout on dual innovation in more detail. Several studies suggest that companies tend to prioritize and invest more in innovative technologies that are new and groundbreaking when they anticipate a decline in performance [5]. Conversely, some research has put out a different theory, proposing that when performance outcomes decline, organizations may choose to adopt a more cautious approach, which can hinder the implementation of exploratory innovative [6]. Moreover, research has shown that when performance expectations decrease, a collaborative approach to innovation within companies is promoted [7]. The variability of research results poses a difficulty for companies aiming to steer their technological advancement. Moreover, the analysis of how companies manage the simultaneous pursuit of innovation while facing decreasing performance standards is still a topic that requires further research.

The existing research generally focuses on the direct relationship between performance feedback and company innovation, with a significant lack of analysis regarding the impact of performance feedback on the intermediate stages of technical innovation [6,10,11]. Knowledge is the foundation of firms' technological innovation [5]. A corporation's acquisition of knowledge directly impacts the type of innovation it follows. Knowledge breadth search refers to the enterprise's exploration of a wide range of external knowledge. In contrast, knowledge depth search focuses on the organization's level of specialization in specific knowledge and its ability to utilize similar knowledge effectively [8]. Different types of knowledge search differentially affect firms' dual innovation, but little literature has included knowledge search in the research framework of performance expectation fallout and firms' dual innovation, and it is not clear how performance expectation fallout affects firms' knowledge search behavior. The present study extends the concept of decision-making in firms that react to performance feedback from "assessment-innovation" to "assessment-search-innovation". It further elucidates the correlation between the performance expectation gap and binary innovation by examining various forms of knowledge search. The study sheds light on the relationship between the performance expectation gap and the exploitation and exploration innovations of businesses by examining the relationship between various forms of knowledge search in the context of dual innovation. It also offers a resource for businesses to use when making decisions about technological innovation from a knowledge search standpoint.

Contributions of this paper: First, it reveals the relationship between performance expectation gap and firms' dual innovation from the perspective of knowledge search. According to the theory of corporate behavior, expectation fallout will trigger firms' external search behavior, and acquiring external knowledge is an important factor in firms' technological innovation. In view of this, this paper incorporates knowledge search into the model, examines the impact mechanism of knowledge search on the relationship between corporate performance expectation fallout and dual innovation, and clarifies the relationship between the two from the perspective of knowledge search, which not only enriches and expands the research related to the theory of corporate behavior, but also provides practical insights on how to carry out different types of knowledge search for enterprises to improve their innovation capability. Second, based on the performance expectation gap, we examine the knowledge search decisions under different performance gap levels from the perspective of business dilemma, and also explore the impact of different types of knowledge search on dual innovation from the perspective of the type of knowledge searched. By enriching the relationship among performance expectation gap, knowledge search and dual innovation, we provide more detailed reference suggestions for enterprises on how to conduct knowledge breadth search, depth search and trade-off between exploratory innovation and exploitation innovation.

## 2. Literature review and research hypotheses

### 2.1. Literature review

As postulated by Cyert and March, the theory of corporate behaviour posits that firms' active pursuit of solutions is motivated by the presence of issues [2]. Building upon the notion of firm behaviour, further researchers have shown that performance feedback also influences the risk-taking inclination of firms, therefore impacting their strategic choices. Indeed, the organization primarily engages in strategic response behaviour by evaluating its business performance against anticipated performance. Furthermore, the performance gap is the prevailing criterion for making judgments in business decision-making. This gap can stimulate cognitive

transformation within organizations, facilitating the emergence of novel ideas and solutions to challenges. Consequently, this enables the exploitation of potential opportunities for performance growth. Hence, the framework of corporate behaviour theory offers crucial theoretical backing for this study to investigate the strategic response behaviours (such as knowledge search and dual innovation) activated by the performance expectation gap.

Typically, companies that do not fulfill their performance goals are more likely to engage in technological innovation to improve their current standing [3]. Nevertheless, specific research has suggested that companies in this scenario often display behaviors focused on generating immediate profits and a decreased inclination to pursue technical innovation [4]. Currently, it is uncertain whether there is a direct cause-and-effect link between the performance expectation gap and technical progress. The correlation between the discrepancy in performance expectations and technological advancement needs to be clarified. Exploratory innovation and exploitation innovation are two distinct forms of technical innovation inside firms, which together form the dual innovation paradigm of enterprises. Exploratory innovation is distinguished by the emergence of new technologies, the identification of fresh market opportunities, and the establishment of wholly unique market demands. This type of innovation has a higher risk profile and a greater need for resources compared to other forms of innovation. Utilization innovation refers to the incorporation and application of existing knowledge, experience, and technology to meet the demands and requirements of customers and the market. This procedure is distinguished by a reduced initial capital outlay and a diminished level of risk [9].

There is currently no agreement among researchers on the effects of the performance expectation gap on businesses' ability to innovate in multiple areas. Several studies have determined that there needs to be more than just making little tweaks through innovation. Instead, they suggest that exploratory innovation is the most successful approach for organizations to address performance challenges [10]. Several studies suggest that companies typically follow a cautious strategy when utilizing their current resources. They prefer to prioritize exploratory ideas that are seen as less risky and more likely to be successful. Conversely, exploratory inventions are considered to have higher levels of risk and uncertainty [6]. Furthermore, other studies have demonstrated that the repercussions of performance expectations influence exploitative and exploratory innovations in a similar manner [7]or exhibit a non-linear correlation with dual innovation [11].

Performance expectation fallout signifies a deficiency in the functioning of business processes. To effectively resolve the issue and prevent its recurrence, it is imperative to analyze the underlying reasons and identify viable remedies. Acquiring knowledge, information, and opportunities from many sources has impacted a company's strategic decision-making processes [8]. When a firm chooses to pursue both exploratory and exploitative innovation where performance expectations have fallen, the specific knowledge it seeks from external sources affects the balance between these two types of innovation. The process of knowledge search is commonly categorized into two distinct groups: Breadth-first search versus depth-first search [12]. Breadth search involves conducting a comprehensive and diverse search for external knowledge. This helps to increase the organization's knowledge domain and innovation scope, leading to the generation of more innovative solutions. On the other hand, depth search involves the company concentrating on specific channels for acquiring knowledge and enhancing its innovation resources by utilizing existing knowledge for in-depth study and learning. Research has revealed that both breadth and depth search benefit enterprises conducting technological innovation [13].

The performance expectation gap in firms' binary innovation decisions is influenced by the process of external knowledge search. The present study introduces the concept of knowledge search, broadens the decision-making framework of firms in response to performance feedback from "assessment-innovation" to "assessment-search-innovation", and investigates the mechanism of knowledge search to elucidate its significance in the association between performance expectation fallout and dual innovation. We investigate the function of knowledge search in the relationship between performance expectation gap and dual innovation in order to address the interaction between exploratory innovation, exploitation innovation, and performance expectation gap. This will enable organizations to engage in knowledge search and facilitate the implementation of technological innovation.

### 2.2. Research hypothesis

#### 2.2.1. Performance expectation gap and knowledge search

The performance expectation gap occurs when an organization lacks the necessary resources and knowledge to achieve the desired level of performance. *Knowledge search* is a highly successful approach organizations can use to seek answers to challenges and overcome internal resource restrictions [14]. In this paper, knowledge search is categorized into breadth search and depth search [12]. A breadth search, which emphasizes the wide range and variety of enterprises engaged in researching new external knowledge, promotes the exchange of knowledge across firms operating in diverse domains. This facilitates the dismantling of barriers to information and the overcoming of technological limitations, hence enhancing the efficacy of innovation [15]. To change the current state of the performance gap, organizations often engage in a comprehensive search to create new technologies and solutions that are difficult to copy. They do this by incorporating external knowledge from different sources, which helps them gain a unique competitive advantage. Despite the need for a greater allocation of resources and the increased risk of uncertainty resulting from a lack of comprehensive knowledge about the market, technology, or competitive environment, breadth search is still necessary [16]. The wide range of expertise that breadth search provides can help companies surpass narrow knowledge areas and gain a full awareness of the broader industrial context. This allows them to capitalize on additional market and technology prospects, improve their strategic adaptability, and improve their current operational state. As a result, companies with lower expectations for their performance often choose to pursue new information in a hazardous way.

The deep search focuses on a thorough study of a specific topic of knowledge, as opposed to the wide-ranging search for general knowledge in a knowledge-width search. Although this strategy may have a moderate cost and lack certainty, it can improve an enterprise's knowledge and skills in specific areas. Nevertheless, obtaining a solitary piece of knowledge can result in excessive

dependence on the current knowledge framework, potentially restricting the organization's ability to adopt innovative or revolutionary new knowledge. This might lead to a need for more progress in fundamental technology, obstructing the creation of new technical routes and the enterprise's capacity to innovate and adapt [8,17]. The uniform knowledge produced by extensive knowledge searches must be revised to let businesses properly adjust to the ever-changing market. Moreover, it hinders identifying fresh growth prospects and innovations, thus hindering innovation performance improvement. As a result, businesses often prioritize acquiring new knowledge instead of relying on current knowledge to adjust to market fluctuations when their performance could be improved. This, in turn, leads to a decrease in their level of searching for in-depth knowledge.

Based on this, this paper proposes the following hypotheses.

**Hypothesis 1a**. Performance expectation fallout promotes corporate knowledge breadth search.

**Hypothesis 1b**. Performance expectation fallout inhibits corporate knowledge depth search.

*2.2.2. Knowledge search and corporate dual innovation*

Knowledge is an essential resource for businesses, allowing them to engage in innovative activities vital to their core competitiveness [5]. Enterprises obtain new and valuable information from the external environment through extensive research. This information provides fresh insights, perspectives, and methods and offers innovative resources that go beyond the current technological field and effectively solve the innovation problem [18]. Simultaneously, exploratory innovation requires new information to create new technologies, goods, and services [6]. Enterprises acquire external heterogeneous knowledge resources through extensive searching, which results in a solid knowledge base and favorable conditions for exploratory innovation. This allows enterprises to overcome the limitations of traditional technologies and implement diverse innovation practices. Engaging in knowledge breadth search is vital for organizations due to the challenging nature, significant risk, and high probability of failure associated with exploratory innovation. This strategy facilitates the prompt acquisition of new market knowledge and information, hence improving reaction efficiency and delivering effective solutions in a timely fashion [19]. Consequently, enterprises can effectively promote exploratory innovation through knowledge breadth search.

The knowledge depth search is a technique that focuses on the enterprise's understanding and utilization of existing knowledge. Its goal is to establish a strong foundation in the initial knowledge base, enhancing and optimizing known technologies and solutions [20] while maintaining a distinct separation from the enterprise's technological development path. Simultaneously, utilization-based innovation focuses on utilizing existing knowledge in familiar areas to generate small-scale technological, product, and service advancements. The knowledge depth search utilizes advanced mining techniques and a uniform knowledge base, ensuring ample knowledge reservoirs. These reserves support the enterprise's goal of delivering more precise solutions for current customers and markets [21]. As the extent of knowledge exploration expands, the enterprise's ability to effectively employ and enhance current technical knowledge also grows. The reason is that the more thorough the search, the more extensive the enterprise's comprehension of the current technical domain. Simultaneously, it is necessary to thoroughly examine current sources of information to pinpoint possible domains for technological advancement. The objective is to rectify inaccuracies, augment the worth of knowledge application, and boost the efficiency of innovation based on utilization [8]. Consequently, enterprises enhance their comprehension of existing knowledge through in-depth knowledge search, facilitating utilization-based innovation.

Based on this, this paper proposes the following hypotheses.

**Hypothesis 2a**. Knowledge breadth search positively influences firms' exploratory innovation.

**Hypothesis 2b**. Knowledge depth search positively influences firms' exploitative innovation.

*2.2.3. The mediating role of knowledge search*

The performance expectation gap indicates that the firm's existing business plan needs to be revised, potentially affecting various aspects, including corporate resource allocation, market strategy, product manufacturing, and internal management [22]. To bridge the performance expectation gap, firms must surpass previous progress constraints and adopt creative techniques. Acquiring knowledge is the fundamental basis for organizations to engage in innovative endeavors [5]. The research and development of novel technologies and products are inherently linked to acquiring knowledge resources. The performance objectives need to meet the enterprise's inclination to use various information sources to overcome cognitive limitations and gather diverse resources. Acquiring diverse resources improves enterprises' capacity to identify distant technology and market prospects and generates fresh strategic concepts [23], which is the foundation for implementing exploratory innovation and boosts the drive for exploratory innovation. Pursuing exploratory innovation is a crucial strategy for organizations to achieve new technology breakthroughs and seize market opportunities. By introducing innovative ideas, creating advanced technologies, and implementing groundbreaking services, businesses are more capable of quickly adapting to changing market demands [24]. This responsiveness helps to mitigate the status quo of performance decline. Consequently, enterprises tend to pursue a breadth of knowledge to acquire new knowledge in the context of declining performance expectations. This acquired knowledge is conducive to promoting exploratory innovation behaviors.

However, when a company faces a gap between expected performance and actual performance, the knowledge resources obtained from a narrow search for in-depth knowledge are not enough to solve the problem of declining performance. This can lead to the company's core becoming inflexible and its thinking becoming rigid [25], which hinders the company's ability to achieve technological breakthroughs. Consequently, the performance expectation gap will reduce the knowledge depth search behavior. Innovation is a method that carries less risk compared to incremental innovation. It involves making improvements within the existing knowledge domain. It signifies a progression of a specific product or technology, utilizing the knowledge and experience gained in the field of

technology. Nevertheless, this method could result in restrictions on the extent and range of knowledge exploration, thereby hindering enterprises from efficiently integrating and applying existing knowledge, as well as limiting the availability of knowledge necessary for exploitative innovations [26]. Therefore, this could ultimately impede the growth of exploitative innovation within the enterprise. Furthermore, the efficacy of used technology is not without constraints, as it yields restricted advantages and accomplishments [27]. Moreover, it is influenced by previous events and constrained by inadequate knowledge, which hinders organizations' capacity to offset falling performance. Consequently, when firms have lower expectations of performance, their desire to conduct thorough knowledge searches decreases. This, in turn, limits their ability to participate in exploitative innovation.

Based on the aforementioned, when firms engage in a trade-off between dual innovation in the context of declining performance expectations, they are more likely to invest the acquired resources in exploratory innovation through a breadth search of knowledge than to promote exploitative innovation through an in-depth search.

Based on this, this paper proposes the following hypotheses.

**Hypothesis 3a**. Performance expectation fallout positively affects knowledge breadth search, which in turn promotes firms' exploratory innovation.

**Hypothesis 3b**. Performance expectation fallout negatively affects knowledge depth search, which in turn inhibits firms from exploitative innovation.

## 3. Research design

### 3.1. Data sources, research design and sample selection

This study employs data from 827 Chinese A-share listed high-tech companies spanning the years 2010–2022 to empirically examine the correlation between performance expectation fallout, knowledge search, and firms' dual innovation. This research is particularly significant for high-tech firms that heavily depend on technological advancement. The quantitative data were acquired from the CSMAR and INCOPAT databases, organized using MYSQL software, and analyzed using STATA software to perform OLS tests. (Data analysis methods encompass descriptive statistics, correlation analysis, baseline regression analysis, robustness test, and endogeneity test. The selection of STATA for data analysis is based on its currently acknowledged status as the leading software for handling secondary panel data. STATA offers a diverse array of sophisticated data analysis methods and is well-suited for handling the extensive dataset of this paper.) Concurrently, to guarantee the validity of the sample data, we eliminate the sample firms that have *ST, ST, and missing data. When calculating the knowledge search, it is not possible to rely on the existing industry framework for industry classification for foreign, personal, and school patents. This is because obtaining specific information about new knowledge from external sources is challenging for this type of knowledge citation. Therefore, this paper selectively retains the information from cited patents outside of China, personal, and school patents that are listed companies. All the data is then subjected to Winsorization processing, resulting in the acquisition of sample data for *ST, ST, and the sample enterprises with missing data. Perform winsorization on the entire dataset, resulting in an unbalanced panel data consisting of 2975 observations.

### 3.2. Model building

In order to test the effect of performance expectation fallout on firms' dual innovation and the mediating role of knowledge search in it, this paper draws on Wen Zhonglin et al.'s (2004) test of mediating effect [28] and designs the following model to test the hypothesized study:

$$M_{i,t}=\beta_0+\beta_1 HG_{i,t}+\beta_2 Controls_{i,t}+\sum Year+\sum Industry+\varepsilon_{i,t} \quad (1)$$

$$N_{i,t}=\beta_0+\beta_3 HG_{i,t}+\beta_2 Controls_{i,t}+\sum Year+\sum Industry+\varepsilon_{i,t} \quad (2)$$

$$M_{i,t}=\beta_0+\beta_1' HG_{i,t}+\beta_4 N_t+\beta_2 Controls_{i,t}+\sum Year+\sum Industry+\varepsilon_{i,t} \quad (3)$$

The first model(1) tests the effect of performance expectation fallout on firms' binary innovation. The second model(2) tests the effect of performance expectation fallout on knowledge search. The third model(3) tests the mediating role of knowledge search between performance expectation fallout and binary innovation. In the model, "$i$" represents the firm, "$t$" represents the year, "$HG_{i,t}$" represents the explanatory variable, "$M_{i,t}$" represents the explanatory variable (*Exploitative, Exploratory*), "$N_{i,t}$" represents the mediating variable (*Depth, Scope*), "$\sum Year$" represents the year fixed effect, "$\sum Industry$" represents the industry fixed effect, and "$\varepsilon_{i,t}$" represents the random error.

### 3.3. Definition of variables

#### 3.3.1. Explained variable: corporate dual innovation

This paper draws upon the study of Xiao Hailian et al. (2014) [29], which was based on the provisions of AS 6 - Intangible Assets, which defines two categories of research and development (R&D) expenditures: exploitative innovation inputs, which are capitalized in the development phase, and exploratory innovation inputs, which are incurred in the research phase or expensed in the development phase.

### 3.3.2. Explanatory variables: performance expectation gap

The present investigation incorporates the historical expectation fallout as an explanatory variable in the study and employs the recursive measurement formula, which draws upon the research method of Chen (2008) [30] as follows:

$$HA_{i,t-1} = \alpha_1 P_{i,\,t-2} + (1-\alpha_1) HA_{i,t-2}$$

Where $HA_{i,\,t\text{-}1}$ denotes the historical expected performance of firm *i* in year *t-1* and $P_{i,\,t\text{-}2}$ denotes the actual performance of firm *i* in year *t-2*, α1denotes the significance of the actual performance in the previous period concerning the expected performance in the previous period, with a value in the range of [0,1]. This paper cites Chen (2008) [30] and selects $\alpha_1 = 0.6$ to measure the historical expected performance. $HA_{i,0}$ is replaced by the actual performance in period 0. In this paper, the strength indicator of the performance expectation gap is divided into performance expectation gap (*HG*), and performance expectation surplus (*HL*); When $P_{i,\,t\text{-}1}$-$HA_{i,\,t\text{-}1} < 0$, it means that it is in the performance expectation gap, and then $HG_{i,t} = |P_{i,\,t\text{-}1}\text{-}HA_{i,\,t\text{-}1}|$, and vice versa take $HG_{i,t} = 0$. When $P_{i,\,t\text{-}1}$-$HA_{i,\,t\text{-}1} > 0$, it is in the performance expectation surplus, and then $HL_{i,t} = P_{i,\,t\text{-}1}$-$HA_{i,\,t\text{-}1}$, and vice versa, take $HL_{i,t} = 0$.

### 3.3.3. Knowledge search

In this paper, we refer to Katila et al. 's study [12] in order to measure the breadth of search (Scope) and the depth of search (Depth). The breadth of search is measured by the citation rate of new knowledge, while the depth of search is measured by the average number of repeated citations of patents by enterprises. The breadth of search reflects the extent of the enterprise's exploration of new knowledge, whereas the depth of search gauges the exploration of existing knowledge. In other words, the more an enterprise utilizes a particular knowledge element, the more deeply it will understand it. The specific formula is as follows:

$$Scope_{it} = \frac{new\ citations_{it}}{total\ citations_{it}} \quad Depth_{it} = \frac{\sum_{y=t-5} repetition\ count_{it}}{\text{total citations}_{it}}$$

In the aforementioned equation, the breadth of knowledge search in year t for firm i is defined as the proportion of newly cited patents to the total number of citations in that year. The depth of knowledge search in year t is represented by the frequency of repeated citations in the past five years for each year t cited patent, on average.

### 3.3.4. Control variables

As required, this paper incorporates control variables that may influence the level of innovation exhibited by the firm in question. This paper includes a number of control variables, including performance expectation surplus (*HL*), firm size (*SIZE*), gearing ratio (*LEV*), nature of the firm (*SOE*), share of fixed assets (*FIXED*), the natural logarithm of the compensation of the three most senior executives (*TMTPay1*), management expense ratio (*MFEE*), share of the number of shares held by the three largest shareholders (*TOP3*), financing constraints (*WW*), and years of establishment (*FirmAge*). Furthermore, this paper employs dummy variables for industry (*Industry*) and year (*Year*), with the specific measures of these variables presented in Table 1.

**Table 1**
Definition of study variables.

| Variable Category | Variable Name | Variable Symbol | Variable Definition |
|---|---|---|---|
| **Implicit Variable** | Exploitative innovation | *Exploitative* | R&D expenditures capitalized in the development phase/revenue from main operations |
| | Exploratory Innovation | *Exploratory* | (R&D expenditures in the research phase + R&D expenditures expensed in the development phase)/Main operating revenues |
| **Independent Variable** | Falling short of performance expectations | *HG* | The absolute value of the difference between the two when the actual performance of the enterprise is lower than the historical expected performance, and vice versa is 0. |
| **Intermediary Variable** | In-depth knowledge search | *Depth* | The average number of repeated citations of patents by enterprises |
| | Breadth of knowledge search | *Scope* | The citation rate of new knowledge in the current year |
| **Control Variable** | Performance expectations surplus | *HL* | The difference between the two is taken when the actual performance of the enterprise is higher than the historical expected performance, and vice versa is taken as 0. |
| | Enterprise size | *SIZE* | Natural logarithm of total assets |
| | gearing | *LEV* | Total assets/total liabilities |
| | Nature of enterprise | *SOE* | 1 for state-owned enterprises, 0 otherwise |
| | Fixed assets as a percentage | *FIXED* | Fixed Assets/Total Assets |
| | Total management remuneration | *TMTPay1* | Natural logarithm of the total compensation of the top three management personnel |
| | management cost ratio | *MFEE* | Administrative Expenses/Operating Income |
| | Number of shares held by shareholders | *TOP3* | Number of shares held by top three shareholders/total shares |
| | Financing constraints | *WW* | −0.091*(Net Profit + Depreciation)/Total Assets-0.062*Dividend Payment+0.021*Long-Term Liabilities/Total Assets-0.044*ln(Total Assets)+0.102*Industry Annual Sales Growth Rate-0.035*Sales Growth Rate |
| | Founding Years | *FirmAge* | Logarithmic treatment of the company's years of existence |

## 4. Analysis of empirical results

### 4.1. Descriptive statistics and correlation analysis

Table 2 presents the results of descriptive statistics and correlation analysis of the variables. The data in Table 2 reveals that the mean value of utilized innovation is 0.524, with a standard deviation of 1.406. The mean value of exploratory innovation is 1.358, with a standard deviation of 2.981. This indicates that high-tech enterprises have generally engaged in dual innovation activities. There is a notable discrepancy in the extent of dual innovation across different enterprises. Further research is warranted to identify the underlying factors influencing this variation. The mean value of the knowledge width search is 0.91 with a standard deviation of 0.161, while the mean value of the knowledge depth search is 0.192 with a standard deviation of 0.354. These values indicate that there are significant differences in the degree of knowledge search among different enterprises. The descriptive statistics values for the remaining variables are reasonably distributed and will not be repeated here.

### 4.2. Analysis of regression results

Table 3 presents the regression results for each model, with columns (1) and (2) reporting the effects of control variables. The results indicate that firm size significantly promotes exploitative innovation, while the number of shares held by the top three shareholders significantly promotes exploratory innovation. The results indicate that the larger the firm size, the stronger the firm's motivation to engage in exploitative innovation. Similarly, the larger the number of shareholders' holdings, the more closely the firm's profits are linked to them and the stronger the motivation to engage in exploratory innovation in order to obtain greater returns. The management expense ratio significantly enhances the enterprise's dual innovation. The ratio indicates that the more investment is made in management, the greater the enterprise's ability to utilize resources, which in turn fosters dual innovation.

Columns (3) and (4) examine the effect of performance expectation gaps on firms' utilized and exploratory innovations, respectively, employing the Spline function (Use model 1)[{1}]. The regression results in column (3) demonstrate that the regression coefficient for the performance expectation gap is significantly negative ($\beta = -1.513$, $p < 0.1$). The regression results in column (4) indicate that the regression coefficient of performance expectation fallout is significantly positive ($\beta = 2.194$, $p < 0.05$). This suggests that, in the state of performance expectation fallout, firms tend to promote exploratory innovation and inhibit the development of utilization innovation.

Columns (5) and (6) investigate the effect of performance expectation fallout on knowledge depth and width searches (Use model 2)[{2}]. The regression results indicate that the regression coefficient for performance expectation fallout is significantly negative for knowledge depth search ($\beta = -0.669$, $p < 0.05$) and significantly positive for knowledge width search ($\beta = 0.295$, $p < 0.05$). This indicates that hypotheses 1a and 1b are supported.

The regression results in column (7) indicate that the regression coefficient of the knowledge depth search is significantly positive ($\beta = 0.135$, $p < 0.05$), while the regression results in column (8) demonstrate that the regression coefficient of the knowledge breadth search is also significantly positive ($\beta = 0.25$, $p < 0.1$). This suggests that knowledge depth search and knowledge breadth search

**Table 2**
Descriptive statistics and correlation analysis.

| Variable | Average Value | (Statistics) Standard Deviation | *Exploitative* | *Exploratory* | *HG* | *Scope* | *Depth* | *HL* | *SIZE* |
|---|---|---|---|---|---|---|---|---|---|
| ***Exploitative*** | 0. 524 | 1.406 | 1 | | | | | | |
| ***Exploratory*** | 1.358 | 2.981 | −0.054*** | 1 | | | | | |
| ***HG*** | 0.0141 | 0.0296 | 0.024 | 0.607 | 1 | | | | |
| ***Scope*** | 0.91 | 0.161 | −0.019 | −0.045** | −0.000 | 1 | | | |
| ***Depth*** | 0.192 | 0.354 | 0.019 | 0.045** | −0.003 | −0.947*** | 1 | | |
| ***HL*** | 0.0132 | 0.0365 | 0.021 | −0.009 | −0.173*** | −0.027 | 0.030* | 1 | |
| ***SIZE*** | 22.175 | 1.135 | 0.044** | 0.070*** | −0.008 | −0.032* | 0.037** | 0.000 | 1 |
| ***LEV*** | 0.362 | 0.180 | −0.002 | −0.030 | 0.043** | 0.092*** | −0.083*** | 0.001 | 0.498*** |
| ***SOE*** | 0.266 | 0.442 | −0.038** | 0.050*** | −0.051*** | −0.028 | 0.027 | 0.034* | −0.315*** |
| ***FIXED*** | 0.220 | 0.135 | −0.112*** | 0.037** | 0.009 | −0.011 | 0.008 | 0.043** | 0.160*** |
| ***TMTPay1*** | 14.782 | 0.656 | 0.048*** | 0.089*** | −0.025 | −0.077*** | 0.086*** | 0.042** | 0.486*** |
| ***MFEE*** | 0.0858 | 0.063 | 0.313*** | −0.015 | 0.089*** | 0.037** | −0.036*** | −0.027 | −0.292*** |
| ***TOP3*** | 44.66 | 13.590 | −0.108*** | 0.071*** | −0.040** | 0.024 | −0.035* | −0.058* | −0.0400** |
| ***WW*** | −1.027 | 0.060 | 0.005 | −0.068 | 0.146*** | 0.057*** | −0.064*** | −0.038* | −0.837*** |
| ***FirmAge*** | 2.951 | 0.278 | −0.079*** | 0.052*** | 0.025 | −0.025 | 0.019 | 0.049*** | 0.218*** |
| Variable | ***LEV*** | ***SOE*** | ***FIXED*** | ***TMTPay1*** | ***MFEE*** | ***TOP3*** | ***WW*** | ***FirmAge*** | |
| ***LEV*** | 1 | | | | | | | | |
| ***SOE*** | 0.210*** | 1 | | | | | | | |
| ***FIXED*** | 0.249*** | 0.143*** | 1 | | | | | | |
| ***TMTPay1*** | 0.091*** | 0.096*** | −0.036* | 1 | | | | | |
| ***MFEE*** | −0.262*** | −0.108*** | −0.127*** | −0.181*** | 1 | | | | |
| ***TOP3*** | −0.111*** | −0.019*** | −0.057*** | −0.035* | −0.027 | 1 | | | |
| ***WW*** | −0.297*** | −0.216*** | −0.083*** | −0.466*** | 0.313*** | 0.090*** | 1 | | |
| ***FirmAge*** | 0.102*** | 0.278*** | 0.058*** | 0.181*** | −0.229*** | −0.063*** | −0.088*** | 1 | |

**Table 3**
Tests of the relationship between historical expectation fallout and firms' dual innovation, and the mediating effect of knowledge search.

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Exploitative | Exploratory | Exploitative | Exploratory | Depth | Scope | Exploitative | Exploratory | Exploitative | Exploratory |
| ***HG*** | | | −1.513* | 2.194** | −0.669** | 0.295** | | | −1.446 | 2.148** |
| | | | (-1.69) | (2.41) | (-2.03) | (1.96) | | | (-1.62) | (2.36) |
| ***Depth*** | | | | | | | 0.135** | | 0.132** | |
| | | | | | | | (2.24) | | (2.19) | |
| ***Scope*** | | | | | | | | 0.250* | | 0.242* |
| | | | | | | | | (1.90) | | (1.84) |
| ***HL*** | −0.297 | 0.128 | −0.530 | 0.466 | 0.196 | −0.055 | −0.363 | 0.173 | −0.584 | 0.503 |
| | (-0.50) | (0.21) | (-0.87) | (0.76) | (0.86) | (-0.53) | (-0.61) | (0.29) | (-0.96) | (0.82) |
| ***SIZE*** | 0.185*** | −0.025 | 0.206*** | −0.064 | 0.047*** | −0.022*** | 0.178*** | −0.020 | 0.199*** | −0.058 |
| | (3.24) | (-0.34) | (3.53) | (-0.85) | (2.93) | (-3.00) | (3.12) | (-0.26) | (3.40) | (-0.77) |
| ***LEV*** | 0.245 | −0.525** | 0.255 | −0.544** | −0.231*** | 0.116*** | 0.267 | −0.538** | 0.276 | −0.556** |
| | (1.20) | (-2.28) | (1.25) | (-2.36) | (-4.11) | (4.54) | (1.31) | (-2.34) | (1.36) | (-2.41) |
| ***SOE*** | −0.237** | 0.085 | −0.244*** | 0.092 | 0.010 | −0.005 | −0.238*** | 0.083 | −0.245*** | 0.090 |
| | (-2.57) | (0.69) | (-2.65) | (0.74) | (0.51) | (-0.58) | (-2.58) | (0.67) | (-2.66) | (0.73) |
| ***FIXED*** | −0.263 | −0.300 | −0.263 | −0.305 | −0.007 | −0.004 | −0.271 | −0.284 | −0.271 | −0.290 |
| | (-1.02) | (-0.99) | (-1.02) | (-1.01) | (-0.11) | (-0.15) | (-1.05) | (-0.94) | (-1.06) | (-0.96) |
| ***TMTPay1*** | −0.037 | 0.067 | −0.040 | 0.073 | 0.019 | −0.001 | −0.038 | 0.063 | −0.040 | 0.069 |
| | (-0.68) | (1.09) | (-0.73) | (1.19) | (1.28) | (-0.09) | (-0.70) | (1.02) | (-0.74) | (1.12) |
| ***MFEE*** | 4.075*** | 2.691*** | 4.164*** | 2.534*** | −0.223 | 2.534*** | 4.081*** | 2.678*** | 4.167*** | 2.525*** |
| | (7.70) | (4.52) | (7.84) | (4.23) | (-1.48) | (4.23) | (7.72) | (4.50) | (7.86) | (4.21) |
| ***TOP3*** | −0.013*** | 0.016*** | −0.013*** | 0.016*** | −0.001** | 0.016*** | −0.013*** | 0.016*** | −0.013*** | 0.016*** |
| | (-4.86) | (4.52) | (-4.88) | (4.56) | (-2.29) | (4.56) | (-4.74) | (4.45) | (-4.76) | (4.49) |
| ***WW*** | 1.401** | −1.365* | 1.727** | −1.844** | 0.375 | −1.844** | 1.354* | −1.335* | 1.666** | −1.804** |
| | (2.00) | (-1.90) | (2.37) | (-2.47) | (1.45) | (-2.47) | (1.93) | (-1.86) | (2.29) | (-2.41) |
| ***FirmAge*** | −0.324* | 0.091 | −0.319* | 0.086 | −0.037 | 0.086 | −0.322* | 0.094 | −0.317* | 0.088 |
| | (-1.78) | (0.27) | (-1.76) | (0.26) | (-1.08) | (0.26) | (-1.76) | (0.28) | (-1.74) | (0.27) |
| ***Year*** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Industry*** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Constant*** | −0.937 | −2.114 | −1.032 | −1.836 | −0.494** | 1.163*** | −0.873 | −2.378 | −0.966 | −2.096 |
| | (-0.87) | (-1.30) | (-0.96) | (-1.12) | (-2.10) | (10.87) | (-0.81) | (-1.45) | (-0.89) | (-1.28) |
| $R^2$ | 0.0259 | 0.0617 | 0.0262 | 0.0638 | 0.0198 | 0.0195 | 0.0290 | 0.0633 | 0.0292 | 0.0653 |
| ***Wald*** $\chi^2$ | 156.48 | 107.93 | 160.08 | 113.33 | 73.88 | 77.51 | 161.50 | 110.50 | 164.83 | 116.71 |

Note: ***, **, * represent significance at the 1 per cent, 5 per cent and 10 per cent levels, with z-values in parentheses, below.

promote firms to utilize-based and exploratory innovations, respectively. This indicates that hypotheses 2a and 2b are supported.

The regression results in column (9) demonstrate that the regression coefficients for depth of knowledge search are all significant, while the regression results in column (10) indicate that the regression coefficients for performance expectation gap and breadth of knowledge search are also significant. This is the final step in the mediation effect test (Use model 3)[{3}]. After knowledge depth and knowledge width searches have been included in the model, the regression coefficients for the performance expectation gap for utilized and exploratory innovations decreased from 1.513 to 2.194 to 1.446 and 2.148, respectively. This suggests that knowledge search mediates the relationship between the performance expectation gap and dual innovation, with knowledge depth and width searches influencing the innovation process. The preceding analysis reveals that the performance expectation gap has a significant impact on the level of innovation adopted by businesses. Specifically, it is observed that this factor encourages exploratory innovation activities by facilitating the search for broader knowledge and discourages those that involve the exploitation of existing knowledge by limiting the depth of the search. Consequently, it can be stated that both Hypotheses 3a and 3b have been validated.

### *4.3. Robustness tests*

#### *4.3.1. Robustness tests for mediating effects*

(1) Replacement of Mediator Variable Measurements

The five-year window period of the depth of knowledge search variable, as proposed by Katila et al. [12], is replaced with a three-year window period for calculation. This results in the generation of a new depth of knowledge search variable (Depth3), which is then subjected to regression analysis. The resulting regression results are presented in Table 1, which are consistent with the previous test results. Consequently, the conclusions of this paper remain robust.

(2) Change the Mediating Variable Test Method

A literature study by Jiang Ting(2022) [31]reveals that the step-by-step regression method for testing mediating mechanisms has inherent limitations. The test results may be subject to bias, and the mediating effect model must be supported by either literature or empirical common sense. This paper builds upon the methodology proposed by Jiang Ting(2022) to adopt a two-step regression method that integrates experimental data and empirical research to assess the mediating effect.

Firstly, it is a relatively straightforward process to construct mechanism validation equations with the objective of testing the impact of performance expectation fallout on knowledge search. Second, numerous scholars have presented arguments regarding the role of knowledge depth and width searches on firms' dual innovation processes [32,33]. Consequently, this paper develops a regression model between the mediating variables (*depth*、*scope*) and the performance expectation gap (*HG*), which is largely consistent with the previous paper. In addition to the control variables previously outlined, this paper incorporates three further variables into the research model: total asset turnover (*ATO*), total asset growth rate (*Growth*), and operating income growth rate (*AssetGrowth*). This allows for a more comprehensive examination of the firm's capacity to mobilize available capital for knowledge search and innovation. This paper employs the same rigorous empirical testing methodology as the benchmark regression, which necessitates that the results of the mechanism test essentially align with the hypotheses of this paper. The results are presented in Table 2, which are consistent with the results of the mediation effect test previously described. The mediation effect demonstrated in this paper is robust.

#### *4.3.2. Replacing the measurement of explanatory variables*

In the measurement part of performance expectation fallout, this paper references the practice of Yi Changjun et al. (2024) [34] and assumes that $\alpha_1$ equals 0.5 and re-tests that value. The regression results are presented in Table 3, which are partially consistent with the results of the main and mediating effects tests previously discussed. These findings indicate that the conclusions of this paper remain robust.

#### *4.3.3. Endogeneity test*

This paper employs a two-stage least squares approach to the model, as proposed by Shao Jianbing et al. (2023) [35], in order to mitigate the impact of the endogeneity problem. In the initial stage, a dummy variable is generated based on the existence of a performance expectation gap within the firm [34]. This variable is defined as 1 when a performance expectation gap is present and 0 otherwise. A Probit model is then employed to regress the potential endogenous factors influencing firms' binary innovation inputs. This is done in alignment with the control variables presented in the preceding section, with the dummy variable for the performance expectation gap serving as the dependent variable. In the second stage, the endogeneity bias adjustment calculated in the first stage is substituted into the model regression. The results obtained are shown in Table 4. The endogeneity bias adjustment is not significant in the model, and the results are consistent with the conclusions of this paper. Therefore, the previous conclusions are somewhat robust.

There may be an inverse relationship between performance expectations and firms' dual innovation. Additionally, the implementation of firms' dual innovation strategy may also contribute to firms' performance expectations. This paper refers to the study of Wang Xu et al. (2022) [36], in which the sum of current and future periods of exploratory innovation and utilization innovation were included as explanatory variables in the research model. The model was re-estimated, and the regression results are shown in Table 5. The regression coefficients of the performance expectation fallout were found to be significantly negative at the 5 % level and

significantly positive at the 5 % level, respectively. In alignment with the preceding findings, the conclusions of this paper remain robust.

#### 4.3.4. Further studies

(1) Insolvency risk and the reconciling effect of whether or not there is a loss

The financial circumstances of a firm will influence strategic decisions in the event of poor performance. This may include the risk of bankruptcy and the emergence of a loss-making situation. In the event that an enterprise is experiencing poor performance, it is likely to be facing a risk of bankruptcy or a loss of status. This indicates that the enterprise's internal operating conditions are severely deficient. Consequently, it is more inclined to obtain information about market trends, competitive dynamics, and new opportunities through a breadth search in order to overcome the limitations of its knowledge and technology. This contrasts with a depth search, which would involve delving into the details of existing knowledge domains. Consequently, in order to obtain a more heterogeneous knowledge base and regain a competitive advantage, enterprises will increase their breadth of search for knowledge and reduce their depth of search for knowledge. In order to rationalize the results of this paper, the paper incorporates Z-score bankruptcy risk as well as whether or not it is loss-making to test the moderating role it plays between performance expectation fallout and corporate knowledge search. In accordance with previous literature [37], the modified Z-value method proposed by Altman (2000) is employed to assess firms' bankruptcy risk. This is defined as high when the Z-score bankruptcy risk is less than 1.81, and vice versa. When the firm is in a loss position, the value is taken as 1, and vice versa is 0. The results of Table 4 demonstrate that the regression coefficients of the performance expectation fallout are significant when the firm has a high bankruptcy risk or is in a loss position, and vice versa are not significant. This is consistent with the above inference.

(2) Moderating effects of same-industry knowledge search and cross-industry knowledge search

The external knowledge sources of the enterprise exert a certain influence on the relationship between knowledge search and dual innovation. Patents in the same industry are analogous to the research direction of the enterprise and exhibit a high degree of knowledge overlap, which, to a certain extent, facilitates the enterprise's capacity to conduct knowledge-depth searches, thereby promoting the enterprise's utilization-based innovation. Patents from different industries are more disparate from the enterprise's research direction and comprise novel and heterogeneous knowledge. This enables the enterprise to conduct a breadth search, thereby further promoting exploratory innovation. In this paper, external patents cited by enterprises are categorized by industry when calculating the enterprises' external knowledge sources. The number of patent citations obtained from the same industry (*Cite_Same*)

**Table 4**
Insolvency risk and whether or Not to Lose Reconciliation tests.

| Variable | High risk of insolvency | | Low risk of insolvency | | Company loss | | No loss of business | |
|---|---|---|---|---|---|---|---|---|
| | Scope | Depth | Scope | Depth | Scope | Depth | Scope | Depth |
| ***HG*** | 0.571* | −1.182* | 0.244 | −0.547 | 0.620** | −1.275** | 0.182 | −0.437 |
| | (1.85) | (-1.70) | (1.44) | (-1.47) | (2.39) | (-2.34) | (0.92) | (-1.01) |
| ***HL*** | −0.197 | 0.576 | −0.051 | 0.181 | 0.043 | 0.618 | −0.070 | 0.204 |
| | (-0.43) | (0.56) | (-0.46) | (0.75) | (0.09) | (0.60) | (-0.65) | (0.86) |
| ***SIZE*** | −0.060*** | 0.135*** | −0.014* | 0.029 | −0.056** | 0.119*** | −0.019** | 0.040** |
| | (-4.23) | (4.08) | (-1.66) | (1.57) | (-2.57) | (2.61) | (-2.37) | (2.33) |
| ***LEV*** | 0.130* | −0.314* | 0.101*** | −0.194*** | −0.018 | 0.031 | 0.125*** | −0.247*** |
| | (1.77) | (-1.83) | (3.43) | (-2.99) | (-0.28) | (0.23) | (4.60) | (-4.09) |
| ***SOE*** | 0.051*** | −0.099** | −0.016 | 0.030 | 0.064** | −0.133** | −0.009 | 0.017 |
| | (2.62) | (-2.17) | (-1.58) | (1.35) | (2.45) | (-2.44) | (-0.97) | (0.81) |
| ***FIXED*** | −0.081 | 0.191 | 0.017 | −0.055 | −0.011 | 0.032 | 0.001 | −0.017 |
| | (-1.52) | (1.52) | (0.51) | (-0.73) | (-0.17) | (0.23) | (0.03) | (-0.25) |
| ***TMTPay1*** | 0.000 | −0.008 | 0.002 | 0.016 | −0.015 | 0.024 | −0.001 | 0.022 |
| | (0.01) | (-0.24) | (0.23) | (0.95) | (-0.71) | (0.56) | (-0.16) | (1.36) |
| ***MFEE*** | −0.101 | 0.116 | 0.102 | −0.234 | −0.071 | 0.042 | 0.112 | −0.243 |
| | (-0.59) | (0.29) | (1.38) | (-1.43) | (-0.53) | (0.15) | (1.48) | (-1.46) |
| ***TOP3*** | 0.001 | −0.002* | 0.000 | −0.001* | −0.000 | 0.001 | 0.001* | −0.002** |
| | (1.59) | (-1.65) | (1.25) | (-1.90) | (-0.43) | (0.38) | (1.72) | (-2.45) |
| ***WW*** | −0.647*** | 1.386*** | −0.024 | 0.138 | −0.753* | 1.516* | −0.105 | 0.304 |
| | (-2.83) | (2.69) | (-0.18) | (0.46) | (-1.77) | (1.70) | (-0.82) | (1.08) |
| ***FirmAge*** | 0.051 | −0.114 | 0.017 | −0.041 | −0.027 | 0.048 | 0.019 | −0.039 |
| | (1.50) | (-1.40) | (1.01) | (-1.09) | (-0.69) | (0.59) | (1.17) | (-1.08) |
| ***Year*** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Industry*** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Constant*** | 1.388*** | −0.794 | 1.074*** | −0.294 | 1.727*** | −1.499*** | 1.115*** | −0.424* |
| | (6.14) | (-1.49) | (9.17) | (-1.13) | (6.22) | (-2.58) | (10.00) | (-1.71) |
| $R^2$ | 0.0674 | 0.0779 | 0.0182 | 0.0171 | 0.0906 | 0.0630 | 0.0212 | 0.0220 |
| Wald $\chi^2$ | 50.13 | 41.42 | 62.40 | 55.87 | 33.61 | 34.50 | 69.93 | 64.52 |

and the number of cross-industry patent citations (*Cite_Different*) are included in the study. The median of the two is then taken for grouping [38] in order to test the moderating effects of the number of same-industry patent citations on the relationship between the depth of knowledge search and the enterprise's utilization-style innovation and the moderating role of the number of cross-industry patent citations between the breadth of knowledge search and enterprise exploratory innovation. The regression results obtained are presented in Table 5. It can be observed that when the number of patent citations in the same industry is high, the depth of knowledge search has a positive effect on enterprises' utilized innovation. Conversely, when the number of patent citations across industries is high, the breadth of knowledge search has a positive effect on enterprises' exploratory innovation.

## 5. Conclusions and implications of the study

### 5.1. Conclusions

Innovation is a crucial catalyst for the growth and progress of businesses. Enterprises face the task of finding the perfect equilibrium between innovation and exploration. This study utilizes the theoretical framework of corporate behavior to analyze empirical data on high-tech businesses listed on the A-share market from 2010 to 2022. The data indicates that organizations prioritize searching for a wide range of knowledge when it comes to performance requirements. However, they limit their search for in-depth knowledge to a higher degree. Moreover, doing in-depth research enables the progress of exploratory and usage innovation. The mechanism analysis showed that knowledge search is a mediator between the gap in performance expectations and the dual innovation of enterprises. The study reveals that when performance expectations are not met, it leads to an increase in exploratory creativity by expanding the search for a broader range of knowledge. Reduced performance expectations hinder exploitative innovation by limiting the extent of knowledge exploration.

### 5.2. Theoretical contributions

This study extends prior research on the influence of performance expectation gaps on corporate strategic decision-making by examining the dual viewpoints of innovation and knowledge search. Prior research has predominantly concentrated on the direct influence of disparities in performance expectations on technological innovation, resulting in inconclusive findings [10,11]. The idea of "assessment innovation" has been infrequently utilized in these studies, and there has been a significant neglect of the impact of performance expectation gaps on corporate innovation. The notion that information serves as the fundamental basis for organizational innovation is widely acknowledged. The selection of business innovation type is intricately linked to the knowledge it obtains. This

**Table 5**
Cross-industry and same-industry patent citation moderating effect test.

| Variable | High number of patent citations in the same industry | Low number of patent citations in the same industry | High number of cross-industry patent citations | Low number of cross-industry patent citations |
|---|---|---|---|---|
| | Exploitative | Exploitative | Exploratory | Exploratory |
| ***HG*** | 0.203** | 0.063 | 0.866* | 0.094 |
| | (2.29) | (0.74) | (1.94) | (0.83) |
| ***HL*** | −0.194 | −0.682 | −0.838 | 1.023* |
| | (-0.24) | (-0.76) | (-0.63) | (1.70) |
| ***SIZE*** | 0.189** | 0.214*** | −0.221 | 0.026 |
| | (2.30) | (2.84) | (-1.38) | (0.35) |
| ***LEV*** | 0.423 | −0.046 | −0.561 | −0.391* |
| | (1.35) | (-0.18) | (-0.99) | (-1.78) |
| ***SOE*** | −0.232* | −0.129 | 0.135 | 0.138 |
| | (-1.72) | (-1.14) | (0.45) | (1.26) |
| ***FIXED*** | −0.839** | −0.119 | 0.227 | −0.105 |
| | (-2.17) | (-0.37) | (0.31) | (-0.36) |
| ***TMTPay1*** | −0.015 | −0.064 | 0.113 | 0.081 |
| | (-0.20) | (-0.86) | (0.83) | (1.31) |
| ***MFEE*** | 2.625*** | 4.393*** | 3.944** | 1.523*** |
| | (3.05) | (6.80) | (2.42) | (2.79) |
| ***TOP3*** | −0.011*** | −0.009*** | 0.014* | 0.011*** |
| | (-2.63) | (-2.60) | (1.66) | (3.31) |
| ***WW*** | 2.236** | 0.480 | −2.423 | −0.276 |
| | (2.16) | (0.49) | (-1.49) | (-0.38) |
| ***FirmAge*** | −0.326 | −0.304 | 0.819 | −0.224 |
| | (-1.25) | (-1.46) | (1.26) | (-0.76) |
| ***Year*** | Yes | Yes | Yes | Yes |
| ***Industry*** | Yes | Yes | Yes | Yes |
| ***Constant*** | −0.582 | −2.264* | −2.539 | −1.342 |
| | (-0.38) | (-1.65) | (-0.73) | (-0.86) |
| $R^2$ | 0.0398 | 0.0172 | 0.0782 | 0.0606 |
| Wald $\chi^2$ | 86.63 | 102.85 | 46.21 | 68.87 |

research examines the internal process by which the performance expectation gap impacts corporate dual innovation, focusing on the significance of knowledge and elucidating the connection between the two. This study highlights the need to conduct a knowledge search and combines knowledge-based theory with organizational behavior theory. It expands the decision-making framework of organizations by incorporating performance feedback and promoting "assessment-search-innovation." This study advances research in the field of knowledge management by providing a fresh outlook on the elements that drive information seeking and the internal factors that impact a firm's strategic behaviors when expectations are not fulfilled.

This research aims to clarify the impact of bankruptcy-related risks or losses on the quest for information at the boundary. This research tries explicitly to elucidate the correlation between various forms of knowledge exploration and the concept of dual innovation within enterprises. In order to accomplish this, we analyze the influence of the performance expectation gap on the formation of the boundary effect. This study investigates how internal and external factors influence the strategic decision-making process in response to performance feedback. Specifically, it focuses on the impact of internal finance and external information sources as moderators. A comprehensive comprehension of the complex correlation between gaps in performance expectations, searches for information, and dual innovations is essential for enhancing the research model proposed in this study and advancing related research.

### *5.3. Research implications*

First and foremost, it is crucial for businesses to tackle the performance expectation gap in a detached and objective manner. There is a significant amount of data that confirms the widespread existence of the performance expectation gap in businesses. The presence of a performance expectation gap suggests that the enterprise's performance does not align with the anticipated level of performance, indicating inherent flaws inside the organization. However, in this case, it would also be advantageous to foster a mindset of creativity and willingness to take risks. Therefore, for businesses, the performance expectation gap poses both a difficulty and a chance for advancement. Enterprises should conduct an unbiased study of the feedback outcomes (performance expectation fallout) in reference to the current business situation. This should be grounded in a logical evaluation of the current circumstances rather than on one's own subjective desires. In order to successfully overcome the current challenges and attain long-term growth, it is imperative for them to recognize their limitations and establish clear objectives (That is, the organization should establish the desired degree of performance, level of development, and other strategic goals it aims to accomplish in the future.)

Secondly, enterprises must acknowledge that engaging in dual innovation activities is crucial for overcoming operational constraints and sustaining competitive advantages. Enterprises can acquire revolutionary technology through exploratory innovation and enhance and optimize current technologies through utilization innovation. Therefore, businesses must carefully and appropriately balance the trade-offs between internal and external innovation initiatives, considering multiple dimensions, to sustain their competitive advantage. Moreover, businesses must evaluate the underlying reasons behind the choices made by decision-makers when it comes to adopting new and creative approaches, particularly regarding disparities in performance expectations. It is essential to prevent the formation of short-sighted and self-serving behaviors to guarantee the organization's long-term growth and progress.

Finally, In the context of the knowledge economy, the strategic utilization of knowledge resources has gained significant importance. Enterprises are advised to develop enduring collaborative and interactive partnerships with partners in diverse industries and knowledge domains. This will broaden firms' sources of acquiring new knowledge and facilitate the process of acquiring external knowledge through dialogue, which in turn will expand their own knowledge base. Enterprises should not only acquire external heterogeneous knowledge through breadth search but also integrate and apply external homogeneous knowledge through depth search. Assimilating repetitious knowledge allows firms to establish a dominant position in current technologies. Moreover, it is essential for organizations to thoroughly evaluate and effectively utilize the knowledge they have received. This will enable them to convert it into valuable knowledge that can be applied in their innovation operations.

### *5.4. Research shortcomings and prospects*

#### *5.4.1. Major limitations to the study*

This paper makes an important contribution to the literature on the impact of historical expectation fallout on firms' dual innovation. However, it also has some limitations. (1) First, the research primarily examines the two aspects of knowledge depth and width search and their impact on the relationship between performance expectation fallout and dual innovation. Nevertheless, previous researchers have already categorized knowledge exploration into many dimensions, including remote search and local search, market search, and technological search, among others. This study argues that relying solely on the depth and breadth of knowledge search is inadequate for effectively capturing the variations in external knowledge. This serves as the basis for the variances in innovation observed among firms. Meanwhile, the measure of knowledge search in this paper is relatively one-sided, not all knowledge search activities generate patents, and patent citations may be affected by firm activities other than knowledge search. (2) This paper solely examines the influence of the performance expectation gap on the dual innovation of firms without delving into the specific process of harnessing innovation and using exploratory innovation to reduce the existing performance expectation gap.

#### *5.4.2. Suggestions for future research*

(1) In the future, the mediating role of knowledge search can be explored from a variety of perspectives (market knowledge search, technology knowledge search; remote knowledge search, local knowledge search, etc.) to improve the related research in the

field of knowledge search; In addition, future research on knowledge search could supplement firms' patent data with other variables, such as R&D alliances, new product development methods, etc.

(2) Further research can be undertaken to examine how the adoption of various innovation activities can reduce the performance disparity among firms. This will help address the issue of how firms can select different innovation strategies to enhance their performance dilemma in the presence of a performance expectation gap. Additionally, it will provide systematic guidelines for enterprises to make informed decisions regarding innovation.

## CRediT authorship contribution statement

**Li Zheng:** Writing – review & editing. **Yuanyuan Wang:** Writing – review & editing, Writing – original draft, Validation, Software, Formal analysis, Data curation. **Kang Fang:** Validation, Software.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendixes

**TABLE 1**
Replacement of mediator variable measurements

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Exploitative | Exploratory | Depth | Scope | Exploitative | Exploratory | Exploitative | Exploratory |
| ***HG*** | −1.513* | 2.194** | −0.573** | 0.295** | | | −1.424 | 2.148** |
| | (-1.69) | (2.41) | (-2.08) | (1.96) | | | (-1.60) | (2.36) |
| ***Depth*** | | | | | 0.196*** | | 0.192*** | |
| | | | | | (2.75) | | (2.69) | |
| ***Scope*** | | | | | | 0.250* | | 0.242* |
| | | | | | | (1.90) | | (1.84) |
| ***HL*** | −0.530 | 0.466 | 0.073 | −0.055 | −0.358 | 0.173 | −0.576 | 0.503 |
| | (-0.87) | (0.76) | (0.38) | (-0.53) | (-0.61) | (0.29) | (-0.95) | (0.82) |
| ***SIZE*** | 0.206*** | −0.064 | 0.039*** | −0.022*** | 0.177*** | −0.020 | 0.197*** | −0.058 |
| | (3.53) | (-0.85) | (2.87) | (-3.00) | (3.09) | (-0.26) | (3.37) | (-0.77) |
| ***LEV*** | 0.255 | −0.544** | −0.195*** | 0.116*** | 0.273 | −0.538** | 0.282 | −0.556** |
| | (1.25) | (-2.36) | (-4.16) | (4.54) | (1.35) | (-2.34) | (1.39) | (-2.41) |
| ***SOE*** | −0.244*** | 0.092 | 0.010 | −0.005 | −0.239*** | 0.083 | −0.246*** | 0.090 |
| | (-2.65) | (0.74) | (0.59) | (-0.58) | (-2.59) | (0.67) | (-2.67) | (0.73) |
| ***FIXED*** | −0.263 | −0.305 | 0.004 | −0.004 | −0.276 | −0.284 | −0.276 | −0.290 |
| | (-1.02) | (-1.01) | (0.07) | (-0.15) | (-1.07) | (-0.94) | (-1.08) | (-0.96) |
| ***TMTPay1*** | −0.040 | 0.073 | 0.016 | −0.001 | −0.038 | 0.063 | −0.040 | 0.069 |
| | (-0.73) | (1.19) | (1.23) | (-0.09) | (-0.69) | (1.02) | (-0.73) | (1.12) |
| ***MFEE*** | 4.164*** | 2.534*** | −0.205 | 0.098 | 4.087*** | 2.678*** | 4.172*** | 2.525*** |
| | (7.84) | (4.23) | (-1.63) | (1.42) | (7.73) | (4.50) | (7.87) | (4.21) |
| ***TOP3*** | −0.013*** | 0.016*** | −0.001** | 0.000 | −0.013*** | 0.016*** | −0.013*** | 0.016*** |
| | (-4.88) | (4.56) | (-1.99) | (1.53) | (-4.74) | (4.45) | (-4.76) | (4.49) |
| ***WW*** | 1.727** | −1.844** | 0.279 | −0.142 | 1.350* | −1.335* | 1.658** | −1.804** |
| | (2.37) | (-2.47) | (1.29) | (-1.20) | (1.93) | (-1.86) | (2.28) | (-2.41) |
| ***FirmAge*** | −0.319* | 0.086 | −0.029 | 0.017 | −0.322* | 0.094 | −0.317* | 0.088 |
| | (-1.76) | (0.26) | (-1.02) | (1.07) | (-1.76) | (0.28) | (-1.74) | (0.27) |
| ***Year*** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Industry*** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Constant*** | −1.032 | −1.836 | −0.494** | −1.836 | −0.873 | −2.378 | −0.966 | −2.096 |
| | (-0.96) | (-1.12) | (-2.10) | (-1.12) | (-0.81) | (-1.45) | (-0.89) | (-1.28) |
| $R^2$ | 0.0262 | 0.0638 | 0.0198 | 0.0638 | 0.0290 | 0.0633 | 0.0292 | 0.0653 |
| Wald $\chi^2$ | 160.08 | 113.33 | 73.88 | 113.33 | 161.50 | 110.50 | 164.83 | 116.71 |

**TABLE 2**
Replacement of mediation effect tests

| Variable | *Depth* | *Scope* |
|---|---|---|
| ***HG*** | −0.687** | 0.303** |
| | (-2.08) | (2.01) |
| ***HL*** | 0.294 | −0.099 |
| | (1.26) | (-0.93) |

(*continued on next page*)

**TABLE 2** (*continued*)

| Variable | *Depth* | *Scope* |
|---|---|---|
| ***SIZE*** | 0.034* | −0.016** |
| | (1.95) | (-2.05) |
| ***LEV*** | −0.210*** | 0.108*** |
| | (-3.63) | (4.11) |
| ***SOE*** | 0.008 | −0.005 |
| | (0.39) | (-0.50) |
| ***FIXED*** | −0.013 | −0.006 |
| | (-0.20) | (-0.18) |
| ***TMTPay1*** | 0.017 | 0.000 |
| | (1.13) | (0.03) |
| ***MFEE*** | −0.231 | 0.097 |
| | (-1.40) | (1.29) |
| ***TOP3*** | −0.001** | 0.000 |
| | (-2.20) | (1.48) |
| ***WW*** | 0.074 | −0.014 |
| | (0.24) | (-0.10) |
| ***FirmAge*** | −0.041 | 0.018 |
| | (-1.19) | (1.15) |
| ***ATO*** | −0.005 | 0.000 |
| | (-0.16) | (0.01) |
| ***Growth*** | −0.044* | 0.023* |
| | (-1.66) | (1.87) |
| ***AssetGrowth*** | −0.010 | −0.003 |
| | (-0.34) | (-0.26) |
| ***Year*** | Yes | Yes |
| ***Industry*** | Yes | Yes |
| ***Constant*** | −0.469** | 1.153*** |
| | (-1.99) | (10.72) |
| $R^2$ | 0.0207 | 0.0207 |
| Wald $\chi^2$ | 77.53 | 81.06 |

**TABLE 3**
Replacement of explanatory variable measurements

| Variable | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Exploitative | Exploratory | Depth | Scope | Exploitative | Exploratory |
| ***HG1*** | −1.620* | 1.646* | −0.649* | 0.288* | −1.536* | 1.581* |
| | (-1.75) | (1.76) | (-1.91) | (1.86) | (-1.66) | (1.69) |
| ***Depth*** | | | | | 0.131** | |
| | | | | | (2.17) | |
| ***Scope*** | | | | | | 0.242* |
| | | | | | | (1.84) |
| ***HL*** | −0.586 | 0.421 | 0.182 | −0.049 | −0.635 | 0.454 |
| | (-0.95) | (0.68) | (0.79) | (-0.47) | (-1.03) | (0.73) |
| ***SIZE*** | 0.201*** | −0.047 | 0.045*** | −0.021*** | 0.194*** | −0.041 |
| | (3.48) | (-0.62) | (2.80) | (-2.88) | (3.35) | (-0.54) |
| ***LEV*** | 0.253 | −0.534** | −0.229*** | 0.115*** | 0.274 | −0.546** |
| | (1.25) | (-2.32) | (-4.08) | (4.51) | (1.35) | (-2.37) |
| ***SOE*** | −0.247*** | 0.093 | 0.010 | −0.005 | −0.247*** | 0.091 |
| | (-2.67) | (0.75) | (0.50) | (-0.57) | (-2.68) | (0.74) |
| ***FIXED*** | −0.269 | −0.291 | −0.008 | −0.004 | −0.277 | −0.277 |
| | (-1.05) | (-0.96) | (-0.12) | (-0.15) | (-1.08) | (-0.92) |
| ***TMTPay1*** | −0.041 | 0.073 | 0.019 | −0.000 | −0.042 | 0.069 |
| | (-0.75) | (1.19) | (1.26) | (-0.07) | (-0.77) | (1.12) |
| ***MFEE*** | 4.189*** | 2.555*** | −0.215 | 0.094 | 4.190*** | 2.548*** |
| | (7.87) | (4.26) | (-1.42) | (1.37) | (7.88) | (4.25) |
| ***TOP3*** | −0.013*** | 0.016*** | −0.001** | 0.000 | −0.013*** | 0.015*** |
| | (-4.79) | (4.46) | (-2.16) | (1.41) | (-4.68) | (4.40) |
| ***WW*** | 1.683** | −1.659** | 0.344 | −0.128 | 1.623** | −1.618** |
| | (2.34) | (-2.25) | (1.34) | (-1.10) | (2.25) | (-2.19) |
| ***FirmAge*** | −0.328* | 0.096 | −0.039 | 0.018 | −0.325* | 0.099 |
| | (-1.80) | (0.29) | (-1.14) | (1.13) | (-1.78) | (0.30) |
| ***Year*** | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Industry*** | Yes | Yes | Yes | Yes | Yes | Yes |
| ***Constant*** | −0.922 | −2.050 | −0.461* | 1.148*** | −0.861 | −2.308 |
| | (-0.85) | (-1.26) | (-1.96) | (10.72) | (-0.80) | (-1.41) |
| $R^2$ | 0.0263 | 0.0630 | 0.0210 | 0.0206 | 0.0293 | 0.0645 |
| Wald $\chi^2$ | 160.11 | 111.00 | 73.26 | 76.96 | 164.80 | 114.34 |

**TABLE 4**
Endogeneity test

| Variable | *Exploitative* | *Exploratory* |
|---|---|---|
| ***HG*** | −2.031* | 1.571* |
| | (-1.88) | (1.71) |
| ***HL*** | −23.873 | −154.662 |
| | (-0.10) | (-0.83) |
| ***SIZE*** | 0.219*** | −0.058 |
| | (3.02) | (-0.72) |
| ***LEV*** | 0.491** | −0.206 |
| | (2.03) | (-0.87) |
| ***SOE*** | −0.232** | 0.086 |
| | (-2.20) | (0.68) |
| ***FIXED*** | −0.463 | −0.609* |
| | (-1.52) | (-1.93) |
| ***TMTPay1*** | 0.003 | 0.019 |
| | (0.04) | (0.28) |
| ***MFEE*** | 6.175*** | 2.699*** |
| | (9.12) | (3.72) |
| ***TOP3*** | −0.013*** | 0.020*** |
| | (-4.09) | (5.55) |
| ***WW*** | 1.598* | −1.148 |
| | (1.67) | (-1.42) |
| ***FirmAge*** | −0.175 | 0.490 |
| | (-0.88) | (1.47) |
| ***Adjustment for endogeneity bias*** | 0.009 | 0.039 |
| | (0.15) | (0.82) |
| ***Year*** | Yes | Yes |
| ***Industry*** | Yes | Yes |
| ***Constant*** | −2.765** | −1.949 |
| | (-2.24) | (-1.16) |
| $R^2$ | 0.0487 | 0.0937 |
| Wald $\chi^2$ | 169.94 | 112.35 |

**TABLE 8**
Reverse causality test

| Variable | Exploitative1 | Exploratory1 |
|---|---|---|
| **HG** | −2.823** | 4.744** |
| | (-2.01) | (2.29) |
| **HL** | −1.075 | 1.011 |
| | (-1.13) | (0.72) |
| **SIZE** | 0.294*** | −0.086 |
| | (3.30) | (-0.55) |
| **LEV** | 0.364 | −0.772 |
| | (1.17) | (-1.52) |
| **SOE** | −0.249* | 0.265 |
| | (-1.80) | (1.03) |
| **FIXED** | −0.522 | −1.319** |
| | (-1.33) | (-1.99) |
| **TMTPay1** | 0.032 | 0.021 |
| | (0.38) | (0.15) |
| **MFEE** | 7.709*** | 5.696*** |
| | (9.44) | (4.30) |
| **TOP3** | −0.015*** | 0.013* |
| | (-3.69) | (1.76) |
| **WW** | 1.514 | −5.245*** |
| | (1.33) | (-3.09) |
| **FirmAge** | −0.537** | 0.876 |
| | (-2.02) | (1.46) |
| **Year** | Yes | Yes |
| **Industry** | Yes | Yes |
| **Constant** | −3.521** | −5.301* |
| | (-2.19) | (-1.65) |
| $R^2$ | 0.0339 | 0.0568 |
| Wald $\chi^2$ | 195.42 | 106.42 |

## References


[1] M.J. Benner, M.L. Tushman, Exploitation, exploration, and process management: the productivity dilemma revisited, Acad. Manag. Rev. 28 (2) (2003) 238–256.
[2] R. Cyert, J. March, A Behavioral Theory of the Firm, Prentice-Hall, Englewood Cliffs, NJ, 1963.
[3] Mengzhuo Tan, Sui Sun, Wenyong Pan, Aspiration gap and enterprise innovation in China's new energy listed companies - based on analysis of threshold effect of financial slack, Journal of Industrial Technology and Economy 42 (4) (2023) 77–90, https://doi.org/10.3969/j.issn.1004-910X.2023.04.008.
[4] B.C. Rudy, A.F. Johnson, Performance, aspirations, and market versus nonmarket investment, J. Manag. 42 (4) (2013) 936–959, https://doi.org/10.1177/0149206313503017.
[5] Pengfei Ge, Xiulu Huang, Digital transformation, innovative knowledge, and integrated innovation of manufacturing enterprises, Soft Sci. (2024) 1–15. http://kns.cnki.net/kcms/detail/51.1268.G3.20240229.1415.004.html.
[6] Jianghong Zeng, Yalan Yang, Does aspiration gap promote the exploratory innovation, Sci. Technol. Prog. Policy 38 (16) (2021) 63–73.
[7] Songsong Cheng, Hongyu Liu, Research on the relationship between enterprise network strategy and dual innovation synergy under performance gap, Science and Technology Management Research 43 (7) (2023) 10–19.
[8] K. Laursen, A. Salter, Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms, Strat. Manag. J. 27 (2) (2006) 131–150.
[9] J. Liu, Y. Wu, H. Xu, The relationship between internal control and sustainable development of enterprises by mediating the roles of exploratory innovation and exploitative innovation. Exploitative innovation, Operations Management Research 15 (3) (2024) 913–924.
[10] Shufeng Xiao, Kexin Wang, The different dimensions of underperformance and exploratory innovation, Science of Science and Management of S.& T 43 (4) (2022) 136–155, 2022.
[11] Q. Fan, S. Cheng, D. Chun, et al., To exploit or explore? Research on the relationship between performance gap and ambidexterity innovation, Technol. Anal. Strat. Manag. (2024) 1–14.
[12] R. Katila, G. Ahuja, Something old, something new: a longitudinal study of search behavior and new product introduction, Acad. Manag. J. 45 (6) (2002) 1183–1194.
[13] Xu Jianzhong, Li Fengshu, Wei Pan, et al., The affect of knowledge search ambidexterity on enterprise innovation performance: moderating role of market orientation, Forum on Science and Technology in China (7) (2019) 119–127.
[14] T. Hou, J.J. Li, J. Lin, Linking knowledge search to knowledge creation: the intermediate role of knowledge complexity, Manag. Decis. 61 (5) (2023) 1156–1182.
[15] Y.H. Chiang, K.P. Hung, Exploring open search strategies and perceived innovation performance from the perspective of inter-organizational knowledge flows, R&D Management 40 (3) (2010) 292–299.
[16] J.J. Chrisman, P.C. Patel, Variations in R&D investments of family and nonfamily firms: behavioral agency and myopic loss aversion perspectives, Acad. Manag. J. 55 (4) (2012) 976–997.
[17] G. Dosi, Sources, procedures, and microeconomic effects of innovation, J. Econ. Lit. (1988) 1120–1171.
[18] Yong Cao, Gu Jia, Bingxuan Chen, et al., Digital innovation Capabilities , Boundary-spanning Search , and new product development performance: moderating role of policy perception capabilities, Forum on Science and Technology in China 10 (2023) 41–49.
[19] Wei Wang, Wentian Cui, Xiaoming Sun, et al., The influence of knowledge scope and indirect ties on key Inventors'Creativity, Forecasting 36 (5) (2017) 36–42, https://doi.org/10.11847/fj.36.5.36.
[20] Huijun Yang, Jianjun Yang, Research on the impact of external search, linking intensity and absorptive capacity on innovation performance, Journal of Management Science 29 (3) (2016) 24–37, https://doi.org/10.3969/j.issn.1672-0334.2016.03.003.
[21] Z. Xing, T. Chin, J. Huang, et al., Knowledge-driven networking and ambidexterous innovation equilibrium in power systems transition, J. Knowl. Manag. 28 (5) (2024) 1414–1443.
[22] Yanling Lian, Xiaogang He, Hao Gao, The performance aspiration gap and the strategy adjustment:A case study based on China's listed companies, Journal of Management World (11) (2014) 119–132+188. :CNKI:SUN:GLSJ.0.2014-11-013.
[23] X. Zhu, N. Yang, M. Zhang, et al., Firm innovation: technological boundary-spanning search and knowledge base and distance, Manag. Decis. 62 (1) (2024) 326–351.
[24] D.J. Teece, Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance, Strat. Manag. J. 28 (13) (2007) 1319–1350.
[25] J. Pinkse, R. Bohnsack, A. Kolk, The role of public and private protection in disruptive innovation: the automotive industry and the emergence of low-emission vehicles, J. Prod. Innovat. Manag. 31 (1) (2014) 43–60.
[26] Tao Ketao, Ren Jing, Feng Tianwen, et al., The mechanism of how green innovation under the background of double carbon - the mediating role of environmental protection unlearning, Manag. Rev. 35 (12) (2023) 108–121.
[27] Zicheng Pan, Zhigao Yi, Internal pay gap, the social capital of TMT and enterprise ambidextrous innovation, Journal of Industrial Engineering and Engineering Management 37 (3) (2023) 26–41.
[28] Zhonglin Wen, Lei Zhang, Jietai Hou, et al., Testing and application of the mediating effects, Acta Psychologica Sinica (5) (2004) 614–620.
[29] Hailian Xiao, Qingquan Tang, Meihua Zhou, The impact of debt on firms'innovation investment mode: an empirical research on R&D heterogeneity, Sci. Res. Manag. 35 (10) (2014) 77–85. DOI:CNKI:SUN:KYGL.0.2014-10-010.
[30] W.R. Chen, Determinants of firms' backward-and forward-looking R&D search behavior, Organ. Sci. 19 (4) (2008) 609–622.
[31] Ting Jiang, Mediating effects and moderating effects in causal inference, China Industrial Economics (5) (2022) 100–120.
[32] F. Damanpour, M. Schneider, Phases of the adoption of innovation in organizations: effects of environment, organization and top managers[1], Br. J. Manag. 17 (3) (2006) 215–236.
[33] J. Björk, M. Magnusson, Where do good innovation ideas come from? Exploring the influence of network connectivity on innovation idea quality, J. Prod. Innovat. Manag. 26 (6) (2009) 662–670.
[34] Changjun Yi, Minmin Guo, Xiaoyang Hao, et al., The impact of performance expectation gaps on the speed of corporate internationalization, Sci. Technol. Prog. Policy (2024) 1–10. http://kns.cnki.net/kcms/detail/42.1224.G3.20240305.1440.002.html.
[35] Jianbing Shao, Na Li, "Rebirth in the fog": multiple performance feedback and enterprise digital investment, R&D Management 35 (5) (2023) 29–43.
[36] Wang Xu, Xiaoning Zhang, Sang Liang, et al., Reference eeffect of performance feedback on corporate environmental strategy decision-making:the role of integration boundary based on dual institutional structure, Systems Engineering-Theory & Practice 42 (9) (2022) 2391–2407, https://doi.org/10.12011/SETP2021-2602, 2022,.
[37] Xiaoxi Zhang, Lujia Sun, Collateral Expansion , Over-used leverage and risk of bankruptcy—double-edged swords of chattel mortgage law reform, China Industrial Economics (7) (2017) 175–192, https://doi.org/10.19581/j.cnki.ciejournal.2017.07.010.
[38] Shoufeng Zhang, Desheng Liu, Haorong Liu, Digital talent and open innovation of small and medium-sized enterprises:A mediated moderation model, On Economic Problems (4) (2024) 114–121, https://doi.org/10.16011/j.cnki.jjwt.2024.04.009.