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Institutional Investor Networks and Corporate Innovation: The Moderating Effect of Female Board Directorship

(Rangkaian Pelabur Institusi dan Inovasi Korporat: Kesan Penyederhana Lembaga Pengarah Wanita)

Li Xintong
Hamezah Md Nor
Noradiva Hamzah
Intan Maiza Abdul Rahman
(Faculty of Economics and Management, Universiti Kebangsaan Malaysia)

ABSTRACT

Previous research has focused on the relationship between corporate innovation and institutional investor holdings; however, there is a dearth of studies on the pathway from institutional investor networks to corporate innovation. To address this gap, this study investigates the effect of institutional investor networks on corporate innovation via the moderating role of female board directorship. Using data from a sample of Chinese listed businesses spanning 2014 to 2023, the findings show that institutional investor networks considerably enhance both innovation input and output by providing resource and knowledge advantages. This correlation is strengthened by the presence of female board directors, suggesting that they are better able to leverage network resources and produce creative judgments. By highlighting the critical roles played by institutional investor networks and female board members in fostering corporate innovation, this study offers managers useful guidance on enhancing corporate governance and optimizing investor relations.

Keywords: Institutional investor networks; corporate innovation; female board directorship

ABSTRAK

Penyelidikan terdahulu telah bertumpu pada hubungan antara inovasi korporat dan pegangan pelabur institusi; namun, terdapat kekurangan kajian mengenai laluan daripada rangkaian pelabur institusi kepada inovasi korporat. Bagi menangani jurang ini, kajian ini menyiasat kesan rangkaian pelabur institusi terhadap inovasi korporat melalui peranan penyederhanaan keanggotaan wanita dalam lembaga pengarah. Menggunakan data daripada sampel perniagaan tersenarai di China dari tahun 2014 hingga 2023, dapatan menunjukkan bahawa rangkaian pelabur institusi meningkatkan input dan output inovasi secara ketara dengan menyediakan kelebihan dari segi sumber dan pengetahuan. Hubungan ini diperkukuh dengan kehadiran pengarah wanita dalam lembaga pengarah, mencadangkan bahawa mereka lebih berkeupayaan memanfaatkan sumber rangkaian dan menghasilkan pertimbangan kreatif. Dengan menekankan peranan penting yang dimainkan oleh rangkaian pelabur institusi dan pengarah wanita dalam memacu inovasi korporat, kajian ini menawarkan panduan berguna kepada pengurus untuk memperbaiki tadbir urus korporat dan mengoptimumkan hubungan dengan pelabur.

Kata kunci: Rangkaian pelabur institusi; inovasi korporat; lembaga pengarah wanita

INTRODUCTION

Corporate innovation is the process of turning creative inputs into creative outputs (Stojcic et al. 2018). In 2018, China revised its corporate governance law and company law to promote innovation among businesses. However, Chinese listed firms continue to face various problems: a structural lack of innovative talent due to limited funding for talent development (Hu et al. 2020); geographic limitations (Ying et al. 2023); and insufficient internal innovation capabilities stemming from low R&D investment and poor strategic guidance (Yip et al. 2016). Consequently, improving Chinese companies' overall innovation capacity is a crucial issue that demands immediate attention and further research.

Prior research has examined the factors influencing corporate innovation from the viewpoints of institutional investors (Kim et al. 2019) and board characteristics (Cumming & Leung 2021). In practice, however, this relationship is undermined by institutional investors' dispersed ownership (Hassanein et al. 2022). On average, controlling shareholders own approximately 36% of publicly traded companies, while institutional investors hold only about 6% (Jiang & Kim 2020). Dispersed ownership may lead to inadequate oversight of management by institutional investors, as they lack sufficient incentives (Velte & Obermann 2021). Due to short holding periods,

institutional investors may also prioritize short-term performance over long-term innovation investments (Kim et al. 2019).

To address the shortfalls of dispersed shareholding, China's capital market has launched mechanisms such as the Shanghai-Hong Kong Stock Connect, Shenzhen-Hong Kong Stock Connect, Qualified Foreign Institutional Investor (QFII), and RMB Qualified Foreign Institutional Investor (RQFII), making it simpler for both domestic and international institutional investors to participate in the A-share market. In addition, beginning in 2018, China gradually relaxed investment quota restrictions on QFII and RQFII; in the same year, A-shares were included in the MSCI Emerging Markets Index. These changes have lowered entry barriers for institutional investors, allowing international organizations to more easily access and participate in China's evolving finance market.

As the number of institutional investors continues to grow, investing in diversified securities has become a popular strategy for risk reduction. As a result, it is not uncommon for several institutional investors to jointly own shares in the same listed firm in China. When multiple institutions collectively own shares in a listed company, institutional investor networks (hereafter IINs) are formed (Crane et al. 2019; Bajo et al. 2020; Wu et al. 2023). According to Crane et al. (2019), this network of institutional investors created by joint shareholding can encourage individual institutions to practice cooperation and information transparency, thus increasing their corporate governance efficacy. Studies also suggest that IINs can alleviate extreme stock market risks (Gong & Du 2022), boost firm value (Bajo et al. 2020), enhance ESG performance (Yang et al. 2024), and increase total factor productivity (Chen et al. 2023). Notably, these networks can positively impact corporate innovation through increased R&D investments and innovation patent output (Fan et al. 2023).

Institutional investors, by virtue of their financial resources, governance expertise, and market influence, play a pivotal role in shaping firms' strategic decisions, including the allocation of resources toward innovation activities. Individual institutions often lack the incentives or capacity to monitor management effectively. Individual institutions often lack the incentives or capacity to monitor management effectively (Muhmad & Zainul Abidin 2025). In contrast, institutional networks can pool expertise, oversee more rigorously, and commit to longer investment horizons. For Chinese listed firms facing structural constraints such as talent shortages, geographic fragmentation, and limited R&D leadership, these networks offer a practical path to securing stable, long-term support for innovation initiatives. In this regard, institutional investors can position innovation as a strategic priority, either by participating actively in a company's board of directors (BOD) or by providing stable long-term funding (Gharbi & Othmani 2022; Harasheh et al. 2024).

However, existing studies have predominantly examined institutional ownership in isolation, focusing on metrics such as shareholding concentration or holding duration, while overlooking the relational structures created when multiple institutions co-invest in the same firm (Crane et al. 2019; Bajo et al. 2020). Additionally, recent studies have documented the benefits of institutional shareholding on stock liquidity, firm value, and ESG performance, yet the specific impact of IINs on corporate innovation remains underexplored (Qi et al. 2020). Therefore, this study seeks to determine whether IINs affect corporate innovation in Chinese listed firms. By investigating network structures, this study addresses a critical gap regarding how collective ownership configurations translate into better R&D investment, patent output, and innovation quality.

In recognition of the special role female directors play in corporate governance and innovation, some businesses have taken the initiative to increase the gender diversity of their boards. The updated Law of the People's Republic of China on the Protection of Women's Rights and Interests encourages women's participation in economic and social affairs, including corporate management and decision-making. As a result, the percentage of Chinese listed companies with female directors increased annually between 2012 and 2021, reaching 16.57% in 2021 (Nankai.edu.cn 2023). Female directors are generally considered to be more diligent monitors, less tolerant of opportunistic behavior, and more focused on transparency and ethical governance (Wang 2020). Their enhanced oversight can mitigate agency problems and make certain that strategic decisions, such as innovation investments, are in the interest of long-term value creation. Notably, female directors can strengthen board monitoring and uphold the influence of IINs, ensuring that institutional investors' efforts are effectively translated into meaningful innovation outcomes.

Notwithstanding China's encouragement of female participation on corporations' BOD since 2018, women remain underrepresented on boards (Liu et al. 2022). Unlike in several European and North American countries, China does not yet have a legislated minimum ratio for BOD gender composition. Cultural and institutional differences in China, namely its unique corporate governance structure and the evolving role of institutional investors, may further influence the context-specific dynamics between female directors, IINs, and corporate innovation (Liu et al. 2022). Therefore, existing empirical evidence on female directorship's impact on corporate innovation may not be directly applicable to the Chinese market.

In fact, despite the growing recognition of board gender diversity's importance, empirical research on the moderating role of female directorship in the relationship between IINs and corporate innovation remains limited. Several studies have examined the impact of female directorship on innovation (Griffin et al. 2021; Hakovirta et al. 2020), but few have examined how it influences the effectiveness of IINs in driving innovation. This gap in the literature highlights the need for further research to understand the interplay among these variables.

From a practical standpoint, understanding the moderating role of female directorship can help firms optimize their governance structures to boost innovation. By identifying the conditions under which female directors amplify the positive effects of IINs on innovation, firms can make more informed decisions about board composition and investor relations strategies. This can lead to effective governance and better innovation outcomes, ultimately contributing to long-term organizational success. Overall, testing the moderating role of female directorship in the Chinese context can yield valuable insights and add to the broader literature on gender diversity and corporate governance.

Based on the discussion above, this study proposes that a higher density of IINs is associated with increased innovation output, as measured by firms' R&D investment intensity and number of patent applications. It is also posited that in firms with a higher proportion of female board members, the positive impact of IINs on corporate innovation is more significant. Accordingly, this paper seeks to address two research questions:

1. Do IINs enhance corporate innovation in Chinese listed companies?
2. Does female board directorship moderate the relationship between IINs and corporate innovation?

By answering these questions with specific empirical evidence from the Chinese context, this study contributes to the growing literature on institutional investor governance and gender diversity. The findings offer practical implications for policymakers, investors, and company boards aiming to cultivate innovation-driven development.

Following this introduction of the research issues and context, the next section presents the literature review and development of hypotheses. The methodology and empirical models are then outlined, followed by a report of the analysis results. Next, the managerial and theoretical implications of the findings are discussed. Finally, the paper concludes by offering suggestions for further research.

LITERATURE REVIEW

INSTITUTIONAL INVESTOR NETWORKS (IINs) AND CORPORATE INNOVATION

The advantageous influence of IINs on corporations is well supported by theory. Agency Theory suggests that dispersed ownership can exacerbate principal–agent problems, leading to underinvestment in long-term projects with uncertain outcomes. On the other hand, when institutions co-invest and form networks, they establish interlocking connections that foster information sharing, collective monitoring, and mutual enforcement of governance standards. Agency Theory also highlights the potential conflicts of interest between managers and shareholders, with institutional investors often acting as monitors who align managerial actions with shareholder interests (Jensen & Meckling 1976). Social Network Theory further posits that networked actors can access diverse resources and exert coordinated pressure, thereby heightening their ability to influence board decisions and managerial behavior. Thus, studying IINs deepens theoretical understanding by integrating relational governance into established innovation and control frameworks.

The effects of IINs on corporate innovation have been the subject of numerous studies, yielding mixed results in both global and Chinese contexts. For example, Bajo et al. (2020) found that while IINs' direct influence on innovation is not substantial, innovation mediates the association between IINs and firm value in the United States. Chemmanur et al. (2022) also contended that institutional ownership increases innovation output (e.g., innovation patents and citations); however, their emphasis on patents may overlook other types of innovation. Gantchev et al. (2020) highlighted the role of institutional investor activism in fostering innovation, but their findings appear to be context-specific and susceptible to reverse causality. Similarly, Cao et al. (2023) linked IIN centrality to improved innovation performance in emerging markets, yet their limited intellectual property protections may restrict the findings' generalizability. Dyck et al. (2023) further discovered that ESG-focused institutional investors promote green and sustainable innovation, although their focus on environmental technologies may obscure other innovation areas.

In China, Cheng et al. (2023) and Wang (2022) emphasized the importance of governance and digital transformation in innovation. Nonetheless, their sector-specific findings may not apply universally. Gu and Yuan (2024) noted that CEO experience moderates the relationship between IINs and innovation, whereas both Chen et al. (2023) and Wu et al. (2023) revealed a direct positive effect of these networks on innovation. These varying findings imply that moderating factors may influence the extent to which IINs affect corporate innovation in different contexts. Therefore, this study aims to address this knowledge gap by examining female directorship as a moderator of this relationship.

INSTITUTIONAL INVESTOR NETWORKS (IINs) AND FEMALE BOARD DIRECTORSHIP

Social Network Theory suggests that institutional investors, who often form highly concentrated groups, may collaborate with one another (Balp & Strampelli 2020). As such, institutional investor groups have the potential to improve corporate governance by encouraging members to work together more closely. Crane et al. (2019) found that IIN members are more likely to reveal their coordinated ownership positions to other investors and align their proxy voting behavior with that of the group, thereby influencing governance outcomes and corporate policies. In fact, the percentage of institutional investor group holdings is positively associated with the probability and extent of future executive reductions, due to the group behavior of institutional investors within the network (Peng & Li 2021).

As part of corporate governance, board members' choices and actions significantly impact an organization's stakeholders, operations, and overall growth. According to Agency Theory, gender-diverse boards can offer more comprehensive perspectives, resulting in improved governance and oversight (Wang 2020). Additionally, Resource Dependence Theory posits that firms must acquire and maintain critical resources from their external environment to enhance performance and competitive advantage (Pfeffer & Salancik 1978). In line with these theories, female board members are believed to bring unique resources, diverse viewpoints, and robust networks to the boardroom, thereby improving a firm's capacity to acquire and utilize external resources effectively (Belingheri et al. 2021; Griffin et al. 2021). Female directors also exhibit a greater willingness to supervise and heightened awareness of social responsibility in governance (Ardito et al. 2021). In the context of IINs, female directors can leverage their diverse connections to facilitate better coordination and resource-sharing among institutional investors, which ultimately enhances the firm's innovation capabilities.

FEMALE BOARD DIRECTORSHIP AND CORPORATE INNOVATION

Gender diversity is more than a numbers game; it represents an organization's values and culture. Gender diversity can increase employee loyalty and happiness while helping attract and retain female talent. Leiñena Mendizabal et al. (2024) observed that board gender quota systems promote gender equality and contribute to firm improvement. On the BOD, an increased percentage of female directors is generally considered a sign of gender diversity (Arenas-Torres et al. 2021). When more women serve on BODs, companies benefit from broader perspectives, more creative thinking, and more effective decision-making (Hakovirta et al. 2020). The introduction of female directors is not only a compliance requirement, but also can improve financial performance (Puhat et al. 2024). Because of their varied backgrounds, gender-diverse board members offer new perspectives and problem-solving approaches, which can enhance a firm's flexibility and creativity in response to market shifts (Zahoor et al. 2024).

The range of viewpoints and experiences that female board members bring can improve the quality and comprehensiveness of innovation-related decisions (Griffin et al. 2021). Indeed, several studies have found that a company's innovation can be boosted by having a gender-diverse board (Attah-Boakye et al. 2020; Hakovirta et al. 2020; Mirza et al. 2020; Griffin et al. 2021; Konadu et al. 2022; Zahoor et al. 2024). Thus, by appointing and retaining board directors across genders, businesses can access a greater spectrum of talent resources and improve both market share and innovation competitiveness.

HYPOTHESES DEVELOPMENT

While prior studies have stressed the influence of institutional investors in improving corporate governance and firm performance, they have often treated institutional investors as independent and isolated entities. In reality, institutional investors do not operate in silos; they form complex, overlapping networks through shared investments, co-monitoring behaviors, and inter-organizational relationships (Jiang & Kim 2020). These IINs facilitate greater information flow, collective voice, and coordinated engagement with firms, thereby amplifying their influence on strategic decisions related to corporate innovation.

Ioanid et al. (2018) contended that social networks are instruments for open innovation. According to Peng et al. (2022), expanding the size of a social network can widen access to both more and better entrepreneurial resources. Correspondingly, Social Network Theory suggests that networks foster creativity via knowledge dissemination and informational advantages (Dahesh et al. 2020). Within such networks, members are more likely to recognize and acknowledge one another's similarities, cultivating cooperative relationships and information sharing. For instance, institutional investors within networks can share information about firms' innovation potential, mitigate risks through reputational spillovers, and collectively advocate for innovation-friendly policies at the board level. Therefore, the "networked" nature of institutional investors may exert a stronger and more sustained influence on firms' innovation input (e.g., R&D investment) and output (e.g., patenting activity) compared to individual institutional ownership.

Based on the above discussion, the following hypothesis is proposed:

H_1 Instituional investor networks (IINs) are positively correlated with corporate innovation among Chinese listed firms.

From the perspective of Resource Dependence Theory, the composition of a company's board significantly influences its ability to secure critical resources from the external environment. Female directors, in this regard, bring unique backgrounds, experiences, and viewpoints to the boardroom that expand a firm's access to external networks, knowledge, and legitimacy, particularly in stakeholder-sensitive areas like innovation (Belingheri et al. 2021). This diversity contributes to more balanced and inclusive decision-making, which is essential for deliberating a wide range of innovative ideas and strategies (Hakovirta et al. 2020). Sierra-Morán et al. (2024) also emphasized that diverse boards, especially those with higher female representation, enhance a firm's ability to engage with external stakeholders and reduce the uncertainty associated with innovative ventures. Accordingly, in the presence of IINs, firms with a higher proportion of female directors are better positioned to convert investor influence into meaningful innovation outcomes. Female directors not only strengthen board monitoring but also facilitate the integration of external knowledge and long-term strategic thinking into firm decision-making.

Based on the above discussion, the following hypothesis is proposed:

H_2 The relationship between institutional investor networks and corporate innovation is strengthened by a higher proportion of female board directorship among Chinese listed firms.

METHODOLOGY

SAMPLE AND DATA COLLECTION

China has made technological innovation a key component of its economic growth by accelerating its innovation-driven development plan. In line witht his strategy, the number of invention patents increased by 118.88%, reaching 3.649 million by 2023, while R&D spending rose by 156.28% between 2014 and 2023 to RMB 3,335.7 billion. To support this growth, China encouraged institutional investors to increase their shareholding percentages (which reached 26.8% in 2023) by lifting QFII and RQFII investment quotas and including A-shares in the MSCI Emerging Markets Index. Accordingly, this study selected Chinese listed companies' data from 2014 to 2023 as the sample. A total of 6144 observations were obtained after removing the following: companies in the insurance and financial industries, companies labelled as ST (special treatment), companies missing relevant financial or governance data, and companies with excessive asset growth or negative sales revenue.

VARIABLE MEASUREMENT

INSTITUTIONAL INVESTOR NETWORKS (IINS)

Following Bajo et al. (2020) and Yang et al. (2024), this study constructed the measurement of IINs using a three-step process, with 'betweenness centrality' as an indicator of network centrality. To ensure the reliability of the findings, the study also applied the log(1 + corresponding value) as an alternative measure of network centrality. This is a robust method for handling zero or negative values, normalizing skewed distributions, and enhancing result interpretability.

First, as per Equation (1), a two-mode network matrix *S* was constructed, linking institutional investors and listed companies. An edge is formed when two institutional investors each hold at least 5% of the same listed firm at the end of the year. The link is created when the edge value is set to one.

$$S_{i,n} = \begin{cases} 0 \text{ Institutional investor } B_i \text{ holds less than 5\% of the shares of firm } F_n \\ 1 \text{ Institutional investor } B_i \text{ holds at least 5\% of the shares of firm } F_n \end{cases} \quad \ldots(1)$$

Second, a reduced-mode technique was employed to convert the bipartite network into an undirected, unimodal network with institutional investors as nodes. The formula is presented in Equation (2).

$$W = S \times S^T \quad \ldots(2)$$

Third, the diagonal values in the IIN matrix were assumed to be zero, as per Equation (3) below.

$$\begin{bmatrix} 0 & w_{1,2} & \dots & w_{1,j} \\ w_{2,1} & 0 & \dots & w_{2,j} \\ \dots & \dots & \dots & \dots \\ w_{i,1} & w_{i,2} & \dots & 0 \end{bmatrix} \quad \dots(3)$$

Where S is a bimodal network matrix, and each element $S_{i,n}$ represents the relationship between institutional investor *i* and firm *n*. In the unimodal network *W*, institutional investors are nodes. If institutional investors *i* and *j* together hold more than 5% of a company's shares, then $w_{i,j} = 1$.

Betweenness centrality measures the extent to which an institutional investor *i* acts as a "bridge" between other investors in the network. It reflects how frequently other institutional investors must pass through investor *i* to connect with each other. The formula to calculate it shown in Equation (4) below:

$$Bet = \sum_{j \neq k} [\frac{gjk(i)}{gjk}] \quad \dots(4)$$

CORPORATE INNOVATION

Organizations can accomplish their innovation objectives and goals by measuring their innovation (Taques et al. 2021). Research has found that the most accurate approach to assessing real innovation outcomes is the input and output perspective (Taques et al. 2021). Building on prior Chinese studies (Ren et al. 2021; Shi & Li 2023; Zhang & Vigne 2021), this study used R&D spending as a percentage of sales to quantify innovation input. For innovation output, the metric used was invention patents, in line with previous Chinese research (Jiang & Yuan 2018; Tan et al. 2020).

FEMALE BOARD DIRECTORSHIP

This study explored the moderating effect of female board directorship. The measurement method for this variable was adopted from Pucheta-Martínez and Gallego-Álvarez (2020), who used the ratio of female directors as a proxy. Therefore, the proportion of female board members was calculated as: Number of female board members / Total number of board members.

CONTROL VARIABLES

To ensure the objectivity and robustness of the regression results, this study incorporated several control variables that potentially affect corporate innovation, as used in past studies (Fang et al. 2017; Jiang & Yuan 2018; Yuan & Wen 2018; Bajo et al. 2020; Tan et al. 2020). The control variables were: size, leverage, tangibility, profitability, sales, sales growth, and Tobin's Q.

Table 1 below summarizes the abbreviations, definitions, and measurement methods for the dependent variable (corporate innovation), independent variable (IINs), moderating variable (female board directorsship), and control variables used in this study.

TABLE 1. Definitions and measurements of variables

Variables	Abbreviations	Definitions	Measurements	References
Dependent Variables				
Corporate innovation (Inv)	Innovation input: lnvRd	R&D expenditure	R&D expenditure/ sales	Ren et al. 2021; Shi & Li 2023; Zhang & Vigne 2021
	Innovation output: InvPat	Patent	Total number of patent applications filed (and eventually granted) by a firm in a given year.	Jiang & Yuan 2018, Tan et al. 2020
Independent Variable				
Institutional investor networks	IIN	The ability to act as a bridge between otherwise unconnected investors.	The aggregate value of all fund-level betweenness centrality for each quarter, converted to annual level by dividing it by four	Yang et al. 2024
Moderating Variable				
Female board directorship	FB	Ratio of female board directors	Female members of the BOD / total number of BOD members	Pucheta Martínez & Gallego - Álvarez 2020
Control Variables				
Firm size	Size	Size of the firm	Log (total asset)	Fang et al. 2017; Jiang and Yuan 2018; Yuan and Wen 2018; Bajo et al. 2020 and Tan et al. 2020
Leverage	Lev	Leverage of the firm	Total liabilities/ Total assets	
Tangibility	Tang	Tangibility	PP & E/ Total assets	
Profibitliy	Prof	Profitability	Return/ Total assets	

Sales	Sales	Total revenue	Log (total sales)
Sales growth rate	SG	Sales growth rate	Annual sales growth rate
Tobin's Q	TobinQ	The ratio of market value of debt and equity to total asset replacement cost.	(Market value of equity + Total debts)/ Total assets
Age	Firm age	Firm age	Number of years since the firm's IPO

RESEARCH MODELS

In line with Fan et al. (2023), Model (5) was constructed to examine the relationship between the independent variable (IINs) and the dependent variable (corporate innovation).

$$Inv_{it} = \alpha_0 + \alpha_1 IIN_{it} + \alpha_2 Size_{it} + \alpha_3 Lev_{it} + \alpha_4 Tang_{it} + \alpha_5 Prof_{it} + \alpha_6 Sales_{it} + \alpha_7 SG_{it} + \alpha_8 TobinQ_{it} + \alpha_9 Age_{it} + \Sigma Year_{it} + Firm_{it} + \varepsilon_{it} \quad ...(5)$$

To evaluate how the moderating variable (female board directorship) affects the relationship between the independent variable (IINs) and the dependent variable (corporate innovation), Model (6) was constructed as follows.

$$Inv_{it} = \gamma_0 + \gamma_1 IIN_{it} + \gamma_2 FB_{it} + \gamma_3 IIN_{it} \times FB_{it} + \gamma_4 Size_{it} + \gamma_5 Lev_{it} + \gamma_6 Tang_{it} + \gamma_7 Prof_{it} + \gamma_8 Sales_{it} + \gamma_9 SG_{it} + \gamma_{10} TobinQ_{it} + \gamma_{11} Age_{it} + \Sigma Year_{it} + Firm_{it} + \varepsilon_{it} \quad ...(6)$$

RESULTS

Descriptive statistics are presented in Table 2. The data distribution for the variables is generally concentrated, with no particularly extreme values. Specifically, the distributions are reasonably symmetrical, with the means of innovation input and innovation output at 18.499 and 3.779, respectively. The data for IINs are extremely concentrated, with most observations close to zero.

TABLE 2. Descriptive analysis results

VarName	Obs	Mean	SD	Min	Median	Max	P25	P75
lnvRd	6144	18.499	1.440	11.580	18.336	24.630	17.537	19.342
InvPat	6144	3.779	1.504	0.000	3.761	7.735	2.773	4.718
IIN	6144	0.002	0.007	0.000	0.000	0.042	0.000	0.000
FB	6144	0.152	0.127	0.000	0.125	0.500	0.000	0.222
Size	6144	22.313	1.380	20.128	22.036	26.593	21.292	23.068
Lev	6144	0.378	0.200	0.044	0.363	0.857	0.214	0.528
Tang	6144	0.195	0.142	0.005	0.162	0.615	0.083	0.278
Prof	6144	0.043	0.059	-0.211	0.044	0.205	0.018	0.073
Sales	6144	21.580	1.577	18.864	21.349	26.182	20.380	22.488
SG	6144	0.322	0.733	-0.620	0.126	4.541	-0.025	0.403
TobinQ	6144	2.040	1.264	0.853	1.630	7.998	1.267	2.314

Most corporations have about 0.125% female board representation. Despite China's strong national efforts to raise the percentage of women on the board, a gap remains between male and female directorship in firms. Additionally, the concentrated distributions of firm size, leverage, and asset tangibility indicate that the majority of companies share similarities in capital structure and asset allocation. Overall, these statistics provide a thorough overview of firms' innovation, governance, and financial stability.

The correlation analysis results are shown in Table 3. The independent variable, IIN, has a positive and significant correlation with innovation input, which is consistent with previous studies (Chen et al. 2023; Wu et al. 2023). IIN also shows a positive and significant correlation with innovation output, supporting Fan et al. (2023). Similarly, female board directorship demonstrates positive and significant correlations with both innovation input and output, consistent with Pucheta-Martínez and Gallego-Álvarez (2020). Previous studies have relied on only one measure of innovation to analyze its driving factors. However, high R&D expenditures do not necessarily translate into effective results, and a large number of patents does not mean high-quality innovation. Consequently, this study used both R&D investment and patent output to avoid the shortcomings of a single perspective and gain deeper insights into innovation mechanisms.

TABLE 3. Correlation matrix

	InvRd	InvPat	IIN	FB	Size	Lev	Tang	Prof	Sales	SG	TobinQ
InvRd	1										
IIN	0.374***	0.279***	1								
FB	-0.138***	-0.112***	-0.070***	1							
Size	0.741***	0.541***	0.400***	-0.172***	1						

Lev	0.338***	0.283***	0.137***	-0.152***	0.574***	1					
Tang	-0.002	-0.013	0.027**	-0.034***	0.206***	0.203***	1				
Prof	-0.012	-0.005	0.054***	0.068***	-0.056***	-0.344***	-0.092***	1			
Sales	0.728***	0.516***	0.371***	-0.167***	0.929***	0.604***	0.237***	0.055***	1		
SG	-0.041***	-0.007	-0.035***	-0.011	-0.079***	-0.014	-0.224***	-0.072***	-0.142***	1	
TobinQ	-0.118***	-0.115***	0.007	0.034***	-0.317***	-0.287***	-0.098***	0.216***	-0.286***	0.008	1

Note: Pearson's correlation coefficients, *** p<0.01, ** p<0.05, * p<0.1

The control variables also affect the research variables in positive and negative directions. For instance, the correlation between firm size and female board representation is negative and significant (r = -0.172), suggesting that larger firms tend to have lower proportions of female board members. This aligns with Tan et al. (2020), who argue that entrenched board structures in larger firms may inhibit gender diversity initiatives. Conversely, the strong positive correlation between firm size and sales (r = 0.929) supports the idea that economies of scale in larger firms drive higher revenue generation (Tan et al. 2020). Likewise, the negative correlation between Tobin's Q and leverage (r = -0.287) means that companies with greater market valuations typically have lower leverage. This supports the Trade-Off Theory (Titman & Wessels 1988), which suggests higher market valuations enable firms to access equity financing more readily, reducing debt dependency. The inverse relationship between profitability and leverage (r = -0.344) is further consistent with the Pecking Order Theory (Myers & Majluf 1984), which posits that profitable firms prefer internal financing over external borrowing. Interestingly, leverage, tangibility, and Tobin's Q exhibit no significant association with sales growth. This mirrors the mixed results reported by Fan et al. (2023), implying that these financial and asset structure variables may influence sales growth through nonlinear or contingent channels rather than direct effects.

The regression analysis results for IINs' impact on innovation are illustrated in Table 4. IINs have a positive and significant impact on both innovation input and innovation output, as reflected by the coefficients for InvRd and InvPat, which are 6.169 and 8.240, respectively. These results provide support for Hypothesis 1.

TABLE 4. Regression analysis results

	lnvRd	InvPat
IIN	6.169***	8.240***
	(1.390)	(2.746)
Size	0.441***	0.523***
	(0.029)	(0.057)
Lev	-0.596***	-0.106
	(-0.081)	(-0.159)
Tang	0.414***	0.086
	(0.105)	(0.208)
Prof	-1.471***	-1.076***
	(-0.157)	(-0.309)
Sales	0.668***	0.178***
	(0.026)	(0.051)
TobinQ	0.023***	0.019
	(0.007)	(0.013)
cons	18.644***	3.789***
	(0.039)	(0.077)
N	6144	6144
F	759.131	80.652
r^2	0.580	0.128

Note: t statistics in parentheses $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

The findings of this study align with recent literature (Chen et al. 2023; Wu et al. 2023; Fan et al. 2023; Yang et al. 2024), all of which reported a positive relationship between IINs and corporate innovation. Only Bajo et al. (2020) found a non-significant effect, possibly because their sample consisted of firms in the United States, which operate under different national conditions than firms in China.

The interaction effect results between corporate innovation, female board directorship, and IIN is presented in Table 5. Both IINs and female directorship independently promote innovation, with significant positive impacts. The interaction term between the two variables yields coefficients of 7.189 for innovation input and 19.437 for innovation output, both of which are statistically significant. The F-statistic further confirms the overall model's significance.

TABLE 5. Interaction effect results

	(1) lnvRd	(2) InvPat
IIN	3.549***	6.874**
	(1.325)	(2.776)
FB	0.017**	0.079***
	(0.008)	(0.029)
IIN*FB	7.189***	19.437***
	(0.930)	(0.611)
Size	0.229***	0.377***
	(0.029)	(0.061)
Lev	-0.399***	0.046
	(-0.077)	(0.161)

Tang	0.380***	0.087
	(0.099)	(0.208)
Prof	-0.574***	-0.440
	(0.152)	(0.319)
Sales	0.548***	0.091*
	(0.025)	(0.052)
SG	-0.032***	-0.023
	(0.010)	(0.020)
TobinQ	0.019***	0.016
	(0.006)	(0.013)
age	0.075***	0.052***
	(0.003)	(0.007)
_cons	17.941***	3.296***
	(0.049)	(0.102)
N	6144	6144
F	595.796	56.505
r^2	0.632	0.140

Note: t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The positive and significant interaction terms indicate that the association between IINs (as measured by betweenness centrality) and innovation is positively moderated by the presence of female board members. The R^2 value further shows that the control variables have strong explanatory power towards innovation input but limited explanatory power towards innovation output. Therefore, Hypothesis 2 is supported. Although the positive relationship between IINs and innovation is consistent across studies, the underlying mechanisms and magnitudes of the effects may vary. For instance, Wu et al. (2023) found that the influence of IIN centrality on innovation in emerging markets is strengthened by green finance and weakened by family ownership. Similarly, Fan et al. (2023) showed that IINs can promote corporate innovation through mechanisms such as information diffusion and firm quality.

To verify the accuracy of the findings, Tables 6 and 7 present the results of robustness tests for the direct and moderating effects, respectively. In these tests, betweenness centrality was replaced with log(1 + corresponding value) as an alternative measure of IIN.

TABLE 6. Robustness test results

	lnvRd	InvPat
IIN	6.209***	8.336***
	(1.415)	(2.794)
Size	0.441***	0.523***
	(0.029)	(0.057)
Lev	-0.596***	-0.106
	(-0.081)	(-0.159)
Tang	0.414***	0.086
	(0.105)	(0.208)
Prof	-1.471***	-1.076***
	(-0.157)	(-0.309)
Sales	0.668***	0.178***
	(0.026)	(0.051)
TobinQ	0.024***	0.019
	(0.007)	(0.013)
_cons	18.644***	3.789***
	(0.039)	(0.077)
N	6144	6144
F	758.987	80.635
r^2	0.580	0.128

Note: t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In the robustness test results in Table 6, the effect of IINs on innovation input and output remain positive and significant, with coefficients of 6.209 and 8.336, respectively. This reaffirms the robustness of the main regression findings regarding the positive association between IINs and corporate innovation.

TABLE 7. Robustness test results for moderating effect

	lnvRd	InvPat
IIN	3.549***	6.874**
	(1.325)	(2.776)
FB	0.017**	0.079***
	(0.008)	(0.029)
IIN*FB	7.189***	19.437***
	(0.930)	(0.611)
Size	0.229***	0.377***
	(0.029)	(0.061)
Lev	-0.399***	0.046
	(-0.077)	(0.161)
Tang	0.380***	0.087
	(0.099)	(0.208)
Prof	-0.574***	-0.440
	(-0.152)	(-0.319)
Sales	0.548***	0.091*
	(0.025)	(0.052)

TobinQ	-0.032***	-0.023
	(-0.010)	(-0.020)
Age	0.075***	0.052***
	(0.003)	(0.007)
_cons	17.941***	3.296***
	(0.049)	(0.102)
N	6144	6144
F	595.796	56.505
r^2	0.632	0.140

Note: t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As shown in Table 7, the interaction term also remains significant in the robustness test, indicating that female board members strengthen the positive impact of IINs on innovation. The R^2 value for innovation input is 0.632, indicating strong explanatory power for R&D investment. However, the R^2 for innovation output is 0.140, suggesting that the model has weaker explanatory power for patent output. Potentially, other factors influence the output dimension of innovation.

MANAGERIAL IMPLICATIONS

The results of this study offer vital practical implications for listed firms in China. Firstly, they demonstrate the importance of IINs in promoting corporate innovation. These networks provide access to critical resources, industry knowledge, and strategic insights that can improve a firm's innovative capabilities; as such, it is imperative for managers to cultivate good relationships with institutional investors. Firms should also actively engage with institutional investors and leverage their networks to identify innovation opportunities.

Secondly, the moderating effect of female board directorship implies that the influence of institutional investors on innovation can be amplified by the presence of women on the board. Greater female representation can result in a wider range of viewpoints, better decision-making, and increased responsiveness to investor-driven innovation strategies. Therefore, to fully optimize the advantages of IINs, companies should consider encouraging female director participation on their boards. Corporate governance policies should also promote greater gender diversity at the board level to foster a more innovative and inclusive strategic environment. By aligning board composition with investor engagement strategies, companies can enhance their innovation capabilities and maintain their competitive advantage.

THEORETICAL IMPLICATIONS

This study contributes to the growing literature on the IIN–innovation link in firms. First, it provides empirical evidence that IINs positively affect innovation in terms of both input (R&D expenditure) and output (patent activity), consistent with Agency Theory, Social Network Theory, and Resource Dependence Theory. Second, and more importantly, it introduces female board directorship as a key moderating variable, demonstrating that female directors enhance the effectiveness of IINs. While previous research has largely emphasized the role of institutional investors in enhancing governance and performance, this paper expands the scope by revealing how gender dynamics within board structures can strengthen innovation outcomes. Thus, it shows that board gender diversity is not only a matter of equity but also a strategic enabler of innovation. This corroborates a growing body of governance literature advocating for more inclusive and diverse leadership to foster broader organizational competencies.

Overall, this study addresses a notable research gap by integrating gender dynamics into the nexus between institutional investors and corporate innovation, a domain that has received limited scholarly attention. In doing so, it highlights how the interplay between investor pressure and board diversity can significantly shape innovation trajectories, adding a novel dimension to innovation governance research.

CONCLUSION AND FUTURE DIRECTIONS

This study investigated the relationship between IINs and corporate innovation, with a specific focus on the moderating role of female board directorship in Chinese listed firms. Drawing on Agency Theory, Social Network Theory, and Resource Dependence Theory, it aimed to provide an understanding of how external governance structures (institutional investors) and internal governance structures (board diversity) jointly influence firms' innovation capabilities. Using a comprehensive dataset of Chinese A-share listed companies from 2014 to 2023, the measurement of IINs was constructed based on co-shareholding relationships among institutional investors in the same firm. Corporate innovation was evaluated using both input (R&D intensity) and output (patent applications and approvals) indicators, yielding a multidimensional assessment of innovation activity.

The empirical results revealed that IINs have a significant positive impact on both innovation input and output. This suggests that when institutional investors form collaborative networks through joint shareholding, they are better positioned to influence corporate governance, encourage long-term strategic planning, and alleviate

the risk aversion often associated with innovation investments. These networks also facilitate information sharing, coordinated monitoring, and collective pressure on management, thereby creating a more conducive environment for sustained innovation. Furthermore, the study found that the presence of female board directors strengthens the IINs–innovation relationship. In firms with higher female board representation, the positive effect of IINs on innovation is significantly amplified. This supports the view that female directors enhance board oversight and contribute diverse perspectives, leading to more balanced and forward-thinking governance. Female board members are also associated with increased ethical sensitivity and stronger stakeholder orientation, which may encourage firms to prioritize innovation as a long-term value-creation strategy.

Notwithstanding these findings, this study has limitations that offer directions for future research, First, corporate innovation is not limited to the financial measures employed in this study, i.e., R&D spending and patents. Non-financial metrics, such as product quality and customer satisfaction, also reflect innovation (Coluccia et al. 2020). Future studies could thus examine how non-financial characteristics affect the relationship between IINs and innovation. Second, this study did not test for reverse causality. While it is a theoretically plausible concern that highly innovative firms may attract IINs (rather than be influenced by them), the present study focused only on the governance and monitoring role of institutional investors, in line with Agency Theory and Resource Dependence Theory. The core research interest lied in explaining how IINs, as an external governance mechanism, shape corporate decision-making regarding innovation. Future research may apply methods such as Granger causality tests, instrumental variable models, or difference-in-differences techniques to isolate and directly address potential reverse causality.

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REFERENCES

Ardito, L., Dangelico, R.M. & Messeni Petruzzelli, A. 2021. The link between female representation in the boards of directors and corporate social responsibility: Evidence from B corps. *Corporate Social Responsibility and Environmental Management* 28(2): 704-720.

Arenas-Torres, F., Bustamante-Ubilla, M. & Campos-Troncoso, R. 2021. Diversity of the board of directors and financial performance of the firms. *Sustainability* 13(21).

Attah-Boakye, R., Adams, K., Kimani, D. & Ullah, S. 2020. The impact of board gender diversity and national culture on corporate innovation: A multi-country analysis of multinational corporations operating in emerging economies. *Technological Forecasting and Social Change* 161.

Bajo, E., Croci, E. & Marinelli, N. 2020. Institutional investor networks and firm value. *Journal of Business Research* 112: 65-80.

Balp, G. & Strampelli, G. 2020. *Institutional Investor Collective Engagements: Non-Activist Cooperation Vs Activist Wolf Packs*. Ohio St. Bus. LJ. Bocconi Legal Studies Research Paper.

Belingheri, P., Chiarello, F., Fronzetti Colladon, A. & Rovelli, P. 2021. Twenty years of gender equality research: A scoping review based on a new semantic indicator. *Plos one* 16(9).

Cao, G., Geng, W., Zhang, J. & Li, Q. 2023. Social network, financial constraint and corporate innovation. *Eurasian Business Review* 13(3): 667-692.

Cheng, I.H., Hong, H. & Shue, K. 2023. Do managers do good with other people's money? *The Review of Corporate Finance Studies* 12(3): 443-487.

Chen, X., Li, Q., Cui, W. & Hu, Y. 2023. Institutional investor network embedding and firms' total factor productivity. *Emerging Markets Finance and Trade* 59(6): 1896-1918.

Chemmanur, T.J., Kong, L., Krishnan, K. & Yu, Q. 2019. Top management human capital, inventor mobility, and corporate innovation. *Journal of Financial and Quantitative Analysis* 54(6): 2383-2422.

Coluccia, D., Dabić, M., Del Giudice, M., Fontana, S. & Solimene, S. 2020. R&D innovation indicator and its effects on the market. An empirical assessment from a financial perspective. *Journal of Business Research* 119: 259-271.

Crane, A.D., Koch, A. & Michenaud, S. 2019. Institutional investor cliques and governance. *Journal of Financial Economics* 133(1): 175-197.

Cumming, D. & Leung, T.Y. 2021. Board diversity and corporate innovation: Regional demographics and industry context. *Corporate Governance: An International Review* 29(3): 277-296.

Dahesh, M.B., Tabarsa, G., Zandieh, M. & Hamidizadeh, M. 2020. Reviewing the intellectual structure and evolution of the innovation systems approach: A social network analysis. *Technology in Society* 63.
Dyck, A., Lins, K.V., Roth, L., Towner, M. & Wagner, H.F. 2023. Renewable governance: Good for the environment? *Journal of Accounting Research* 61(1): 279-327.
Fang, L.H., Lerner, J. & Wu, C. 2017. Intellectual property rights protection, ownership, and innovation: Evidence from China. *The Review of Financial Studies* 30(7): 2446-2477.
Fan, Y., Ly, K.C. & Jiang, Y. 2023. Institutional investor networks and firm innovation: Evidence from China. *International Review of Financial Analysis* 89.
Gantchev, N., Sevilir, M. & Shivdasani, A. 2020. Activism and empire building. *Journal of Financial Economics* 138(2): 526-548.
Gharbi, S. & Othmani, H. 2022. Which institutional investors encourage R&D investments? *International Journal of Management and Enterprise Development* 21(3): 241-262.
Gong, X. L. & Du, Z. Q. 2022. Institutional investor network, analyst public information and extreme risks. *Economic research-Ekonomska istraživanja* 35(1): 4300-4321.
Goranova, M. & Ryan, L. V. 2022. The corporate objective revisited: The shareholder perspective. *Journal of Management Studies* 59(2): 526-554.
Griffin, D., Li, K. & Xu, T. 2021. Board gender diversity and corporate innovation: International evidence. *Journal of Financial and Quantitative Analysis* 56(1): 123-154.
Gu, W. & Yuan, W. 2024. Research on the influence of chain shareholder network on enterprise green innovation. *Journal of Business Research* 172.
Hakovirta, M., Denuwara, N., Bharathi, S., Topping, P. & Eloranta, J. 2020. The importance of diversity on boards of directors' effectiveness and its impact on innovativeness in the bioeconomy. *Humanities and Social Sciences Communications* 7(1): 1-9.
Hassanein, A., Marzouk, M. & Azzam, M. E. A. 2022. How does ownership by corporate managers affect R&D in the UK? The moderating impact of institutional investors. *International Journal of Productivity and Performance Management* 71(8): 3636-3654.
Harasheh, M., Capocchi, A. & Amaduzzi, A. 2024. Capital structure in family firms: The role of innovation activity and institutional investors. *EuroMed Journal of Business* 19(2): 251-275.
Hu, B., Liu, Y., Zhang, X. & Dong, X. 2020. Understanding regional talent attraction and its influencing factors in China: From the perspective of sInvPatiotemporal InvPattern evolution. *Plos one* 15(6): 1-18.
Ioanid, A., Deselnicu, D. C. & Militaru, G. 2018. The impact of social networks on SMEs' innovation potential. *Procedia Manufacturing* 22: 936-941.
Kim, H.D., Park, K. & Roy Song, K. 2019. Do long-term institutional investors foster corporate innovation? *Accounting & Finance* 59(2): 1163-1195.
Konadu, R., Ahinful, G.S., Boakye, D.J. & Elbardan, H. 2022. Board gender diversity, environmental innovation and corporate carbon emissions. *Technological Forecasting and Social Change* 174.
Jensen, Michael C. 1979. *Tests of Capital Market Theory and Implications of the Evidence*. Handbook of Financial Economics.
Jiang, F. & Kim, K.A. 2020. Corporate governance in China: A survey. *Review of Finance* 24(4): 733-772.
Jiang, X. & Yuan, Q. 2018. Institutional investors' corporate site visits and corporate innovation. *Journal of Corporate Finance* 48: 148-168.
Leiñena Mendizabal, E., Basoredo-Otzerinjauregi, I., Meijomil González, A. & Villafañez Pérez, I. 2024. A code of good practice to promote gender equality on boards of directors of medium-sized enterprises as a corporate sustainability goal. *SN Business & Economics* 4(4).
Liu, H., Liang, Q. & Ling, L. 2022. Underrepresentation of female CEOs in China: The role of culture, market forces, and foreign experience of directors. *Research in International Business and Finance* 63.
Mirza, S.S., Majeed, M.A. & Ahsan, T. 2020. Board gender diversity, competitive pressure and investment efficiency in Chinese private firms. *Eurasian Business Review* 10: 417-440.
Muhmad, S.N. & Zainul Abidin, A.F. 2025. Corporate sustainability commitment, institutional investors and financial performance: Evidence from Malaysia. *Jurnal Pengurusan* 73: 1-17.
Myers, S.C. & Majluf, N.S. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13(2): 187-221.
Nankai.edu.cn. 2023. *The China Institute of Governance released a special report on female directors: Board diversity and sustainable development*. [online] Available at https:// news. nankai.edu.cn/zhxw/system/2023 /11/10/030058741.shtml.
Peng, H., Li, B. & Liu, Y. 2022. How social network influences the growth of entrepreneurial enterprises: Perspective on organizational and personal network. *Sage Open* 12(2): 1-16.
Peng, Y. & Li, B. 2021. Can institutional investor clique play a governance role? Based on the perspective of insider reduction. In *E3S Web of Conferences* (Vol. 235, p. 01066). EDP Sciences.

Pfeffer, Jeffrey and Salancik, Gerald R*., The External Control of Organizations: A Resource Dependence Perspective (1978).* University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.
Pucheta-Martínez, M.C. & Gallego-Álvarez, I. 2020. Do board characteristics drive firm performance? An international perspective. *Review of Managerial Science* 14(6): 1251-1297.
Puhat, N.H.A., Hasnan, S., Marzuki, H. & Ali, M.M. 2024. Board characteristics and financial performance: evidence from bursa Malaysia financial times stock exchange (FTSE) top 100 index firms. *Jurnal Pengurusa* 71: 1-14.
Qi, L., Wang, L. & Li, W.A. 2020. Do mutual fund networks affect corporate social responsibility? Evidence from China. *Corporate Social Responsibility and Environmental Management* 27(2): 1040-1050.
Ren, S., Cheng, Y., Hu, Y. & Yin, C. 2021. Feeling right at home: Hometown CEOs and firm innovation. *Journal of Corporate Finance* 66.
Shi, W. & Li, B. 2023. In the name of national security: Foreign takeover protection and firm innovation efficiency. *Global Strategy Journal* 13(2): 391-419.
Sierra-Moran, J., Cabeza-Garcia, L., González-Álvarez, N. & Botella, J. 2024. The board of directors and firm innovation: A meta-analytical review. *BRQ Business Research Quarterly* 27(2): 182-207.
Stojcic, N., Hashi, I. & Orlic, E. 2018. Creativity, innovation effectiveness and productive efficiency in the UK. *European Journal of Innovation Management* 21(4): 564-580.
Tan, Y., Tian, X., Zhang, X. & Zhao, H. 2020. The real effect of partial privatization on corporate innovation: Evidence from China's split share structure reform. *Journal of Corporate Finance* 64.
Taques, F.H., López, M.G., Basso, L.F. & Areal, N. 2021. Indicators used to measure service innovation and manufacturing innovation. *Journal of Innovation & Knowledge* 6(1): 11-26.
Titman, S. & Wessels, R. 1988. The determinants of capital structure choice. *The Journal of finance* 43(1): 1-19.
Velte, P. & Obermann, J. 2021. Compensation-related institutional investor activism–a literature review and integrated analysis of sustainability aspects. *Journal of Global Responsibility* 12(1): 22-51.
Wang, T. 2022. Board human capital diversity and corporate innovation: A longitudinal study. *Corporate Governance: The International Journal of Business in Society* 22(4): 680-701.
Wang, Y.H. 2020. Does board gender diversity bring better financial and governance performances? An empirical investigation of cases in Taiwan. *Sustainability* 12(8): 1-10.
Wu, B., Gu, Q., Liu, Z. & Liu, J. 2023. Clustered institutional investors, shared ESG preferences and low-carbon innovation in family firm. *Technological Forecasting and Social Change* 194.
Wu, L., Xu, L. & Jiang, P. 2023. State-owned venture capitals and bank loans in China. *Pacific-Basin Finance Journal* 77.
Yang, B., Guo, C. & Fan, Y. 2024. Institutional investor networks and ESG performance: Evidence from China. *Emerging Markets Finance and Trade* 60(1): 113-137.
Ying, Z.H.U., Xiaoqi, Z.H.E.N.G. & Yan, Z.H.A.N.G. 2023. Analysis of mobility invpatterns of science and technology innovation talents in China: An empirical study of science and technology innovation leaders based on China's ten thousand talents program. *Frontiers of Business Research in China* 17(2).
Yip, G.S. & McKern, B. 2016. *China's Next Strategic Advantage: From Imitation to Innovation*. MIT press.
Yuan, R. & Wen, W. 2018. Managerial foreign experience and corporate innovation. *Journal of Corporate Finance* 48: 752–770.
Zhang, D. & Vigne, S. A. 2021. How does innovation efficiency contribute to green productivity? A financial constraint perspective. *Journal of Cleaner Production* 280(2).
Zahoor, N., Khan, H., Donbesuur, F., Khan, Z. & Rajwani, T. 2024. Grand challenges and emerging market small and medium enterprises: The role of strategic agility and gender diversity. *Journal of Product Innovation Management* 41(2): 473-500.

Li Xintong (corresponding author)
Faculty of Economics and Management
Universiti Kebangsaan Malaysia
43600 UKM Bangi Selangor, MALAYSIA.
E-Mail: P110068@siswa.ukm.edu.my

Hamezah Md Nor
Faculty of Economics and Management
Universiti Kebangsaan Malaysia
43600 UKM Bangi Selangor, MALAYSIA.
E-Mail: miezah@ukm.edu.my

Noradiva Hamzah
Faculty of Economics and Management
Universiti Kebangsaan Malaysia
43600 UKM Bangi Selangor, MALAYSIA.
E-Mail: adibz@ukm.edu.my

Intan Maiza Abdul Rahman
Faculty of Economics and Management
Universiti Kebangsaan Malaysia
43600 UKM Bangi Selangor, MALAYSIA.
E-Mail: intanmaiza@ukm.edu.my