The Effect of Board Capital Development on Innovation Performance of High-Tech Enterprises in Shandong Province, China

[1]Wang Fei, [2]Chalermkiat Wongvanichtawee, and [3]Jidapa Chollathanrattanapong

[1, 2]Graduate School of Management, Siam University, Thailand

[3]Graduate School of Business Administration, Siam University, Thailand

E-mail: kingfly409061351@gmail.com[1], siamzhu@gmail.com[2]

Received June 6, 2024; **Revised** July 24 2024; **Accepted** August 20, 2024

Abstract

The objectives of this study were threefold: This study aimed to investigate the influence of board capital investment on technological innovation performance in high-tech enterprises. Specifically, it examined the relationships between board capital, technological innovation resources, and the quality of innovation strategies, as well as their collective impact on innovation performance. Utilizing a quantitative research method, 450 questionnaires were distributed to board members of high-tech enterprises in Shandong Province, with 401 valid responses, yielding an 89.11% validity rate. Structural equation modeling (SEM) and confirmatory factor analysis (CFA) were employed to test the proposed hypotheses.

The results revealed several key findings: 1) Human capital (HCB), social capital (SCB), and institutional capital (ICB) of the board significantly affect the innovation performance of high-tech enterprises; 2) The human capital of the board has a significant positive impact on resource acquisition and the quality of strategic decisions, while social capital significantly impacts strategic decision quality but not resource acquisition. Institutional capital does not significantly affect resource acquisition but positively influences the quality of strategic decisions; and 3) Technological innovation resource acquisition and the quality of strategic decision-making both have significant positive effects on technological innovation performance.

Keywords: Board Capital; Technological Innovation Resources; Quality of Technological Innovation Strategy; Technological Innovation Performance; High-Tech Enterprises in Shandong

Introduction

China has aggressively pursued policies to foster innovation by supporting high-tech enterprises (HTEs), which integrate advanced technology, knowledge, and talent. As a result, the number of HTEs in China surged by 24% in 2020, contributing significantly to operating revenue, industrial output value, and total profit (Feng et al., 2022). Despite this growth, there remains a critical need to explore how various forms of board capital—comprising human, social, and institutional capital—affect the innovation performance of these enterprises, especially in high-tech hubs like Shandong Province.

Shandong Province, the most populous region in China, is pivotal in the national strategy for high-tech development. The province's high-tech enterprises are expected to leverage robust board governance to enhance competitiveness and innovation performance. However, the effectiveness of board governance has been inconsistent, particularly within the "China National-level High-Tech Demonstration Zones," revealing a gap in how board capital impacts technological innovation in this crucial region.

Existing literature often highlights the importance of board capital in general, but there is a notable lack of focused research on its specific effects on technological innovation within high-tech enterprises in Shandong Province. This gap is critical given that board governance, including intellectual capital, is integral to managing and supervising innovation processes and outcomes. Furthermore, while Shandong offers various incentives and preferential policies to attract and support HTEs, the province's economic value-added ratio remains lower than the national average, signaling inefficiencies and underperformance that merit closer examination. This study aims to address this gap by investigating how different components of board capital influence technological innovation performance in Shandong's high-tech enterprises. The specific research question driving this investigation is: How do human, social, and institutional capital within board governance impact technological innovation resources and the quality of innovation strategies, and how do these factors collectively affect innovation performance. Understanding the performance mechanism of board capital is crucial for enhancing the effectiveness of innovation strategies and improving the overall competitiveness of high-tech enterprises. Insights from this research will not only contribute to academic knowledge but also provide practical implications for policy makers and business leaders seeking to optimize board governance and innovation outcomes in high-tech sectors.

Research Objectives

The objectives of this research are

(1) To find out the factors of board capital investment on the technological innovation performance of high-tech enterprises.

(2) To explore the effects of board capital on technological innovation resources and the quality of the technological innovation strategy of high-tech enterprises.

(3) To explore how technological innovation resources and the quality of technological innovation strategies affect technological innovation performance.

Literature Review

Board Capital

Board capital refers to members' diverse backgrounds and experiences, such as industry, discipline, and cultural and geographic backgrounds (Crossan & Apaydin, 2010). When board members come from different fields and cultural backgrounds, their perspectives and knowledge can bring a broader range of ideas and solutions to the company. The three-dimensional structure of board capital is: human capital (CHB), social capital (BSC), and institutional capital (BIC) (Feng et al., 2022). Human capital refers to the knowledge, skills, and experience of board members and their positions, reputations, and networks within the company (Cornforth, 2001). Social capital refers to the relationships and connections board members have with external organizations and individuals. These connections may include business partnerships, social networks, government relationships, industry associations, etc. Institutional capital is the "infrastructure" or "knowledge platform" that supports the creation of wealth by human and social capital. It is the key to the performance of board capital, providing a bridge and a tool for board human and social capitals to function, but it is also created by board social capital (Chiu et al., 2006).

Human capital is the core of board capital performance. The higher the stock of human capital, the higher the board's working ability and efficiency, and thus the higher the value it embodies. The SCB is an important way for the Board of Directors to realize value creation. It is the environmental condition for board capital performance. The Board's social relationships unite all stakeholders into an organically connected whole, creating strong ties. Relevant relationships provide the basis for network members to trust each other, convey influence and trust, effectively fill internal gaps between relationship partners, improve internal organizational cohesion and effectiveness, and are the guarantee for the formation of actual board performance. Institutional capital is the "infrastructure" or "knowledge

platform" that supports the creation of wealth by human and social capital. It is the key to the performance of board capital, providing a bridge and a tool for board human and social capitals to function, but it is also created by board social capital (Chiu et al., 2006). It provides a stable work environment where board members are interested in and aware of their mission. The board can function in a safe, orderly, and high-quality manner, providing a platform for members to work and interact. Based on the above analysis, human capital is the core of board capital and plays a leading role in creating value for board capital. Social capital is an essential guarantee for board capital performance, plays a catalytic role in the operation of board capital, and is a decisive factor in the transformation of board capital into board performance. Institutional capital is the primary platform for board capital performance; it creates conditions for the optimal use of human capital and social capital and cooperates with human capital and social capital to create value. The three-dimensional synergy of board capital contributes to the improvement of board performance.

Human capital of Board

Board capital is an abstract idea that cannot be directly observed and can only be measured by scientific conceptual measurement models or methods based on understanding its theoretical conceptions (Murray et al., 2017). According to the difference in the intrinsic relationship between measurement indicators and theoretical concepts, conceptual measurement models can be divided into constitutive measurement models and reflective measurement models. Based on the literature review, this study classifies board capital into three dimensions: human capital, social capital, and institutional capital (Byun et al., 2017). The entries for the human capital of the board focus on four dimensions: knowledge, skills, abilities, and intrinsic qualities.

Social Capital of Board

The existing research on board capital measurement is mainly based on the constitutive measurement model, i.e., the constitutive indicators of various aspects of board capital are selected, and the synthetic indicators of board capital are formed using specific methods. While using the constitutive measurement model to measure board capital, there are drawbacks such as difficulty in ensuring consistency between theoretical concepts and variable measurements, conceptual ambiguity, and statistical imprecision, which may cause deviation of statistical results from the actual situation. The entries for board social capital focus on three dimensions: structural dimensional social capital, relational dimensional social capital, and cognitive dimensional social capital (Fama & Jensen, 2021).

Institutional Capital of Board

In contrast, the reflective measurement model is closer to the positivist epistemological tradition, as the theoretical constructs represent the objective reality of the phenomenal world. The selected measurement indicators are the various external manifestations of this objective existence. This study uses the reflective measurement model to measure board capital. The entries on the Board of Institutional Money are designed in three aspects: mechanism, practice, and culture (Fama & Jensen, 2021).

Technological Innovation Resources

The scale of resource acquisition is mainly reflected in the quantitative and qualitative characteristics of resource acquisition. The number of resources, i.e., the adequacy and quality of resources, can generally be operationalized as the timeliness, accuracy, usefulness, and cost–utility of information (Latour, 2022). Scholars in subsequent studies have invoked this idea, improved the characteristics of different resource types, and developed scales for different types of resource acquisition. In the study of social capital and resource acquisition and technological innovation by resource–based enterprise executives, the investment of resources is divided into three dimensions: information resource acquisition, knowledge resource acquisition, and financial resource acquisition, which are measured in terms of the quantity and quality of different types of resources. In the study of social capital and knowledge creation in knowledge–based enterprises (Yli–Renko et al., 2002), the knowledge acquisition scale is designed regarding timeliness and adequacy of knowledge acquisition. Information acquisition is measured in terms of the degree of accuracy, usefulness, and timeliness of information in the relationship between entrepreneurial social capital and strategic decision quality. Drawing on the scales of scholars' empirical studies and relevant empirical studies, this study divides resources into three categories: information, knowledge, and capital (Morgan & Hunt, 2020).

Quality of Technological Innovation Strategy

For the evaluation of strategic decision quality, research scholars have proposed criteria: internal consistency, environmental consistency, adaptability, and degree of risk. Based on the strategic scale of strategic decision–making in the study, concerning relevant theoretical and empirical studies, this study evaluates two aspects of technological innovation path decision and technological innovation mode decision from the perspective of the adaptation of technological innovation strategy to the internal conditions and external environment of the enterprise (Zhou et al., 2019). The internal conditions considered for technical innovation path decisions include knowledge system structure, innovation personnel strength, and organizational learning ability; the external environment consists of

the external market environment and external policy environment. The internal conditions considered in the decision of technology innovation mode include technology capability, network capability, and innovation results protection mechanisms; the external environment considered consists of the market environment and policy environment (Amit & Schoemaker, 2021). The internal conditions considered for technology innovation investment decisions are cash capacity and risk-bearing capacity; the external environment considered includes the market environment and policy environment.

Technological Innovation Performance

TIP refers to some results that can be objectively measured and perceived as the direct output of technological innovation activities, which can be reflected by technical performance and economic performance. Technology performance is mainly formed by two movements: technology research and development and technology industrialization (Albino et al., 2015). The scientific and technological results obtained from research and development activities reflect the early technical value of technological innovation, mainly the results of the knowledge technology category. The number of patents granted for inventions is the direct innovation result of technology development activities, which is an international standard measurement index of technological innovation output (Byun et al., 2017). Industrialization completes all technical issues, from technology development to trial production to meet production needs. The most crucial work is finding new products that can be produced. The number of new product development projects is the leading indicator to measure the success of technical output in the industrialization stage of technological innovation. Therefore, this study selects two hands to reflect the technological performance: the number of patents granted for inventions and the number of new product projects developed.

The ultimate purpose of technological innovation in high-tech enterprises is to use new products or technologies to improve business performance and obtain economic benefits. Therefore, this paper selects the financial indicators reflecting the operating performance to measure the economic performance. Total asset margin represents the overall profitability of all assets, including net assets and liabilities. It is used to evaluate the overall profitability of an enterprise using all purchases, which is an important indicator to assess the operational efficiency of the enterprise's assets. Net cash flow from operations is the fundamental guarantee for sustainable business operations, which not only provides resources for expanding reproduction but also is a decisive factor in the strength of the liquidity of an enterprise. By analyzing the cash flow status of an enterprise, it is possible to gain a more objective perspective on its operations and evaluate management performance. Since an enterprise's net

operating cash flow index is affected by its size factor, this paper selects the cash–asset ratio of operational activities to measure its net operating cash flow (Grant, 2021).

The research literature reveals that there is insufficient research related to Board capital. After comprehensively analyzing the role of board capital in the technological innovation process of high–tech enterprises, we can conclude that the structure and behavior of board capital have an important impact on the acquisition of technological innovation resources and the quality of strategic decision–making, which in turn affects the performance of enterprises. Enterprises with excellent board capital tend to be able to acquire technological innovation resources more effectively, formulate more rational technological innovation strategies, and ultimately achieve better performance. Therefore, board capital plays a key role in the entire technological innovation process. Based on the interrelationships of the variables, the framework of the research was established based on the hypotheses as shown in Figure 1.

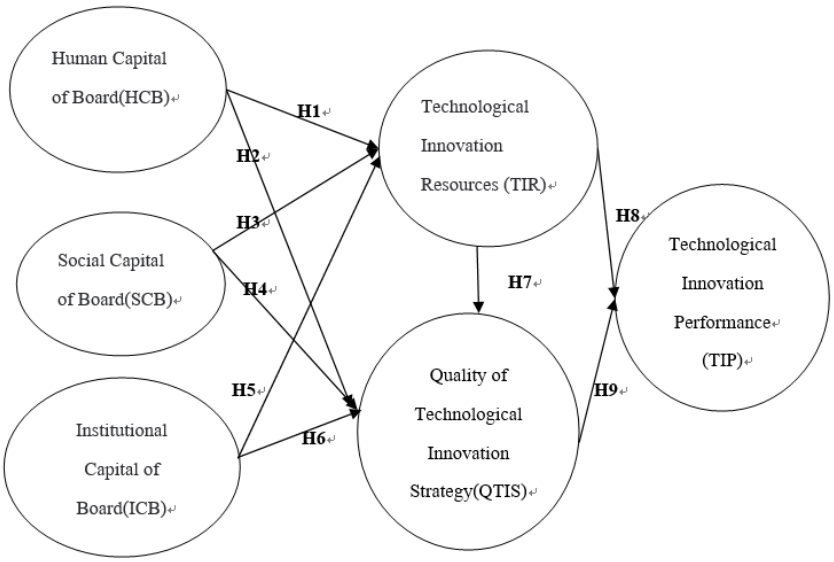

Figure 1 Research Framework

Hypothesis 1: The HCB of high–technology companies has a positive effect on TIR.

Hypothesis 2 The HCB of high–technology companies has a positive effect on QTIS.

Hypothesis 3: The SCB of high–technology companies has a positive effect on TIR.

Hypothesis 4: The SCB of high–technology companies has a positive effect on QTIS.

Hypothesis 5: The ICB of high–technology companies has a positive effect on TIR.

Hypothesis 6: The ICB of high–technology companies has a positive effect on QTIS.

Hypothesis 7: The TIR of high–technology companies has a positive effect on QTIS.

Hypothesis 8: The TIR of high-technology companies has a positive effect on TIP.

Hypothesis 9: The QTIS of high-technology companies has a positive effect on TIP.

Research Methodology

The quantitative research method is used in this study. Questionnaires are identified based on the literature review, and questionnaires and relevant data are collected. The variables measured in this study are human capital, social capital, and institutional capital—on technology innovation resources access (TIR), the quality of technological innovation systems (QTIS), and technology innovation performance (TIP). This aims to understand how different forms of board capital contribute to the effectiveness and success of technological innovations in high-tech enterprises.

The population includes high-tech enterprises in Shandong province, which can be obtained through industry associations, government agencies, commercial databases, etc. The sample selection is based on specific criteria and indicators, such as enterprise size, industry type, technological innovation capability, etc. The sample size is determined by the research design, and the number of randomly selected samples is calculated according to the analysis using the random sampling survey method. According to government statistics, in 2021, there will be 23,345 (http://tjj.shandong.gov.cn/) high-tech enterprises in Shandong Province. Yamane (1974) adjusted the calculation formula to be more accurate by increasing the π = population variance from the dichotomous variable equal to 0.50 and z =z score at significance level β (where z = 1.96 at β = 0.05 and z = 2.56 at β = 0.01), calculating the sample size is 399. Pre-tests were conducted on the questionnaire. The questionnaire was pre-tested with 30 company individuals.

Board Capital Dimensions: 20 questions addressing human, social, and institutional capital. There are six questions on Technology Innovation Resources, six questions on technical innovation strategy decision quality, and four questions on enterprises' technology innovation performance. The total number of questions is 36. Data collection for the variable sample was Likert Scale: Responses are measured using a seven-point Likert scale, where higher scores indicate greater agreement.

Research Results

Research findings are 1) Human capital of board positively affects technological innovation resources acquisition; 2) Human capital of board, social capital of board, institutional capital of board, technological innovation resources' positively affect the quality of technological innovation strategy. 3)

Technological innovation resources, Quality of technological innovation strategy positively affect innovation performance. Each of the factor loading values for each part must be within the standards. Based on the findings of relevant studies, the factor loading value cannot be less than 0.5. When assessing the scale's structural validity, it is important to consider the average of the variance extracted (AVE) for each dimension as well as the composite validity (CR) of each variable. To demonstrate excellent structural validity, relevant research and standards demand an average variance value of more than 0.5 (Hair, Black, Babin, & Anderson, 2010) and a minimum CR requirement of 0.7 (Fornell & Larcker, 1981). As shown in Table 1.

Table 1 Results of the analysis

Path relationship			Estimate	Cronbach's Alpha	AVE	CR
Q1	<---	HCB	0.827	0.877		
Q2	<---	HCB	0.726			
Q3	<---	HCB	0.734			
Q4	<---	HCB	0.795			
Q5	<---	HCB	0.759		0.592	0.878
Q6	<---	SCB	0.747	0.892		
Q7	<---	SCB	0.809			
Q8	<---	SCB	0.756			
Q9	<---	SCB	0.762			
Q10	<---	SCB	0.795			
Q11	<---	SCB	0.711		0.584	0.894
Q12	<---	ICB	0.751	0.902		
Q13	<---	ICB	0.765			
Q14	<---	ICB	0.790			
Q15	<---	ICB	0.765			
Q16	<---	ICB	0.788			
Q17	<---	ICB	0.824		0.610	0.904
Q18	<---	TIR	0.773	0.892		
Q19	<---	TIR	0.764			
Q20	<---	TIR	0.769			
Q21	<---	TIR	0.755			
Q22	<---	TIR	0.771			
Q23	<---	TIR	0.874		0.617	0.906
Q24	<---	QTIS	0.757	0.888		
Q25	<---	QTIS	0.774			
Q26	<---	QTIS	0.737			
Q27	<---	QTIS	0.769			
Q28	<---	QTIS	0.754		0.574	0.89

Path relationship			Estimate	Cronbach's Alpha	AVE	CR
Q29	<---	QTIS	0.755			
Q30	<---	TIP	0.716	0.837		
Q31	<---	TIP	0.780			
Q32	<---	TIP	0.766			
Q33	<---	TIP	0.739		0.564	0.838

The dimensions of each variable are analyzed for correlation in this study using Pearson's correlation analysis. The discriminant validity of the survey data is determined by comparing the Pearson correlation coefficient with the square root of the AVE. When the absolute value of the square root of AVE is always more significant than the Pearson correlation coefficient, it indicates good discriminant validity of the question items. By analyzing the data, it is clear that the correlation coefficients for each variable are less than the absolute value of the square root of the AVE. The absolute value of the square root of the human capital of Board AVE is 0.769, the absolute value of the square root of the social capital of Board AVE is 0.764, and the absolute value of the square root of the institutional capital of Board AVE has an absolute value of 0.781. Technological Innovation Resources (AVE) has an absolute value of 0.785. The absolute value of the square root of 0.758 represents the quality of technological innovation strategy. The absolute value of the square root of Technological Innovation Performance AVE is 0.751. Meanwhile, according to Table 2, the Pearson correlation coefficient is at most 0.9, and there is no problem with covariance, which meets the requirements. The analytical study of structural equation modeling can be carried out.

Table 2 Discriminant validity analysis

Variables	$\sqrt{AVE}$	HCB	SCB	ICB	TIR	QTIS	TIP
HCB	0.769	0.769					
SCB	0.764	0.239**	0.764				
ICB	0.781	0.296**	0.254**	0.781			
TIR	0.785	0.500**	0.218**	0.244**	0.785		
QTIS	0.758	0.436**	0.365**	0.409**	0.482**	0.758	
TIP	0.751	0.298**	0.191**	0.221**	0.496**	0.524**	0.751

According to the results, the Chi-square in the study is 600.522; df is 483; Chi-square/df is 1.243, is less than 3, which meets the GFI, IFI, and CFI are all greater than 0.9, and RMSEA is 0.026 less than 0.08. Therefore, the model fitting indexes meet the requirements.

Table 3 Testing results

Path relationship			Estimate	S.E.	C.R.	P	Result
TIR	<---	HCB	0.551	0.059	9.283	***	Supported
TIR	<---	SCB	0.094	0.064	1.488	0.137	Unsupported
TIR	<---	ICB	0.075	0.056	1.331	0.183	Unsupported
QTIS	<---	HCB	0.131	0.044	3.012	**	Supported
QTIS	<---	SCB	0.197	0.043	4.545	***	Supported
QTIS	<---	ICB	0.186	0.038	4.837	***	Supported
QTIS	<---	TIR	0.220	0.041	5.347	***	Supported
TIP	<---	TIR	0.269	0.05	5.423	***	Supported
TIP	<---	QTIS	0.513	0.075	6.831	***	Supported

The study results show that The HCB of high-technology companies has positively affected TIR (H1). The HCB of high-technology companies positively affects QTIS (H2). The SCB of high technology companies does not affect TIR (H3). The SCB of high-technology companies positively affects QTIS (H4). The ICB of high-technology companies does not affect TIR (H5). The ICB of high-technology companies positively affects QTIS (H6). The TIR of high technology companies positively affects QTIS (H7). The TIR of high-technology companies positively affects TIP (H8). The QTIS positively affects TIP in high-technology companies (H9).

Discussions

The research conducted revealed the following:

1) Human capital of board positively affects technological innovation resources acquisition.

From the relationship between the human capital of the board has a significant positive impact on the acquisition of technological innovation resources (Grant, 2021). This finding indicates that board capital plays a crucial role as a facilitator in acquiring resources (Makaryanawati, 2018). That is to say, in a board with higher human capital, the overall cognitive level and cognitive state are improved. This leads to better accuracy in identifying the resources needed for technological innovation, more effective selection of channels for obtaining these resources, and enhanced interactions with key providers of technological innovation resources. As a result, a higher human capital level on the board contributes to more successful acquisition of technological innovation resources.

2) Human capital of board, social capital of board, institutional capital of board, technological innovation resources' positively affect the quality of technological innovation strategy.

The results of the structural equation modeling tests all confirm that board social capital has a significant positive effect on the quality of technological innovation and strategic decisions. Social connections within the board play a critical role in shaping strategic decision-making by enhancing the flow and quality of information. Social connections enable the Board members' social networks often include professionals from diverse industries and sectors, which provides access to a broad range of knowledge and perspectives. The wider the board's social network, the more assistance it receives from its members. More social network members from other industries can supply entrepreneurs with new and diverse knowledge. The more thoroughly it scans the environment, the more effectively it can make high-quality strategic decisions about technical innovation. In discussing the relationship between board institutional capital and decision-making quality, structural equation modeling results show that the level of board institutional capital has a significant positive effect on the quality of technological innovation strategy decision-making, implying that the level of board institutional capital is significantly affects the quality of technological innovation strategy decision-making. Structural equation modeling results demonstrate that higher institutional capital positively influences decision-making quality, highlighting its crucial role in shaping effective technological innovation strategies. This finding aligns with the arguments of Xie (2003) and others.

3) Technological innovation resources, Quality of technological innovation strategy positively affect innovation performance.

The findings of the structural equation model test and the neural network model test reveal that acquiring technological innovation resources significantly enhances technological innovation performance. This finding highlights the crucial role of resource acquisition in boosting innovation outcomes, aligning with Boukouras' (2011) perspective that resource accessibility largely determines an enterprise's innovation capacity and level, thus being a key factor influencing technological innovation.

According to the relationship between the quality of technological innovation strategic decision-making and technological innovation performance, it is evident that higher quality decision-making positively influences innovation performance. This underscores the critical importance of high-quality strategic decision-making in enhancing technological innovation outcomes, aligning with Billand et al.'s (2019) viewpoint that the alignment of technological innovation strategies with both internal and external environments of the enterprise is a crucial factor affecting innovation performance, guiding the direction of technology.

From the relationship between the acquisition of technological innovation resources and the quality of technological innovation strategic decision-making, The quality of technological innovation

strategic decision–making has a significant positive impact on technological innovation performance, as demonstrated by the relationship between resource acquisition and decision–making quality (Nutt, 2008). This indicates that high–quality decision–making is crucial for improving innovation performance. It is assumed that when more resources are acquired during the innovation strategy decision–making process, fewer constraints are imposed on decision–making. This increased resource availability expands the options for strategic decisions, thereby enhancing both the freedom of strategy selection and the quality of decision–making. Consistent with Nutt's (2008) empirical analyses, firms with a stable supply of core resources tend to make higher–quality strategic decisions regarding technological innovation compared to firms facing resource scarcity.

Knowledge from Research

Following the analysis and discussion of the research findings, a model of the impact of board capital on technical innovation performance was developed. The board capital model has three primary dimensions: human capital (HCB), social capital (SCB), and institutional capital (ICB). The modeling will provide recommendations and references for increasing the level of innovation ability in high–tech firms. It assists managers of high–tech firms in carrying out enterprise innovation performance management.

Conclusion

Board capital plays a crucial role in influencing the performance of high–tech enterprises by impacting the acquisition of technological innovation resources. A high level of board capital leads to the procurement of high–quality and timely resources, which, in turn, enhances technological innovation performance. Strategic decision–making in technological innovation relies heavily on board capital, which is vital for identifying, selecting, and processing information resources. To further improve the quality of technological innovation and strategic decision–making, it is essential to strengthen information communication, enhance the willingness to transfer information, and encourage work exchanges. Board capital can significantly enhance an enterprise's innovation performance by facilitating the acquisition of technological resources, particularly from universities and scientific research institutions. This process involves both internal and external knowledge acquisition, which depends on trust relationships built through long–term interactions. This process involves both internal and external knowledge acquisition, relying on trust

relationships established through long–term interactions. The board should strive to establish a mutually beneficial network.

Suggestions

In this study, the examination of board capital is concentrated on three dimensions—social capital, human capital, and institutional capital—and their influence on the innovation performance of high–tech businesses. However, the research does not delve into the interplay or coordination between these dimensions, which could provide deeper insights into how they collectively impact innovation outcomes. Future research could also investigate the following areas: Inter–Dimensional Relationships: Explore how social, human, and institutional capital interact and influence each other, and how these relationships affect innovation performance. The relationship and coordination between the three are not investigated. The elements influencing the innovation performance of high–tech businesses in the study are confined to two: Comparative Studies Compare the impact of board capital across different industries or geographical regions to identify industry–specific or region–specific trends in innovation performance. However, these are not the only elements that influence an enterprise's innovation performance.

References

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, *22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092

Amit, R., & Schoemaker, P. J. H. (2021). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33–46.

Bendig, D., Foege, J. N., Endriβ, S., & Brettel, M. (2020). The effect of family involvement on innovation outcomes: The moderating role of board social capital. *Journal of Product Innovation Management*, *37*(3), 249–272. https://doi.org/10.1111/jpim.12522

Billand, P., Bravard, C., & Durieu, J. (2019). Firm heterogeneity and the Pattern of R&D collaborations. *Economic Inquiry*, *57*(4), 1896–1914.

Boukouras, A. (2011). Separation of ownership and control: Delegation as a commitment device. *Electronic Journal*, *33*(44). https://doi.org/10.2139/ssrn.1839245

Byun, J., Sung, T.E., & Park, H.W. (2017). Technological innovation strategy: How do technology life cycles change by technological area. *Technology Analysis & Strategic Management*, *30*(1), 98–112. https://doi.org/10.1080/09537325.2017.1297397

Chiu, C.M., Hsu, M.H., & Wang, E. T. G. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision Support Systems*, *42*(3), 1872–1888. https://doi.org/10.1016/j.dss.2006.04.001

Cornforth, C. (2001). What makes boards effective? An examination of the relationships between board inputs, structures, processes and effectiveness in non–profit organizations. *Corporate Governance*, *9*(3), 217–227.

Crossan, M. M., & Apaydin, M. (2010). A multi–dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, *47*(6), 1154–1191. https://doi.org/10.1111/j.1467–6486.2009.00880.x

Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. (2019). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science*, *4*(1). https://doi.org/10.1186/1748–5908–4–50

Fama, E. F., & Jensen, M. C. (2021). Separation of ownership and control. *The Journal of Law and Economics*, *26*(2), 301–325.

Feng, J., Pan, Y., & Zhuang, W. (2022). Measuring the enterprise green innovation strategy decision–making quality: A moderating—mediating model. *Frontiers in Psychology*, *13*(22). https://doi.org/10.3389/fpsyg.2022.915624

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Grant, R. M. (2021). Toward a knowledge–based theory of the firm. *Strategic Management Journal*, *17*(S2), 109–122.

Hair, J., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective* (7th ed.). Pearson Education.

Latour, B. (2022). Why has critique run out of steam? From matters of fact to matters of concern. *Critical Inquiry*, *30*(2), 225–248. https://doi.org/10.1086/421123

Morgan, R. M., & Hunt, S. D. (2020). The commitment–trust theory of relationship marketing. *Journal of Marketing*, *58*(3), 20–38. https://doi.org/10.2307/1252308

Murray, A., Skene, K., & Haynes, K. (2017). The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*, *140*(3), 369–380.

Nutt, P. C. (2008). Investigating the success of decision–making processes. *Journal of Management Studies*, *45*(2), 425–455.

Xie, Y. (2003). Current situation and problems of China's board of directors' constraint mechanism: A descriptive empirical analysis of 500 listed companies in China. *Business Research*, *2*(19), 63–66.

Yli–Renko, H., Autio, E., & Tontti, V. (2002). Social capital, knowledge, and the international growth of technology–based new firms. *International Business Review*, *11*(3), 279–304.

Zhou, G., Zhang, L., & Zhang, L. (2019). Corporate social responsibility, the atmospheric environment, and technological innovation investment. *Sustainability*, *11*(2), 481.