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The Impact of Technological Innovation on Business Model Innovation and Start-up Performance

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Abstract

The success rate of start-up firms in Vietnam could be low 20.8%. To address this issue, improving start-up performance through technological innovation and business model innovation is crucial. The relationship between technological innovation, business model innovation (BMI), and start-up performance has yet to be widely examined in developing countries like Vietnam. This study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze data from 425 entrepreneurs. The findings reveal that technological innovation has a positive impact on business model innovation and start-up performance; business model innovation also has a positive impact on start-up performance; and the study identifies the partial mediating role of business model innovation between technological innovation and start-up performance. The results have practical implications for entrepreneurs, start-up founders, and policymakers. It emphasizes investing in technological and business model innovations to improve start-up performance. Lastly, the study highlights some limitations and suggests future research directions.

Keywords: Technological Innovation; Business Model Innovation; Start-up Performance.

1. Introduction

In Vietnam, the survival rate of start-up enterprises is around 20.8% within 3.5 years, indicating a low success rate in entrepreneurship [1]. The reasons for the failure of start-ups are attributed to the lack of operational capital in the initial stage, including human capital, social capital, and financial capital. Evidence shows that human capital, social capital, and financial capital have a positive impact on the performance of Small and Medium-Sized Enterprises (SMEs) in South Africa [2]. Furthermore, with the rapid development of the Fourth Industrial Revolution, start-up enterprises often need help adapting to the fast-changing environment. For example, they may need to innovate technology or update their current business models to meet market demands, resulting in lower start-up performance. In response, Vietnam has implemented policies to support digital transformation for Vietnamese enterprises, such as the "Program to support digital transformation of enterprises in 2021-2025" [3]. This program aims to provide training and consulting on digital transformation, support the application of digital technology solutions, and assist in developing digital transformation roadmaps. These policies create opportunities for start-up enterprises to innovate in technology, update their business models, and contribute to improving start-up performance. However, the extensive

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validation of the relationship between technological innovation, business model innovation, and start-up performance in Vietnamese start-ups is still limited.

The relationship between business model innovation (BMI) and firm performance has received attention from scholars worldwide, but it has yet to be fully and widely validated. Foss & Saebi [4] synthesized studies on BMI from 2000 to 2015 and proposed a research direction to test the relationship between BMI and firm performance, including innovation, cost reduction, and financial efficiency. Clauss [5] introduced the components of BMI, including new capacity, technology, partners, processes, products, markets, distribution channels, customer relationships, revenue models, and cost structures. Some researchers are interested in the relationship between business model innovation and start-up performance [6]. BMI has been found to create competitive advantages and improve firm performance [7]. BMI is also directly associated with business judgment, creativity, and vision [4]. However, the validation of the relationship between BMI and start-up performance is still limited and has yielded inconsistent results. Some studies have found a positive relationship between BMI and firm performance [8–12]. On the other hand, Patzelt et al. [13] did not find a significant relationship between BMI and performance. In contrast, Halecker et al. [14] found a negative relationship between BMI and firm performance. Anwar [12] demonstrated a positive relationship between BMI and firm performance for SMEs, moderated by competitive advantage. Hamelink & Opdenakker [15] showed that BMI impacts the performance of the energy storage industry, but the relationship remains unclear. Finally, Guo et al. [16] examined the impact of three components of BMI, including value proposition, value creation, and value capture innovation, on the performance of Chinese digital start-ups. Based on this literature review, it is evident that the relationship between BMI and firm performance has been examined, but the results show a need for more consensus. Most of these studies primarily focused on countries with developed economies where market policies and legal systems are stable, providing a favorable environment for business development. Therefore, to generalize the relationship between BMI and firm performance in developing markets, this study aims to examine the relationship between BMI and start-up performance in developing markets like Vietnam.

In addition, the role of technology in designing a startup business model has been affirmed [1]. Technology plays an essential role in restructuring the operations of an organization to create value [17, 18]. Technological development also contributes to achieving the main objectives of a company, such as customer satisfaction, supplier relationships, quality, and financial performance [3]. Therefore, technology can help expand the market for product consumption, reduce distribution time, and enhance quality [19]. Guo et al. [20] have shown that technology and consumer orientations benefit the performance of startups. Digital technologies have created new business models. Thus, technological innovation will generate new business models to analyze, understand, and meet customer needs [21, 22]. Based on the literature review, it is evident that the role of technological innovation in creating new business models has been affirmed. However, the relationship between them has not been widely examined. Therefore, this study aims to fill this research gap and empirically investigate the relationship between technological innovation and business model innovation for startups in Vietnam.

Indeed, the role of technology in firm performance has been found in numerous previous studies. For instance, Chege et al. [23] found that technological innovation positively impacts the firm performance of 297 businesses in Kenya. Koellinger [24] surveyed 7,302 European enterprises and found that Internet-based technologies have a positive influence on product and process innovation, contributing to positive turnover and employment growth. Technological innovation has been found to have a direct impact on firm performance. However, the mechanism through which it operates with business model innovation still needs to be better understood [25]. Based on the literature review, the relationship between technological innovation, business model innovation, and start-up performance has not been extensively examined for start-up businesses in developing countries like Vietnam. Furthermore, Koellinger [24] has asserted that there is insufficient evidence to support the notion that new technologies and innovations lead to success for businesses. Baden-Fuller & Haefliger [26] suggest that the business model intermediates technology and performance. Therefore, this study aims to fill this research gap with two main contributions:

- To examine the relationship between technological innovation, business model innovation, and start-up performance.
- To investigate the mediating role of business model innovation between technological innovation and start-up performance.

After the introduction, the article's structure will include the following sections: Theoretical Background, Methodology, Results, and Conclusion and Managerial Implications.

2. Theoretical Background

2.1. Technological Innovation

According to the OECD [27], innovation is a significant improvement in a product/service, process, marketing method, or organizational method that introduces novelty into business practice and is adopted by other businesses or organizations. Technological innovation is a specific type of innovation that involves the development and

implementation of new technologies or the application of existing technologies in novel ways. There are four main types of innovation:

Product Innovation: This involves creating and introducing new products or services with improved features, user-friendliness, materials, software, and other enhancements. The goal of product innovation is to provide better, more efficient, and reliable offerings that meet customer needs and exceed their expectations. Businesses must remain competitive, adapt to changing trends, and achieve long-term success.

Process Innovation: This refers to the implementation of improved methods of production or distribution. It encompasses changes to internal processes and operations within an organization to enhance efficiency and effectiveness. Process innovations can help businesses reduce costs, increase productivity, and improve the quality of their products or services.

Marketing Innovation: This involves introducing significant changes in product design, packaging, promotion, or pricing strategies. By implementing marketing innovations, businesses can differentiate themselves from competitors and stand out in the market. It allows them to be trendsetters and attract customers with unique and appealing offerings.

Organizational Innovation: This type of innovation involves implementing new approaches in business practices, workplace organization, and external relations. By adopting innovative organizational methods, businesses can not only stay ahead of the competition but also improve overall efficiency and productivity. It is crucial for companies to stay up-to-date with evolving practices, take proactive measures, and reap the benefits in the long run.

Technological innovation refers to the ability of a business to update its technological resources, improve technical equipment, and regularly utilize new technological potentials to expand its portfolio of products and services. Technological innovation allows businesses to combine technology with market opportunities to facilitate firm growth [28]. It enables businesses to seize growth opportunities by exploiting existing market opportunities or exploring new markets or technologies [29].

2.2. Business Model Innovation (BMI)

Business model innovation (BMI) involves restructuring the activities of an enterprise's current business model to create innovation in a product or service. BMI is a lean innovation method that utilizes resources and capacity to minimize investment [30]. To ensure sustainable development, businesses need to innovate the components of their business models [31]. The following components of BMI can be measured [5]:

New Capacity: Enterprises must possess new capacities to effectively implement business model innovation and take advantage of emerging opportunities in the external environment [32]. These capacities are developed through training, learning, knowledge integration, and exploring new ideas and lessons learned [33].

New Products/Services: Businesses provide products or services that solve customer problems or meet their needs in new or improved ways [34]. Product and service innovation, often driven by research and development (R&D) or new technologies, represents significant changes in the business model [35].

New Customers/Markets: This refers to the group of customers or market segments where the business currently offers or plans to offer its products/services [36, 37]. BMI involves redefining existing markets or entering new markets. The customer and target market are determined by the question, "Who is willing to pay for the product/service you provide?" [26].

New Revenue Model: Customers pay for the value that the business provides [36]. Questions related to the revenue model include: "When is the revenue generated?", "How long is the revenue generated?" and "Who generates the revenue?" [26].

New Cost Structure: This encompasses the direct and indirect costs associated with the business activities of the enterprise [38]. The established cost structure determines the strategic scope of the product or service and its alignment with the market strategy [39]. The cost structure in the business model can change based on the business's strategy.

2.3. Start-up Performance

According to Littunen et al. [40], start-up performance can be defined as the ability of a start-up to survive and maintain its operations during the first three years after establishment. The survival and continuity of a start-up during this crucial early period are considered indicators of entrepreneurial success. Sustaining operations in the early stages is essential for the long-term stability and growth of a business. The VARIM theory, as discussed by Hill et al. [41], supports this perspective on start-up performance. It emphasizes the importance of start-ups existing for less than 3.5 years, demonstrating stability and continuity in their operations, achieving the goals set by the entrepreneur, and

exhibiting potential for future development. In summary, start-up performance is typically measured by the ability of a start-up to survive and maintain its operations during the initial three-year period, indicating its potential for long-term success and growth.

2.4. Literature Review

Zhang et al. [42] demonstrated that businesses aiming to gain a competitive advantage must utilize business model innovation (BMI). Velu [43] conducted a study on the survival of 129 firms in the US bond market from 1995 to 2004 and found that businesses making significant changes to their business models tend to outlast those that make minor changes. Waldner et al. [44] investigated the influence of different stages in the industry lifecycle on BMI and its outcomes. Based on a sample of 1,242 Austrian businesses, the findings suggested that BMI should be implemented early in the industry lifecycle. Pedersen et al. [45] surveyed 540 managers in marketing, logistics, finance, and other fields to assess the impact of BMI on financial performance. The study found that BMI has a positive impact on financial performance, with corporate sustainability acting as a moderator. Bouncken & Fredrich [46] highlighted that the size, age, experience, and duration of cooperation influence the value of BMI. The results showed that BMI has a more significant positive effect on return on equity for less experienced businesses than more experienced ones. Wei et al. [47] examined the relationship between technological innovation, firm growth, and the moderating role of business model design using a survey of 176 Chinese firms. The results indicated that exploitative innovation has a negative effect on firm growth, whereas exploratory innovation has a positive effect. Furthermore, an efficiency-centered business model design amplifies the negative effect of exploitative innovation and weakens the positive effect of exploratory innovation on firm growth. In summary, these studies highlight the importance of business model innovation (BMI) in gaining a competitive advantage, surviving in the market, and achieving financial performance. The timing of BMI implementation, the industry lifecycle stage, and the specific innovation and business model design strategies employed can influence the outcomes and impact on firm growth and sustainability.

Recent studies conducted from 2022 to 2023 have focused on exploring factors influencing innovation performance. The business model design has been found to promote innovation performance, acting as a mediator between product innovation capabilities and technological turbulence [48]. García-Lopera et al. [49] investigated the impact of professionalization, risk-taking, and technological innovation on business performance using a sample of 310 Spanish SMEs. The study revealed that business performance is influenced by professionalization, risk-taking, and technological innovation. Other studies have explored the impact of digital transformation on innovation performance [50].

However, the literature review suggests that the relationship between technological innovation, business model innovation, and start-up firms has not been extensively examined. Therefore, this study aims to investigate the relationship between technological innovation, business model innovation (BMI), and start-up performance in Vietnam.

2.5. Research Model and Hypotheses

The implementation of business model innovation (BMI) aims to achieve various benefits such as cost reduction, introduction of new products, access to new markets, and improved financial performance. This study focuses on identifying the components of the business model that contribute to enhanced performance, drawing from the outcome criteria of BMI proposed by Pedersen et al. [45], as well as the combined results and proposed research problem put forth by Foss & Saebi [4]. Figure 1 illustrates the specific research model proposed in this study.

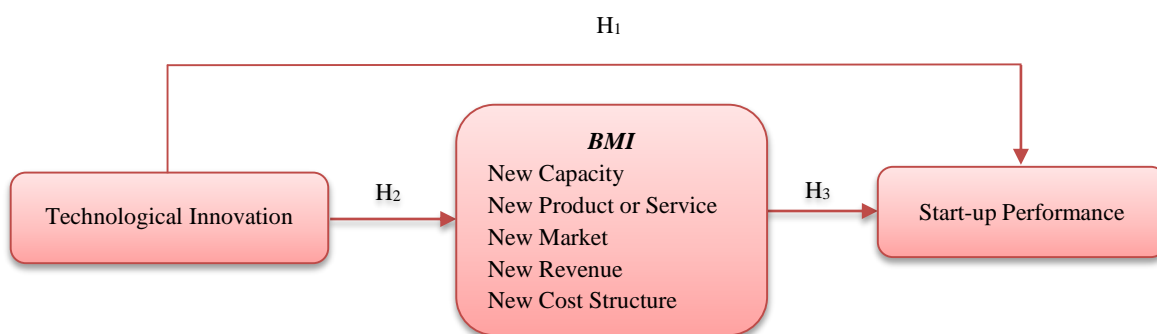


Figure 1. Proposed research model

Reichert & Zawislak [51] discovered a link between technological capabilities and the performance of 133 Brazilian businesses. Technological innovation plays a significant role in firm performance. This influence is significant for high-tech firms in China, where technological innovation is a crucial factor in driving performance

improvement [52]. In an era of rapid technological change and intensified global competition, organizations' ability to develop innovative products and services is considered a critical determinant of long-term performance, as emphasized by Hitt et al. [53]. Numerous studies have consistently demonstrated a positive relationship between technological innovation and firm performance, emphasizing the importance of technological innovation for overall organizational success. In Chinese high-tech firms operating in a transitional economy, technological innovation also plays a pivotal role in enhancing firm performance. Furthermore, enterprises require new technology to restructure their business models. Hypothesis H1 is proposed:

H₁: *Technological innovation has a positive influence on start-up performance.*

Innovation includes innovation in products/services, new organizational processes, or changes in how products are produced and delivered to customers [54]. Chesbrough [55] has contributed significantly to the understanding of the relationship between business model innovation and technological innovation. According to Chesbrough [55], business model innovation refers to the creation, adoption, or modification of a firm's business model to deliver value to customers in a unique and differentiated way. On the other hand, technological innovation involves the development and implementation of new or improved technologies, processes, or products. Indeed, technology development often plays a crucial role in enabling and facilitating new business models [26]. The choice of business model can shape how a company approaches technology development, adoption, and utilization [26]. Wei et al. [47] demonstrated that technological development can support a successful business model. Hypothesis H2 is proposed:

H₂: *Technological innovation positively affects BMI.*

The new capacity will help enterprises capture new revenue development markets and actively seek opportunities to save production costs and adjust costs according to appropriate market prices [5]. Alam et al. [56] demonstrated a positive relationship between capacity innovation and the performance of manufacturing firms in Malaysia. Businesses produce new products/services to meet customer needs, generate revenue, and contribute to improved business results [5]. Atalay et al. [57] demonstrated a positive relationship between product innovation and the performance of the automotive supply industry in Turkey. Moreover, enterprises innovate products to save costs to increase competitive advantages over competitors in the market. Market innovation focuses on developing the target market and determining how the business can best serve the customers in the target market while generating revenue for the business [58]. Market innovation helps businesses achieve the potential market share and revenue growth desired. In addition, businesses develop new markets to seize many opportunities and consider appropriate pricing strategies [5]. Customers are the people who bring in revenue for the business. Revenue model innovation will create new revenue growth opportunities and achieve long-term profitability [5]. The new revenue model will help businesses achieve the desired revenue and profit growth. During the start-up phase, start-ups incur many initial and fixed investment costs. The cost structure determines the performance. Innovating the cost structure to determine the necessary costs related to business operations at the lowest level. Hypothesis H₃ is stated:

H₃: *BMI positively influences start-up performance.*

3. Research Methodology

3.1. Data

Survey Method: The study conducted both direct and online surveys to the target respondents. A total of 227 valid survey questionnaires were sent directly to the respondents, while 198 questionnaires were sent online to the email addresses of respondents who agreed to participate. The final sample size for the study was 425 observations. The observed variables were evaluated using a 5-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). The collected data was surveyed in areas known for high entrepreneurial and innovative spirit, such as Ho Chi Minh City, Dong Nai, Binh Duong, and Ba Ria Vung Tau.

Respondents: The study surveyed entrepreneurs (business founders or senior managers of start-up enterprises).

Sampling Criteria: Based on Project 844, the start-up enterprises surveyed in this study had to meet the following criteria: 1) operating for no more than 5 years, 2) experiencing rapid growth (in terms of revenue, market share, and profitability), and 3) offering technology-based products/services.

Sampling Method: The study employed a convenient sampling method, which was convenient and favorable for the researchers conducting the study.

3.2. Scales

The scales used in the model were initially developed by previous researchers and have been adapted to suit the specific research context. Table 1 presents seven constructs along with 25 observed variables that have been utilized in the study. These items have been adjusted to align with the objectives and requirements of the current research.

Table 1. Scale and origin of the scale

Constructs	Number of observations	Source
Technological Innovation (TEC)	3	[5]
Business model innovation (BMI)		
1. New Capabilities (CAP)	3	[5]
2. New Products (PRO)	3	[5, 59]
3. New Market (MARK)	3	[5, 60]
4. New revenue model (REV)	4	[5, 61]
5. New cost structure (COST)	4	[5, 61]
Startup performance (PERF)	5	[62]

3.3. Data Analysis Methods

The research utilized the Smart-PLS software version 4 for data analysis. The collected data was evaluated based on the following criteria. Measurement model evaluation: Cronbach's alpha > 0.6; Composite reliability > 0.7, and AVE > 0.5 [63]. Discriminant validity: The square root of AVE should be greater than the correlation coefficient. Structural model evaluation: Coefficient of determination: Weak prediction: $R^2 = 0.02$; Weak to moderate prediction: $R^2 = 0.02 - 0.16$; Moderate prediction: $R^2 = 0.16 - 0.26$; Strong prediction: $R^2 > 0.26$ [64, 65]. Q^2 : Blindfolding was used in the study: Weak prediction: $Q^2 < 0.02$; Moderate prediction: $Q^2 = 0.02 - 0.35$; Strong prediction: $Q^2 > 0.35$ [66]. Effect size: Weak effect: $f^2 = 0.02$; Moderate effect: $f^2 = 0.15$; Strong effect: $f^2 = 0.35$ [67].

3.4. Research Process

The research methodology consists of two main stages (See Figure 2): pilot study and formal research:

Pilot Study: The preliminary stage involves qualitative research to adjust the observed variables and ensure they effectively measure the research concepts. This study employed a group discussion technique with five experts, including two scientists and three successful start-up owners. The aim was to gain a clear and conceptual understanding of the scales. The discussions were recorded, and the findings were used to develop and refine a draft scale that aligned with the context of start-ups in Vietnam.

Formal Study: The quantitative preliminary study utilized a convenience sampling method. The draft scale was administered to 101 start-ups to test its reliability. Based on the feedback and analysis of the collected data, adjustments were made to finalize the scale for use in the formal research phase. The formal research phase involved a quantitative research method and was conducted on a larger with 425 observations. This phase aimed to test the research model and hypotheses using the Partial Least Squares Structural Equation Model (PLS-SEM).

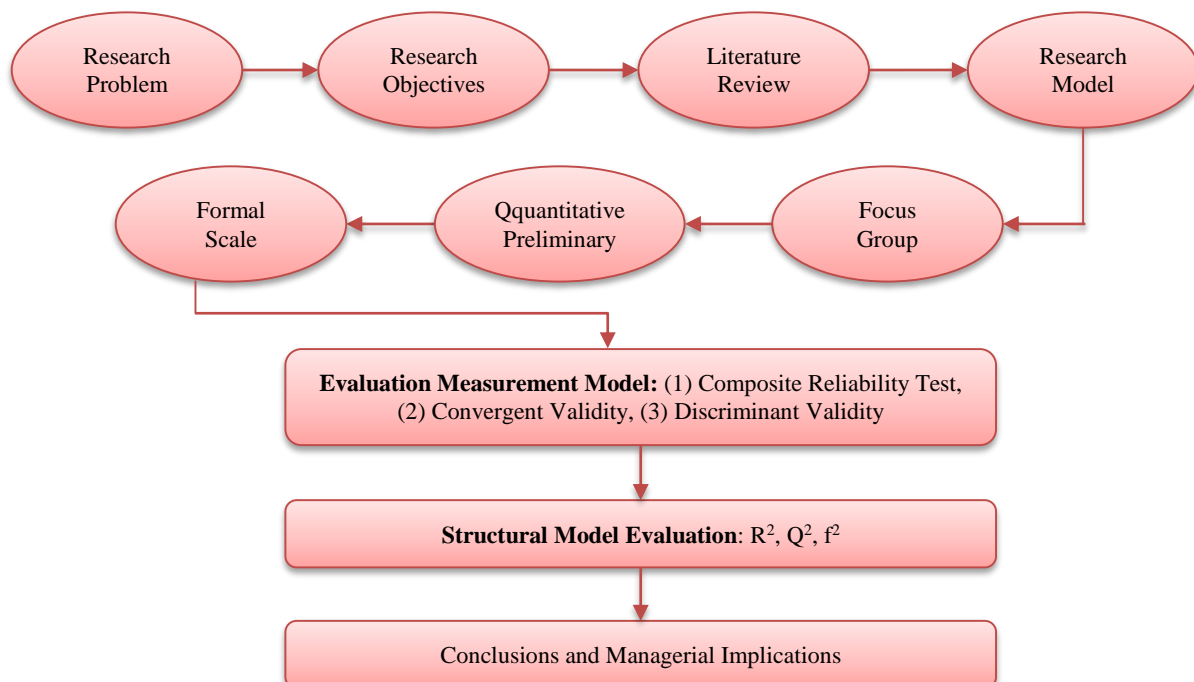


Figure 2. Research process

4. Results

4.1. Sample Characteristics

The Table 2 offers a detailed analysis based on the type of operation, such as private enterprise, limited company, and joint stock company. Additionally, the table provides insights into the field of operation and labor size of the start-ups.

Table 2. Sample characteristics

	Characteristics	Frequency	%
Business type	Private company	20	4.7
	Limited liability company	343	80.7
	Joint Stock company	62	14.6
Business sector	Service	71	17
	Commerce	25	6
	Production	329	77
Size labour	< 10	306	72
	10-30	79	19
	30-50	11	3
	> 50	29	7

Regarding business type, the dataset shows that private companies represent a relatively small proportion, with only 4.7% (20) of the businesses falling into this category. Most businesses are limited liability companies, accounting for 80.7% (343). Joint Stock Companies comprise a significant but smaller portion, representing 14.6% of the businesses (see Figure 3).

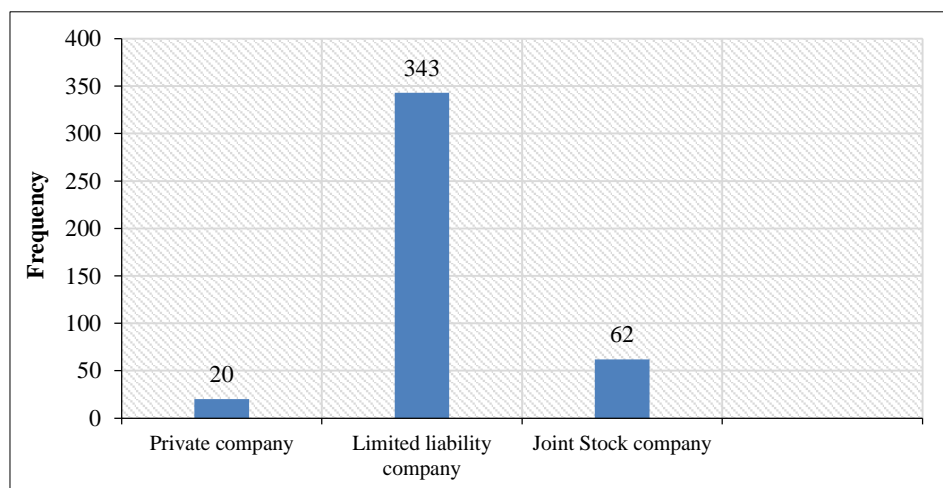


Figure 3. Distribution of business types

The proportion of firms operating in the service sector is 71 (17%), the commercial sector is 25 (6%), and finally the manufacturing industry is 329 (77%), (see Figure 4).

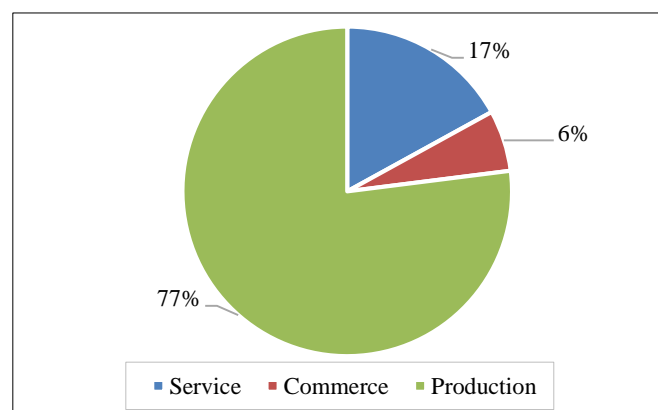


Figure 4. Percentage of business sector

Regarding labor size, the dataset provides information on the number of employees within each business category. Most businesses have less than 10 employees, constituting 72%. Businesses with 10-30 employees make up 19%, indicating a moderate-sized labor force. A smaller percentage of businesses have 30-50 employees (3%), while those with more than 50 employees represent 7% of the total (Figure 5).

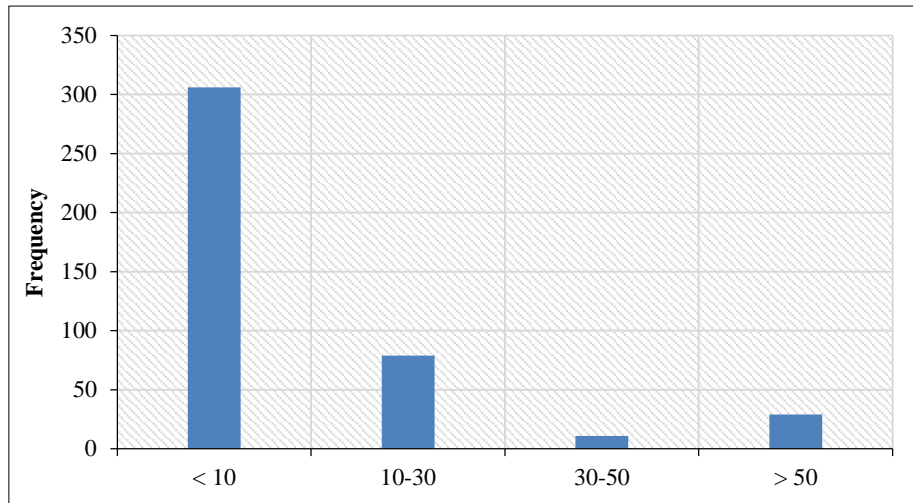


Figure 5. Distribution of labor size

4.2. Scale of Evaluation

Table 3 shows the mean, standard deviation, and loading coefficient of the observed variables used to measure the research concepts and the reliability and variance extracted from the model's scales.

The results show that the Cronbach's alpha coefficients and Composite Reliability of all scales are more significant than 0.6: Technological innovation (TEC): CA = 0.826; CR = 0.830; New Capability (CAP): CA = 0.839; CR = 0.841; New product/service (PRO): CA = 0.825; CR = 0.826; New Market (MARK): CA = 0.803; CR = 0.805; New revenue model (REV): CA = 0.878; CR = 0.879; New cost structure (COST): CA = 0.850; CR = 0.851; Start-up performance (PERF): CA = 0.869; CR = 0.872). According to the evaluation criteria of Hair et al. [63], all scales ensure reliability.

The results indicate that the loading coefficients of all observed variables are more significant than 0.7, except for the observed variable cost4, "We regularly utilize opportunities which arise through price differentiation" which has a low loading coefficient of 0.307 and therefore is excluded. The Average Variance Extracted (AVE) values of all scales are more significant than 0.5 (AVE_{TEC} = 0.613; AVE_{CAP} = 0.757; AVE_{PRO} = 0.741; AVE_{MARK} = 0.718; AVE_{REV} = 0.732; AVE_{COST} = 0.770; AVE_{PERF} = 0.656), indicating that the scales ensure convergent validity [63].

Table 3. Statistical indicators of items

Items	M	SD	λ	T
Technological innovation (TEC): Cronbach's Alpha (CA) = 0.826; Composite Reliability (CR) = 0.830; Average of variance extracted (AVE) = 0.613				
1. We keep the technical resources of our company up to date	2.63	0.98	0.78	23.85
2. Relative to our competitors our technical equipment is very innovative	2.68	1.02	0.82	24.60
3. We regularly utilize new technical opportunities in order to extend our product and service portfolio	2.86	1.12	0.74	18.51
New Capability (CAP): CA = 0.839; CR = 0.841; AVE = 0.757				
4. Our employees constantly receive training in order to develop new competences.	2.92	0.94	0.75	16.30
5. Relative to our direct competitors, our employees have very up-to-date knowledge and capabilities.	2.95	0.96	0.78	16.54
6. We constantly reflect on which new competencies need to be established in order to adapt to changing market requirements.	3.00	1.06	0.86	18.46
New product/service (PRO): CA = 0.825; CR = 0.826; AVE = 0.741				
7. We regularly address new, unmet customer needs.	2.48	0.89	0.87	22.57
8. Our products or services are very innovative in relation to our competitors.	2.52	0.93	0.70	15.72
9. Our products or services regularly solve customer needs, which were not solved by competitors.	2.57	1.00	0.77	18.38
New Market (MARK): CA = 0.803; CR = 0.805; AVE = 0.718				
10. We regularly take opportunities that arise in new or growing markets.	2.70	0.79	0.75	13.23
11. We regularly address new, unserved market segments.	2.60	0.89	0.72	12.97
12. We are constantly seeking new customer segments and markets for our products and services.	2.87	1.02	0.81	15.28

New revenue model (REV): CA = 0.878; CR = 0.879; AVE = 0.732				
13. We recently developed new revenue opportunities (e.g., additional sales, cross selling).	2.73	0.90	0.71	15.70
14. We increasingly offer integrated services (e.g., maintenance contracts) to realize long-term financial returns.	2.75	0.96	0.76	18.34
15. We recently complemented or replaced one-time transaction revenues with long-term recurring revenue models (e.g., Leasing).	2.68	1.05	0.86	19.36
16. We do not rely on the durability of our existing revenue sources.	2.78	1.03	0.86	19.26
New cost structure (COST): CA = 0.850; CR = 0.851; AVE = 0.770				
17. We regularly reflect on our price-quantity strategy.	2.84	0.97	0.81	23.44
18. We actively seek opportunities to save manufacturing costs.	2.88	1.01	0.77	24.35
19. Our production costs are constantly examined and if necessary, amended according to market prices.	2.85	1.06	0.84	23.91
Start-up performance (PERF): CA = 0.869; CR = 0.872; AVE = 0.656				
20. I have obtained stable orders and realize stable increase of operating income.	3.44	1.03	0.75	28.436
21. I have achieved the goal set at the beginning of my venture.	3.46	1.14	0.83	40.540
22. Peers and friends are highly complementary about my entrepreneurship.	3.52	1.06	0.76	28.392
23. The firm gains customer trust.	3.53	1.18	0.77	34.200
24. The business gains partner trust.	3.40	1.10	0.76	20.784

Note: M: Mean; SD: Standard deviation; λ: Loading factor.

Table 4 shows that the smallest square root of AVE is 0.81, more significant than the maximum value of the correlation between concept pairs (0.781), indicating that the research concepts have a discriminant value [64].

Table 4. Fornell-Larcker Criterion results

	Business Model Innovation	Firm Performance	Technology Innovation
Business Model Innovation	0.865		
Firm Performance	0.781	0.81	
Technology Innovation	0.538	0.567	0.861

Henseler et al. [68] proposed using the difference in correlation between the actual data and the predicted model (Standardized Root Mean Square Residual - SRMR) of 0.08 as a criterion to measure the model fit to market data (Goodness of Fit, GoF). However, an SRMR value of 0.12 is still considered acceptable. As a result, Table 5 shows that the GoF index is 0.107, less than 0.12, and thus still deemed acceptable. Therefore, the SRMR values meet the criteria for a good fit (see Table 5).

Table 5. Model fit

	Critical model	Estimation Model
SRMR	0.107	0.107
d_ULS	3.189	3.189
d_G	0.89	0.89
Chi-Square	2094.238	2094.238
NFI	0.592	0.592

The Stone-Geisser's Q² values for Start-up performance are reported as 0.48, more significant than the threshold of 0.35. According to Chin [66], Q² value above 0.35 indicates a predictive solid relevance level. Additionally, the coefficient of determination (R²) for Start-up performance is reported as 0.637, more significant than the threshold of 0.35. This suggests that the predictive accuracy level is substantial (see Table 6).

Table 6. Predictive accuracy and predictive relevance results

	R ²	Predictive accuracy level	Q ²	Predictive relevance level
Start-up performance	0.637	Substantial	0.48	Substantial
Business model innovation	0.285	Moderate	0.465	Substantia

A commonly suggested threshold for the Variance Inflation Factor (VIF) is below 3.3 to ensure unbiased estimates [67]. In Table 7, the VIF values are reported to be lower than 3.3. Therefore, the presence of multicollinearity and common method bias is not violated.

Table 7. Collinearity statistics (VIF) – Inner model

Paths	VIF
TEC → PERF	1.401
TEC → BMI	1.00
BMI → PERF	1.401

4.3. Hypothesis Testing

Table 8 and Figure 6 presents the results indicating the direct effects of technological innovation on business model innovation and firm performance. Specifically, technological innovation has a significant and direct impact on Start-up Performance, supporting hypothesis H₁ ($\beta_{\text{Technological Innovation} \rightarrow \text{Start-up Performance}} = 0.203$; $p < 0.01$). Similarly, technological innovation has a significant and direct impact on business model innovation, supporting hypothesis H₂ ($\beta_{\text{Technological Innovation} \rightarrow \text{BMI}} = 0.541$, $p < 0.01$). The table also provides information about the direct effects of business model innovation on firm performance. The research results show that hypothesis H₃ is accepted ($\beta_{\text{Business model innovation} \rightarrow \text{Start-up Performance}} = 0.673$; $p < 0.01$).

Furthermore, the results indicate the indirect impact of technological innovation on firm performance through business model innovation, which is statistically significant ($\beta = 0.364$, $p = 0.000 < 0.01$). The confidence interval [0.305; 0.412] does not contain the value of 0 and includes the estimated coefficient. These findings suggest that technological innovation plays a partial mediating role between business model innovation and start-up performance.

Table 8. PLS-SEM result

Path coefficients		B	Standard deviation	t- statistics	p-values	Conclusion
<i>Direct effect</i>						
H1	Technological Innovation → Start-up Performance	0.203	0.034	6.127	0.000	Accepted
H2	Technological Innovation → Business Model Innovation	0.541	0.035	15.29	0.000	Accepted
H3	Business Model Innovation → Start-up Performance	0.673	0.027	24.608	0.000	
<i>Indirect effect</i>						
	Technological Innovation → Business Model Innovation → Start-up Performance	0.364	0.028	13.07	0.000	Accepted
f^2	$f^2_{\text{TEC} \rightarrow \text{PERF}} = 0.087, f^2_{\text{BMI} \rightarrow \text{PERF}} = 0.879$					

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

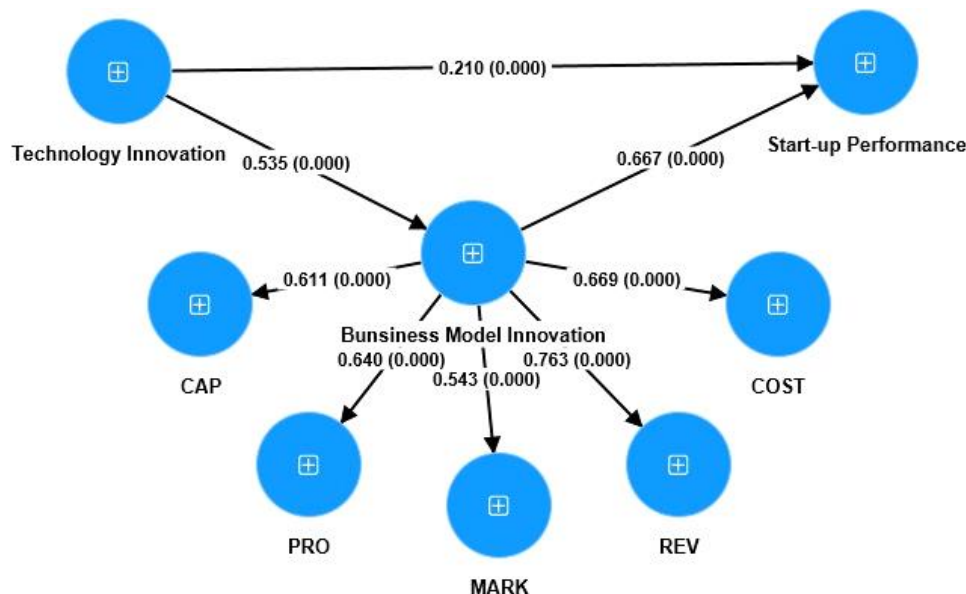


Figure 6. PLS-SEM Estimated model

4.4. Discussion

The findings have added to the theoretical framework the positive relationship between technological innovation, BMI, and start-up performance. The findings are consistent with previous research and address the research problem of BMI and firm performance [68]. Furthermore, the results confirmed the role of technological innovation in implementing BMI and contributed to an increase in start-up performance.

Firstly, the study's findings align with previous research that has demonstrated the significant impact of technological innovation on start-up performance. Reichert & Zawislak [51] and Chege et al. [23] have both found that technological innovation has a positive influence on firm performance. Koellinger [24] has shown that Internet-based technologies contribute to positive improvements in turnover and employment growth. Similarly, Reichert & Zawislak [51] conclude that technological capabilities have a positive impact on performance. Nohria & Gulati [52] have also highlighted the significant role of technological innovation in firm performance. These previous studies support the findings of the current study, reinforcing the notion that technological innovation is a critical factor in determining start-up performance.

Secondly, the study demonstrates that technological innovation has a positive impact on business model innovation, which is consistent with previous research. Avermaete et al. [54] and other studies such as [69, 70] have also found similar results. Kohli & Melville [21] have shown that digital technologies have facilitated the development of new business models. Priem & Wenzel [22] argue that technological innovation leads to the creation of new business models to meet customer needs. Chesbrough [55] has highlighted the relationship between technological innovation and business model innovation. Additionally, Baden-Fuller & Haefliger [26] have concluded that technology development gives rise to new business models. These previous studies further support the current study's findings, indicating a positive association between technological innovation and business model innovation.

Finally, the study findings also indicate that business model innovation has a positive impact on start-up performance, which is consistent with previous research. Teece et al. [32] have shown that business model innovation contributes to productivity, profitability, market value, and financial effectiveness for businesses. Bashir & Verma [71] have also found that business model innovation generates higher profits, with a fourfold increase compared to firms that only innovate their products/services. Additionally, Futterer et al. [11] have demonstrated that business model innovation leads to greater business effectiveness compared to firms that do not innovate their business model. These previous studies support the findings of the current study, highlighting the positive relationship between business model innovation and start-up performance.

5. Conclusion and Managerial Implications

5.1. Conclusion

This study investigated the relationship between technological innovation, business model innovation (BMI), and start-up performance. The findings of the study are as follows:

Firstly, the study confirmed a positive correlation between technological innovation and start-up performance, which is consistent with previous research. This highlights the importance of technological innovation in improving the performance of start-up firms. It suggests that start-ups that invest in technological innovation are more likely to achieve better performance outcomes.

Secondly, the study demonstrated that business model innovation (BMI) itself has a direct positive impact on start-up performance. This means that implementing innovative business models contributes to increased operating income, customer trust, and partnerships. By strategically adjusting their business models, start-ups can enhance their performance and achieve their predefined goals.

Thirdly, the study found that technological innovation plays a role in driving business model innovation to adapt to market changes. Technological advancements create opportunities for start-ups to innovate their business models in response to evolving market dynamics. By leveraging technological innovation, start-ups can develop new and improved business models that better serve their target markets.

Finally, the study revealed that business model innovation acts as a partial mediator between technological innovation and start-up performance. This finding emphasizes the significant role played by BMI in harnessing the benefits of technological innovation and translating them into tangible performance outcomes. It suggests that business model innovation serves as an intermediary mechanism through which technological innovation positively influences start-up performance.

Overall, the study highlights the importance of both technological innovation and business model innovation in driving start-up performance. It emphasizes the interplay between these two factors and their combined effect on the success of start-up firms.

5.2. Managerial Implications

Overall, this study underscores the intertwined nature of technological innovation, business model innovation, and start-up performance. It highlights the need for start-up ventures to embrace technological and business model advancements to maximize their potential for success. The implications of this study suggest that start-ups should not only focus on technological innovation but also proactively explore and innovate their business models to fully leverage the benefits of technological innovation. By adopting flexible and adaptive business models, start-ups can enhance their performance, competitiveness, and ability to navigate dynamic market conditions. It is important to note that further research is warranted to deepen our understanding of the complex relationships among technological innovation, business model innovation, and start-up performance. This study is a foundation for future investigations in this field, providing valuable insights for researchers, practitioners, and policymakers seeking to foster innovation and entrepreneurship.

Improving Technological Innovation:

In order to keep the technical resources of the company up to date, managers must prioritize continuous learning and development initiatives. This can involve providing employees with regular training sessions, encouraging participation in conferences and workshops, and fostering a culture of curiosity and knowledge sharing. Managers should allocate resources and time for employees to stay updated with the latest technological advancements relevant to their roles. Managers should leverage the company's innovative technical equipment relative to competitors as a unique selling point. This implies that managers need to communicate and promote the technological advantages to both internal and external stakeholders. By showcasing the company's ability to leverage cutting-edge technology, managers can attract customers, investors, and top talent, strengthening the company's competitive position in the market.

To effectively utilize new technical opportunities and extend the product and service portfolio, managers should foster an environment that encourages experimentation and adaptation. This can involve creating cross-functional teams and providing them with the necessary autonomy and resources to explore and implement new technologies. Managers should also foster a culture that embraces failure as a learning opportunity and encourages employees to take calculated risks to pursue innovation. To stay updated with new technical opportunities, managers should actively seek collaborations and partnerships with external entities such as research institutions, startups, and technology vendors. By establishing these partnerships, managers can access emerging technologies, expertise, and market insights. This can enable the company to identify and leverage new technical opportunities more effectively, leading to an expanded product and service portfolio.

To support technological innovation, managers should allocate adequate resources for research and development (R&D). This includes budgetary allocations for R&D activities, creating dedicated R&D teams, and providing them with the necessary infrastructure and tools. Managers should also encourage employees to dedicate a portion of their time to exploratory projects and innovative initiatives, fostering a culture of innovation within the organization.

Improving Business Model Innovation:

New Capabilities:

- Employees should actively participate in regular training programs and workshops to enhance their skills and stay up to date with emerging trends.
- Start-up firms regularly assess the skills and knowledge gaps within the workforce and provide targeted training opportunities to ensure employees remain at the forefront of industry advancements.
- Through regular assessments and feedback loops, start-up firms evaluate existing competencies and prioritize establishing new ones that align with evolving market demands.

New Product/Service:

- Conduct regular market research, engage in customer feedback sessions, and stay attuned to industry trends.
- Develop innovative solutions to meet and exceed customer expectations.
- Invest in research and development initiatives, collaborate with industry experts, and encourage a culture of creativity and innovation within an organization.

New Market:

- Pursue opportunities in new or growing markets by conducting thorough market research, analyzing market trends, and evaluating the potential for products or services to meet the needs of these markets.
- Conduct market segmentation analysis and understand the unique needs and preferences of these segments.
- Seek new customer segments and explore untapped markets for products and services, identify emerging customer segments, and evaluate the potential for offerings.

New Revenue Model:

- Explore additional sales channels and implement cross-selling strategies.
- Identify opportunities to enhance offerings and meet evolving customer needs.
- Offer integrated services, such as comprehensive maintenance contracts; complement or replace one-time transaction revenues with long-term recurring revenue models; seek to identify and seize opportunities beyond existing revenue sources.

New Cost Structure:

- Pricing strategy is aligned with market conditions and optimized to maximize profitability.
- Implementing cost-saving initiatives throughout production processes.
- Reduce costs without compromising product quality.
- Monitor the cost components of production processes, including raw materials, labor, energy, and overhead expenses, strive to optimize our production costs and maintain competitiveness in the marketplace.

5.3. Limitation and Further Study

This study acknowledges that its findings may have limitations in terms of representativeness, as it was conducted in a specific region. To enhance the representativeness of the research, future studies should be conducted in various provinces and cities with a significant number of start-ups. By surveying a broader range of locations, a more comprehensive understanding of the relationship between technological innovation, business model innovation (BMI), and start-up performance can be achieved.

Additionally, this study examined start-ups across different industries, which may overlook the unique characteristics and requirements of each specific profession. To obtain more precise and tailored results, it is recommended to conduct research focused on a particular industry to examine the role of technological innovation in implementing BMI and enhancing start-up performance. This would allow for a deeper analysis of industry-specific dynamics and shed light on the industry-specific implications of technological and business model innovations.

Furthermore, it is essential to acknowledge that various factors beyond technological and business model innovations influence start-up success. Factors such as the quality of relationships with strategic partners, support from local start-up organizations, and other contextual variables can significantly impact start-up outcomes. These factors present exciting avenues for further research and should be considered in future studies to gain a comprehensive understanding of the multifaceted nature of start-up success.

6. Declarations**6.1. Author Contributions**

Conceptualization, T.N.G. and N.Q.T.; methodology, T.N.G.; software, N.Q.T.; validation, V.V.D., T.N.G., and N.Q.T.; formal analysis, T.N.G.; investigation, N.Q.T.; resources, T.N.G.; data curation, V.V.D.; writing—original draft preparation, T.N.G.; writing—review and editing, N.Q.T.; visualization, V.V.D.; supervision, N.Q.T.; project administration, V.V.D.; funding acquisition, V.V.D. All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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6.5. Institutional Review Board Statement

Not applicable.

6.6. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

6.7. Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

7. References

- [1] Ghi, T. N., Anh, N. T. P., Thu, N. Q., & Huan, N. Q. (2021). Entrepreneur's human capital and business model innovation: The meditation role of access to start-up resources. *International Journal of Information and Management Sciences*, 32(1), 59–76. doi:10.6186/IJIMS.202103_32(1).0004.
- [2] Fatoki, O. O. (2011). The Impact of Human, Social and Financial Capital on the Performance of Small and Medium-Sized Enterprises (SMEs) in South Africa. *Journal of Social Sciences*, 29(3), 193–204. doi:10.1080/09718923.2011.11892970.
- [3] MPI. (2021). Decision on approving the digital transformation support program for businesses in the 2021-2025 phase. Ministry of Planning and Investment, Hanoi, Vietnam.
- [4] Foss, N. J., & Saebi, T. (2017). Fifteen Years of Research on Business Model Innovation: How Far Have We Come, and Where Should We Go? *Journal of Management*, 43(1), 200–227. doi:10.1177/0149206316675927.
- [5] Clauss, T. (2017). Measuring business model innovation: conceptualization, scale development, and proof of performance. *R and D Management*, 47(3), 385–403. doi:10.1111/radm.12186.
- [6] Trimi, S., & Berbegal-Mirabent, J. (2012). Business model innovation in entrepreneurship. *International Entrepreneurship and Management Journal*, 8(4), 449–465. doi:10.1007/s11365-012-0234-3.
- [7] Aspara, J., Hietanen, J., & Tikkanen, H. (2010). Business model innovation vs. replication: Financial performance implications of strategic emphases. *Journal of Strategic Marketing*, 18(1), 39–56. doi:10.1080/09652540903511290.
- [8] Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. *Journal of cleaner production*, 198, 401–416. doi:10.1016/j.jclepro.2018.06.240.
- [9] Sosna, M., Treviño-Rodríguez, R. N., & Velamuri, S. R. (2010). Business model innovation through trial-and-error learning: The Naturhouse case. *Long Range Planning*, 43(2-3), 383–407. doi:10.1016/j.lrp.2010.02.003.
- [10] Gao, Y., Shu, C., Jiang, X., Gao, S., & Page, A. L. (2017). Managerial ties and product innovation: The moderating roles of macro- and micro-institutional environments. *Long Range Planning*, 50(2), 168–183. doi:10.1016/j.lrp.2016.11.005.
- [11] Futterer, F., Schmidt, J., & Heidenreich, S. (2018). Effectuation or causation as the key to corporate venture success? Investigating effects of entrepreneurial behaviors on business model innovation and venture performance. *Long Range Planning*, 51(1), 64–81. doi:10.1016/j.lrp.2017.06.008.
- [12] Anwar, M. (2018). Business model innovation and SMEs performance-Does competitive advantage mediate? *International Journal of Innovation Management*, 22(7), 1850057. doi:10.1142/S1363919618500573.
- [13] Patzelt, H., Zu Knyphausen-Aufseß, D., & Nikol, P. (2008). Top management teams, business models, and performance of biotechnology ventures: An upper echelon perspective. *British Journal of Management* 19(3), 205–221. doi:10.1111/j.1467-8551.2007.00552.x.
- [14] Halecker, B., Bickmann, R., & Hölzle, K. (2014). Failed Business Model Innovation - A Theoretical and Practical Illumination on A Feared Phenomenon. *R&D Management Conference 2014 - Management of Applied R&D: Connecting High Value Solutions with Future Markets*, 03-06 June 2014, Stuttgart, Germany.
- [15] Hamelink, M., & Opendakker, R. (2019). How business model innovation affects firm performance in the energy storage market. *Renewable Energy*, 131, 120–127. doi:10.1016/j.renene.2018.07.051.
- [16] Guo, H., Guo, A., & Ma, H. (2022). Inside the black box: How business model innovation contributes to digital start-up performance. *Journal of Innovation and Knowledge*, 7(2), 100188. doi:10.1016/j.jik.2022.100188.
- [17] Günzel, F., & Wilker, H. (2012). Beyond high tech: The pivotal role of technology in start-up business model design. *International Journal of Entrepreneurship and Small Business*, 15(1), 3–22. doi:10.1504/IJESB.2012.044586.
- [18] Orlikowski, W. J. (2000). Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science*, 11(4), 404–428. doi:10.1287/orsc.11.4.404.14600.
- [19] Hamel, G., & Trudel, J. D. (2001). Leading the revolution. *The Journal of Product Innovation Management*, 3(18), 212–213.

- [20] Guo, H., Wang, C., Su, Z., & Wang, D. (2020). Technology Push or Market Pull? Strategic Orientation in Business Model Design and Digital Start-up Performance. *Journal of Product Innovation Management*, 37(4), 352–372. doi:10.1111/jpim.12526.
- [21] Kohli, R., & Melville, N. P. (2019). Digital Innovation: A Review and Synthesis, 29(1), 200–223.
- [22] Priem, R. L., Wenzel, M., & Koch, J. (2018). Demand-side strategy and business models: Putting value creation for consumers center stage. *Long Range Planning*, 51(1), 22–31. doi:10.1016/j.lrp.2017.07.007.
- [23] Chege, S. M., Wang, D., & Suntu, S. L. (2020). Influence of technology innovation intensity on firm performance: Technology innovation on firm performance - Case of Kenya. *International Journal of Technology and Human Interaction*, 16(2), 34–52. doi:10.4018/IJTHI.2020040104.
- [24] Koellinger, P. (2008). The relationship between technology, innovation, and firm performance-Empirical evidence from e-business in Europe. *Research Policy*, 37(8), 1317–1328. doi:10.1016/j.respol.2008.04.024.
- [25] Zaheer, A., & Bell, G. G. (2005). Benefiting from network position: Firm capabilities, structural holes, and performance. *Strategic Management Journal*, 26(9), 809–825. doi:10.1002/smj.482.
- [26] Baden-Fuller, C., & Haefliger, S. (2013). Business Models and Technological Innovation. *Long Range Planning*, 46(6), 419–426. doi:10.1016/j.lrp.2013.08.023.
- [27] OECD. (2004). The OECD Principles of Corporate Governance. Accounting and Administration, Organisation for Economic Co-operation and Development, 1-12. doi:10.22201/fca.24488410e.2005.562.
- [28] Bond, E. U., & Houston, M. B. (2003). Barriers to matching new technologies and market opportunities in established firms. *Journal of Product Innovation Management*, 20(2), 120–135. doi:10.1111/1540-5885.2002005.
- [29] Teece, D. J. (2010). Business models, business strategy and innovation. *Long range planning*, 43(2-3), 172-194. doi:10.1016/j.lrp.2009.07.003.
- [30] Santos, J., Spector, B., & Van der Heyden, L. (2011). Toward a Theory of Business Model Innovation within Incumbent Firms. SSRN Electronic Journal, INSEAD Working Paper No. 2009/16/EFE/ST/TOM. doi:10.2139/ssrn.1362515.
- [31] Carayannis, E. G., Sindakis, S., & Walter, C. (2015). Business Model Innovation as Lever of Organizational Sustainability. *Journal of Technology Transfer*, 40(1), 85–104. doi:10.1007/s10961-013-9330-y.
- [32] Teece, D. J., Pisano, G., & Shuen, A. (2009). Dynamic capabilities and strategic management. *Knowledge and Strategy*, 18(7), 77-116. doi:10.1093/oso/9780198781806.003.0019.
- [33] Achtenhagen, L., Melin, L., & Naldi, L. (2013). Dynamics of business models - strategizing, critical capabilities and activities for sustained value creation. *Long Range Planning*, 46(6), 427–442. doi:10.1016/j.lrp.2013.04.002.
- [34] Johnson, M. W., Christensen, C. M., & Kagermann, H. (2008). Reinventing your business model. *Harvard Business Review*, 86(12), 52–60.
- [35] Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 18(7), 509-533. doi:10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z.
- [36] Afuah, A. (2014). Business model innovation: Concepts, analysis, and cases. In *Business Model Innovation: Concepts, Analysis, and Cases*. Routledge, New York, United States. doi:10.4324/9780203584583.
- [37] Junarsin, E., Hanafi, M. M., Iman, N., Arief, U., Naufa, A. M., Mahastanti, L., & Kristanto, J. (2023). Can technological innovation spur economic development? The case of Indonesia. *Journal of Science and Technology Policy Management*, 14(1), 25-52. doi:10.1108/JSTPM-12-2020-0169.
- [38] Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and onto tactics. *Long Range Planning*, 43(2–3), 195–215. doi:10.1016/j.lrp.2010.01.004.
- [39] Zott, C., & Amit, R. (2011). The fit between product market strategy and business model: Implications for firm performance. *The Competitive Dynamics of Entrepreneurial Market Entry*, 29, 468–511.
- [40] Littunen, H., Storhammar, E., & Nenonen, T. (1998). The survival of firms over the critical first 3 years and the local environment. *Entrepreneurship and Regional Development*, 10(3), 189–202. doi:10.1080/08985629800000011.
- [41] Hill, S., Ionescu-Somers, A., Guerrero, M., Coduras, A., Roomi, M. M. A., Bosma, N., ... & Shay, J. (2022). *Global Entrepreneurship Monitor 2021/2022 Global Report: Opportunity amid Disruption*. Dubai Exhibition Center, Dubai, United Arab Emirates.
- [42] Zhang, Y., Zhao, S., & Xu, X. (2016). Business model innovation: an integrated approach based on elements and functions. *Information Technology and Management*, 17(3), 303–310. doi:10.1007/s10799-015-0225-5.
- [43] Velu, C. (2015). Business model innovation and third-party alliance on the survival of new firms. *Technovation*, 35, 1–11. doi:10.1016/j.technovation.2014.09.007.

- [44] Waldner, F., Poetz, M. K., Grimpe, C., & Eurich, M. (2015). Antecedents and consequences of business model innovation: The role of industry structure. *Business models and modelling*, 33, 347–386. doi:10.1108/S0742-332220150000033009.
- [45] Pedersen, E. R. G., Gwozdz, W., & Hvass, K. K. (2018). Exploring the Relationship between Business Model Innovation, Corporate Sustainability, and Organisational Values within the Fashion Industry. *Journal of Business Ethics*, 149(2), 267–284. doi:10.1007/s10551-016-3044-7.
- [46] Bouncken, R. B., & Fredrich, V. (2016). Learning in coopetition: Alliance orientation, network size, and firm types. *Journal of Business Research*, 69(5), 1753–1758. doi:10.1016/j.jbusres.2015.10.050.
- [47] Wei, Z., Yang, D., Sun, B., & Gu, M. (2014). The fit between technological innovation and business model design for firm growth: Evidence from China. *R and D Management*, 44(3), 288–305. doi:10.1111/radm.12069.
- [48] Jin, C., Liu, A., Liu, H., Gu, J., & Shao, M. (2022). How business model design drives innovation performance: The roles of product innovation capabilities and technological turbulence. *Technological Forecasting and Social Change*, 178, 121591. doi:10.1016/j.techfore.2022.121591.
- [49] García-Lopera, F., Santos-Jaén, J. M., Palacios-Manzano, M., & Ruiz-Palomo, D. (2022). Exploring the effect of professionalization, risk-taking and technological innovation on business performance. *PLoS ONE*, 17(2 February), 263694. doi:10.1371/journal.pone.0263694.
- [50] Li, S., Gao, L., Han, C., Gupta, B., Alhalabi, W., & Almakdi, S. (2023). Exploring the effect of digital transformation on Firms' innovation performance. *Journal of Innovation and Knowledge*, 8(1), 100317. doi:10.1016/j.jik.2023.100317.
- [51] Reichert, F. M., & Zawislak, P. A. (2014). Technological capability and firm performance. *Journal of Technology Management and Innovation*, 9(4), 20–35. doi:10.4067/S0718-27242014000400002.
- [52] Nohria, N., & Gulati, R. (1996). Is slack good or bad for innovation? In *Academy of Management Journal* (Vol. 39, Issue 5, pp. 1245–1264). doi:10.2307/256998.
- [53] Hitt, M. A., Hoskisson, R. E., & Kim, H. (1997). International diversification: Effects on innovation and firm performance in product-diversified firms. *Academy of Management Journal*, 40(4), 767–798. doi:10.2307/256948.
- [54] Avermaete, T., Viaene, J., Morgan, E. J., & Crawford, N. (2003). Determinants of innovation in small food firms. *European Journal of Innovation Management*, 6(1), 8–17. doi:10.1108/14601060310459163.
- [55] Chesbrough, H. (2010). Business model innovation: Opportunities and barriers. *Long Range Planning*, 43(2–3), 354–363. doi:10.1016/j.lrp.2009.07.010.
- [56] Alam, S. S., Arumugam, V., Mohd Nor, N. G., Kaliappan, P., & Fang, L. S. (2013). Relationships between Innovation Capabilities, Business Performance, Marketing Performance and Financial Performance: A Literature Review. *Business and Management Horizons*, 1(1), 59. doi:10.5296/bmh.v1i1.3415.
- [57] Atalay, M., Anafarta, N., & Sarvan, F. (2013). The Relationship between Innovation and Firm Performance: An Empirical Evidence from Turkish Automotive Supplier Industry. *Procedia - Social and Behavioral Sciences*, 75, 226–235. doi:10.1016/j.sbspro.2013.04.026.
- [58] Shirokova, G., Vega, G., & Sokolova, L. (2013). Performance of Russian SMEs: Exploration, exploitation and strategic entrepreneurship. *Critical Perspectives on International Business*, 9(1), 173–203. doi:10.1108/17422041311299941.
- [59] Cooper, R. G., & Kleinschmidt, E. J. (1987). New products: What separates winners from losers? *The Journal of Product Innovation Management*, 4(3), 169–184. doi:10.1016/0737-6782(87)90002-6.
- [60] Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science*, 52(11), 1661–1674. doi:10.1287/mnsc.1060.0576.
- [61] Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers* (Vol. 1). John Wiley & Sons, New Jersey, United States.
- [62] Pirolo, L. (2010). The impact of social capital on the start-ups' performance growth. *Strategic Direction*, 26(10), 12–14. doi:10.1108/sd.2010.05626jad.007.
- [63] Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. doi:10.1108/EBR-11-2018-0203.
- [64] Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39. doi:10.2307/3151312.
- [65] Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, Third Edition. Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences, 3th Edition. Routledge, London, United Kingdom. doi:10.4324/9780203774441.

- [66] Chin, W. W. (2016). Handbook of Partial Least Squares How to Write Up and Report PLS Analyses. Springer Handbooks of Computational Statistics, Springer, Berlin, Germany, 655-690. doi:10.1007/978-3-540-32827-8_29.
- [67] Cohen, J. (2013). Statistical Power Analysis for the Behavioral Sciences. Routledge, New York, United States. doi:10.4324/9780203771587.
- [68] Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management and Data Systems*, 116(1), 2–20. doi:10.1108/IMDS-09-2015-0382.
- [69] Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of E-Collaboration*, 11(4), 1–10. doi:10.4018/ijec.2015100101.
- [70] Andreini, D., & Bettinelli, C. (2017). Business Model Innovation. From Systematic Literature Review to Future Research Directions. *International Series in Advanced Management Studies*, 21, 185.
- [71] Bashir, M., & Verma, R. (2017). Why Business Model Innovation Is the New Competitive Advantage. *IUP Journal of Business Strategy*, 14(1), 7–17.