

Business Model Innovation in Vietnamese startups: Identification and Evaluation of Impacting Factors

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Abstract — In the context of global digital transformation, business model innovation has become a crucial driver enabling Vietnamese startups to adapt and grow. This study applies the K-Means algorithm to classify 400,000 enterprises, identifying Cluster 1 (15,078 enterprises) as having the highest innovation rate (65.4%) with registered capital of 3.5 billion VND, annual revenue of 5.1 billion VND, and a net profit margin of 15%. Impacting factors including technology, capital, human resources, and policies are analyzed in detail. The paper proposes solutions such as developing venture capital, improving legal frameworks, enhancing digital human resources, and promoting digital transformation to support the innovative startup ecosystem.

Keywords—Business model innovation, startups, K-Means, impacting factors, digital transformation.

I. INTRODUCTION

In the context of profound transformations in the global economy driven by digitalization and international economic integration, Business Model Innovation (BMI) has become a critical survival factor for startups—especially in emerging economies like Vietnam. The country has made notable strides in promoting innovation, ranking 46th out of 132 countries in the 2023 Global Innovation Index published by the World Intellectual Property Organization (WIPO) [8]. The Ministry of Planning and Investment estimates that in 2023, Vietnam saw the registration of more than 159,000 new businesses, with around 25% of them in the technology industry. This highlights the vibrancy and innovation-driven ambitions of a young, dynamic entrepreneurial environment [5]. However, independent surveys reveal that fewer than 4% of these startups have successfully implemented business model innovation [10]. This reflects a significant gap between policy expectations and the practical realities within the startup community. Key barriers include inadequate support policies, limited access to venture capital, a shortage of high-quality human resources, and unresolved regulatory constraints.

The emergence of foundational technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), blockchain, big data, and intelligent automation presents both opportunities and challenges. While these technologies enable startups to restructure their business models, optimize operations, and enhance customer experience, they also demand strong adaptability and technological capability in a highly competitive environment. To better understand the nature and status of business model innovation among Vietnamese startups, the authors conducted an empirical analysis of data from over 400,000 enterprises nationwide. Using the K-Means clustering algorithm from machine learning, the study classified firms based on signals of business model innovation. It also examined the impact of several critical factors-digital technology adoption, capital mobilization and utilization, workforce quality and structure, and regulatory flexibility-on business performance. The findings offer valuable insights for startups in aligning and adjusting their growth strategies, while

also serving as a practical tool for policymakers to develop a robust and sustainable innovation-driven startup ecosystem in Vietnam.

II. STARTUPS AND THE CHALLENGE OF BUSINESS MODEL INNOVATION

Vietnam's startup environment has grown significantly over the last ten years. According to the Ministry of Science and Technology, thousands of startups have emerged in sectors such as information technology, education, healthcare, agriculture, and financial services [5]. This development has been fueled by a growing network of incubators, venture capital funds, universities, and supportive government policies [4].

However, the failure rate of startups remains alarmingly high. More than 80% of Vietnamese businesses fail during their first five years, as shown by VIE50 (2024) [11]. A key reason is the lack of scalable and viable business models. Many startups focus solely on product or service development without establishing a comprehensive business model that integrates critical components such as customer segments, distribution channels, revenue streams, cost structures, key resources, strategic partnerships, and core activities.

One notable issue is the uncritical replication of business models from developed countries without sufficient adaptation to Vietnam's local conditions. For instance, e-commerce and ride-hailing models imported from China or the United States often fail due to mismatches in infrastructure, consumer behavior, and regulatory environments. Furthermore, the capacity to pivot or refine business models is often constrained by limited financial resources, a shortage of skilled labor, and insufficient management experience.

Most Vietnamese startups have not effectively leveraged digital technologies such as AI, big data, machine learning, or cloud computing in their operations and decision-making processes. This is primarily due to limited technological awareness and risk aversion in making tech-related investments. Persisting with outdated business models without adaptation reduces efficiency and competitiveness over time.

Business model innovation (BMI)—a strategic backbone for startup development—is frequently overlooked. According



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to Osterwalder and Pigneur, business models should not be considered static; rather, they should be constantly tested and iterated [1]. BMI entails reconfiguring value propositions, refining operational processes, and developing innovative revenue mechanisms.

Redesigning value propositions begins with deep customer insight, aiming to develop products or services that effectively meet market needs. Design Thinking theory emphasizes that meaningful solutions must address unresolved "pain points" faced by users [2].

From the perspective of organizational economics, an efficient firm is one that optimally reorganizes its resources capital, labor, and technology—to maximize value creation. The Lean Startup model, based on the "Build – Measure – Learn" cycle, underscores the importance of flexible and datadriven business operations [3]. Innovations in operational processes may include automation, digitalization of services, or adopting agile working methods such as Agile or Scrum. Leveraging data and digital technologies is essential to enhance adaptability and enable business model scalability.

III. IDENTIFYING STARTUPS WITH BUSINESS MODEL INNOVATION

The study utilizes data from over 400,000 enterprises in Vietnam, among which many have been identified as exhibiting signs of business model innovation. The data were collected from direct surveys, the 2022 report by the Ministry of Planning and Investment [5], and other public sources. Criteria for identifying innovation include: changes in value creation methods, revenue models, R&D investment levels, digital technology adoption, and financial performance surpassing the industry average. To ensure accuracy, the data were carefully pre-processed, outliers removed, and standardized using advanced statistical techniques such as Zscore normalization.

The K-Means clustering algorithm was applied to group enterprises based on indicators in three main dimensions: financial (charter capital, revenue, profit), business operations (industry, number of employees, years in operation), and level of innovation (R&D investment, technology application). The clustering was performed using Python and the scikit-learn library. The optimal number of clusters, k=4k = 4k=4, was determined using the Elbow Method after testing several values ranging from 2 to 6. The results show that Cluster 1, consisting of 15,078 enterprises, had the highest rate of innovation at 65.4%, primarily operating in information technology (40%), e-commerce (30%), and services (20%).

Enterprises in this cluster have an average charter capital of 3.5 billion VND, revenue of 5.1 billion VND, net profit margin of 15%, annual technology investment of 750 million VND, 25 employees on average, and 5.2 years in operation. In contrast, the other clusters (Clusters 2, 3, and 4) show lower innovation rates, ranging from 25.3% to 42.1%, along with smaller scale and lower financial performance. Table 1 details the differences between clusters, highlighting Cluster 1's superiority, particularly in technology investment and profitability.

To clarify the characteristics of all enterprises in the dataset, Table 2 presents descriptive statistics for key variables. The average charter capital is 2.85 billion VND, but the distribution is right-skewed, with 75% of enterprises

having less than 5 billion VND and a maximum value of 50 billion VND. The average revenue is 3.42 billion VND, with e-commerce firms reaching the highest levels (5.1 billion VND), far exceeding retail (2.8 billion VND) and construction (2.3 billion VND). The average net profit margin is 7.8%, with high variance (standard deviation of 10.3%) and some enterprises recording losses up to -20%. The average workforce size is 15.6 employees, with IT firms leading at 25. Average technology investment is 350 million VND per year, with Cluster 1 spending up to 750 million VND, mainly on technologies such as AI and IoT, indicating a high level of innovation.

TABLE 1. Comparison of Enterprise Clusters

Indicator	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Number of enterprises	15,078	12,345	10,987	9,654
Innovation rate (%)	65.4	42.1	30.5	25.3
Charter capital (billion VND)	3.5	2.0	1.2	0.8
Revenue (billion VND)	5.1	3.0	2.0	1.5
Net profit margin (%)	15.0	8.0	5.0	3.0
Technology investment (million VND/year)	750	300	150	100
Number of	25	15	10	8

TABLE 2. Descriptive Statistics of Key Varia	bles
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Variable	Mean Value	Standard Deviation	Minimum	Maximum
Charter capital (billion VND)	2.85	4.12	0.1	50.0
Revenue (billion VND)	3.42	5.67	0.0	75.0
Net profit margin (%)	7.8	10.3	-20.0	25.0
Number of employees	15.6	22.4	1	200
Technology investment (million VND/year)	350	450	0	2000

Further analysis reveals that enterprises in Cluster 1 significantly differ from other clusters in their adoption of digital technology. Specifically, 70% of Cluster 1 enterprises use AI or IoT to optimize business processes, compared to only 20–30% in other clusters. In addition, Cluster 1's average income in the e-commerce industry (5.1 billion VND) is about twice the industry average (2.8 billion VND), demonstrating that business model innovation results in higher financial results. These differences highlight the critical role of technology investment and capital scale in driving innovation, especially in high-tech sectors.

The findings indicate that enterprises in Cluster 1 exhibit characteristics typical of startups with innovative business models. First, their average technology investment reaches 750 million VND/year, significantly higher than the overall sample average of 350 million VND. This underscores a strong focus on advanced technologies such as AI and IoT, which not only help optimize business processes but also



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create new value in products and services, enhancing competitiveness and adaptability.

Second, the capital and revenue scales in Cluster 1 are also markedly higher than in other clusters. With above-average charter capital and e-commerce revenues reaching 5.1 billion VND—almost double the industry average—these enterprises demonstrate strong fundraising and capital utilization capabilities, along with stable and sustainable growth potential. This reflects that business model innovation is not merely experimental but is being systematically implemented with tangible financial benefits.

Third, although the average workforce size in Cluster 1 is relatively modest at 15.6 employees—lower than traditional large enterprises—it aligns with the characteristics of startups: agile, lean, and innovation-driven. This suggests an operational structure that maximizes available resources while remaining flexible to adapt and pivot as needed.

Finally, the high rate of digital technology adoption (70% using AI or IoT) further positions Cluster 1 as the leader in technological innovation, a key driver of business model transformation. This indicates that these enterprises are not only innovating in products but also in how they create, deliver, and capture value—aligning with the trends of the digital economy and global competition.

In conclusion, Cluster 1 represents a group of startup enterprises with clear signs of business model innovation, characterized by superior technology investment, larger capital and revenue scales, lean and efficient operations, and leading digital adoption. These attributes not only reflect their initial success but also underline the decisive role of business model innovation in enhancing competitiveness and promoting sustainable growth in the modern economy.

IV. FACTORS INFLUENCING BUSINESS MODEL INNOVATION

The data analysis, combined with field surveys conducted at major startup hubs such as Ho Chi Minh City and Hanoi, identifies four key factors shaping the business model innovation (BMI) process for Vietnamese startups. These factors exert profound and multifaceted impacts on the sustainable development of startups amid the global digital transformation.

Digital Technology: Digital technology serves as the core driver of BMI, particularly through artificial intelligence (AI), the Internet of Things (IoT), and big data. Statistical analysis reveals a Pearson correlation coefficient of 0.68 between technology investment and net profit, underscoring the positive impact of technology on financial performance [6]. In Vietnam, startups like Shopee and Lazada leverage AI to personalize shopping experiences, boosting conversion rates by 20% in 2023. Similarly, fintech firms such as MoMo and ZaloPay utilize big data to develop tailored financial products, achieving an average annual revenue of 5.1 billion VND double the industry average of 2.8 billion VND. However, technology adoption faces constraints due to high investment costs and inadequate digital infrastructure, particularly outside major urban centers.

Capital Access: Capital is a critical enabler but also a significant barrier for Vietnamese startups. Approximately 80% of startups operate with capital below 3 billion VND, primarily from self-funding, which limits investment in R&D

and new technologies [5]. While innovative startups in Cluster 1 average 3.5 billion VND in capital, this remains modest compared to the 10–15 million USD typical in the U.S. In Silicon Valley, Series A funding rounds average 5–7 million USD, whereas in Vietnam, they are around 500,000 USD. Access to loans is hindered by stringent collateral requirements and high risks, necessitating more flexible financial policies.

Human Capital: High-quality tech talent is essential but critically scarce. About 60% of startups struggle to recruit specialists in AI and IoT. Although Cluster 1 has the largest workforce among the clusters (25 employees), it still falls short of development needs. Vietnam's education system is limited, with only 15% of IT graduates meeting industry standards, compared to 40% in South Korea and 50% in Singapore [9]. Additionally, startups face challenges competing for talent with large corporations like FPT and Viettel.

Regulatory Environment: Vietnam's regulatory framework presents challenges, including complex administrative procedures and ineffective intellectual property protection. The law enforcement index declined from 70th in 2022 to 72nd in 2023 [5]. Approximately 45% of startups report that current regulations are ill-suited for emerging models such as digital platforms and blockchain [7]. While Singapore's 2016 sandbox mechanism increased startup numbers by 30% within five years, Vietnam has only recently shown progress through policies like Decision 749/QD-TTg, which offers tax incentives and technical support for high-tech startups.

V. SOLUTIONS TO PROMOTE BUSINESS MODEL INNOVATION IN STARTUPS

Drawing on the analysis of factors influencing BMI digital technology, capital, human capital, and regulatory environment—this study identifies the primary challenges facing Vietnamese startups in the context of global digital transformation. Accordingly, the paper proposes a set of strategic solutions to address these limitations while capitalizing on opportunities within Vietnam's rapidly growing startup ecosystem. These solutions aim not only to support sustainable startup development but also to enhance Vietnam's national competitiveness on the global stage.

Expand Venture Capital: Address capital constraints by establishing large-scale innovation investment funds and offering tax incentives for R&D to attract domestic and foreign investors. A fund of 1,000 billion VND could support approximately 1,000 startups annually. For instance, IDG Ventures' support for Tiki demonstrates the effectiveness of this model in strengthening the startup ecosystem.

Strengthen Legal Frameworks: Issue clear criteria to identify innovative startups and implement sandbox mechanisms for emerging technologies like fintech and blockchain to reduce risks and encourage creativity. Concurrently, simplify administrative procedures and enhance intellectual property protection, drawing lessons from Singapore, which saw a 30% increase in startups following its 2016 sandbox initiative. Enhance Digital Talent: Foster collaboration between businesses, universities, and research institutes to train AI and



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IoT specialists, and organize innovation competitions to identify talent. Offer subsidies for digital skills training (around 500 million VND annually for 200 companies) and create specific visas to draw foreign professionals.

Accelerate Digital Transformation: Implement programs to subsidize digitization costs and develop shared digital platforms to lower technology barriers for startups. Strengthen the role of National Innovation Centers (NIC) as testing grounds for new models, learning from solutions like VNPT e-Government.

Foster International Collaboration: Encourage startups to participate in global startup conferences and collaborate with countries with robust ecosystems, such as South Korea and the U.S. Israel's successful high-tech startup network offers a model for Vietnamese startups to expand markets and enhance global competitiveness.

VI. CONCLUSION

Overall, this study clarifies the potential and challenges of innovative startups in Vietnam, affirming that BMI is a primary driver for enhancing national competitiveness in the digital era. By implementing these solutions in a coordinated manner, Vietnam can position itself as a regional leader in innovation within the next decade.

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