DOCTORAL (PHD) DISSERTATION

THE IMPACT OF DIGITALIZATION ON THE FINANCIAL PERFORMANCE OF ENTERPRISES IN VIETNAM

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THE IMPACT OF DIGITALIZATION ON THE FINANCIAL PERFORMANCE OF ENTERPRISES IN VIETNAM

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The aim of this dissertation is to obtain a doctoral (PhD) degree in the scientific field of „Management and Business”

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DECLARATION

I undersigned (name: Tran Lam Quynh Trang, date of birth: 1988/12/1) declare under penalty of perjury and certify with my signature that the dissertation I submitted in order to obtain doctoral (PhD) degree is entirely my own work.

Furthermore, I declare the following:

- I examined the Code of the Doctoral School of Management and Business Administration and I acknowledge the points laid down in the code as mandatory;
- I handled the technical literature sources used in my dissertation fairly and I conformed to the provisions and stipulations related to the dissertation;
- I indicated the original source of other authors' unpublished thoughts and data in the references section in a complete and correct way in consideration of the prevailing copyright protection rules;
- No dissertation which is fully or partly identical to the present dissertation was submitted to any other university or doctoral school for the purpose of obtaining a PhD degree.

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Tran Lam Quynh Trang

signature

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1. INTRODUCTION AND RESEARCH OBJECTIVES

1.1 Background of the dissertation

The emergence of Industry 4.0 and the imminent Industrial Revolution 5.0 have substantial implications for both the global economy and society at large. These revolutions primarily aim to establish innovative structures and operational frameworks for production (Mariani & Borghi, 2019), leveraging cutting-edge technology such as the Internet of Things (IoT) and Artificial Intelligence (AI)) (Kuzlu et al., 2021). At its core, Industry 4.0 relies on digital technology, encompassing all intelligent technologies to streamline and optimize production processes and techniques (Gilchrist & Gilchrist, 2016). One of the most notable features of Industry 4.0 is the interconnectivity of entities and economic cycles, facilitated by the advancement of information technology infrastructure and the Internet (Wollschlaeger et al., 2017). This connectivity is spurring a new trend where business models leverage technology to maximize resource utilization (Berman, 2012).

Digitalization has emerged as a crucial component of Industrial Revolution 4.0. It has gained significant traction, particularly during the COVID-19 pandemic (Amankwah-Amoah et al., 2021). The world is currently experiencing a rapid shift towards digitalization, as evidenced by the widespread adoption of intelligent and connected Information and Communication Technologies (ICTs) by consumers (Bolton et al., 2018), businesses (Reis et al., 2018), and governments (Pérez-Morote et al., 2020). This global shift has significantly broadened the scope of previously unavailable services (Bhutani et al., 2015), signaling a paradigm shift in how we conduct business, interact, and function as a society.

According to a 2018 report by McKinsey global institute (MGI) (Bughin et al., 2018), digitalization can potentially contribute an additional $13 trillion to the global GDP by 2030. Moreover, a report by the International labor organization (ILO) (Charles et al., 2022) highlights the profound impact of digitalization on work organization, including changes in work practices, skill requirements, employment relationships, social protection systems, formalization of informal sectors, and job quality. In response, policymakers have launched initiatives to promote digitalization by prioritizing its importance on the national agenda, developing industry governance, adopting an ecosystem perspective, promoting competition, and ensuring sustainable development (Sabbagh et al., 2013).

Digitalization is a crucial factor in all sectors, and its impacts present direct and significant challenges for various enterprises. While digital transformation models have resulted in many beneficial services for customers and the effective utilization of societal resources, they have

also presented fundamental and potential challenges to traditional business models (Niemand et al., 2017), specifically in terms of strategic and operational aspects such as market acceptance, financial considerations, and short-term vision (Marcon et al., 2019). It can be viewed as a technology and supply shock that significantly impacts key economic aggregates, including competition, productivity, employment, and the interaction of institutions and governance (Salnikova, 2022). The advent of digital technology has significantly altered how companies conduct business and interact with their customers and suppliers. This has resulted in a paradigm shift in how businesses approach their operations and engage with stakeholders in the digital age (von Kutzschenbach & Daub, 2020). Digitalization offers advantages beyond just improving the efficiency of traditional operations. In recent times, the focus of digitalization has shifted from simply improving the delivery of traditional tasks to introducing fundamentally new business opportunities and models (Gomber et al., 2017). This has led to the emergence of new industries and business sectors and the transformation of existing ones, with the potential to disrupt established norms and provide significant value to consumers and stakeholders. The widespread adoption of technology has enabled businesses to scale and compete more effectively in the marketplace (Gawer, 2022).

Additionally, digitalization has forced businesses to innovate continually to remain relevant and competitive (Ignat, 2017). With the emergence of new digital landscapes, companies are required to constantly adapt and innovate their operations (Nylén & Holmström, 2015), as failure to do so may result in stagnation and deteriorating performance. Therefore, innovation is essential for businesses to stay ahead of the competition and ensure continued success in the digital age (Tardieu et al., 2020). New technologies have become a key source of competitive advantage for companies across multiple industries (Abou-Foul et al., 2020). The finance sector, for instance, has been significantly impacted by the adoption of new technologies (Soni et al., 2022), as have the banking sector (Kitsios et al., 2021), the tourism sector (Saseanu et al., 2020), the manufacturing sector (Buer et al., 2021) and the supply chain sector (Bigliardi et al., 2022). In each of these sectors, new technology has enabled companies to improve their operations, reduce costs, and enhance their overall competitiveness (Attaran, 2020). As such, digitalization has become an essential factor in determining the success of companies across various industries (Bleicher & Stanley, 2017).

The rise of social media has also led to a need for businesses to adopt targeted marketing strategies to increase brand reach and generate leads (Dwivedi et al., 2021). Additionally, storage solutions have evolved, with many companies now leveraging cloud computing technology to efficiently manage large volumes of data (Attaran, 2017). The increasing use of

AI and other emerging technologies is expected to significantly change to the business landscape across all sectors. Therefore, businesses must remain adaptive and innovative to stay competitive and take advantage of these emerging opportunities (Aksin-Sivrikaya & Bhattacharya, 2017). Extensive research has been conducted to examine the impact of digitalization on business operations and efficiency, with noteworthy results. By facilitating access to knowledge beyond traditional boundaries, digitalization also affects the knowledge resources of businesses. By implementing digital technologies, workflows are becoming more streamlined, reducing errors and enhancing efficiency in all business operations. Such streamlined workflows also enable the continuation of risk operations. Studies have shown that digitalization positively impacts on the financial performance of businesses, including reducing costs, increasing revenue, and improving market capital. Nevertheless, there is still a lack of a comprehensive study that measures factors that affect the capability of digitalization and assesses its impact on comprehensive financial performance indicators of enterprises across multiple industries.

Vietnam, with a current population of 96 million and the fastest-growing economy in the region, possesses a youthful, dynamic, and technologically adept population. These factors present strong opportunities for businesses in Vietnam to achieve breakthroughs in the era of "digital transformation" (Dang, 2020). The Vietnamese government has formulated the "National digital transformation program to 2025, orientation to 2030" (Vietnam Government, 2020a), which aims to develop the digital economy and enhance the country's competitiveness. According to this program, the digital economy is anticipated to represent 20% of Vietnam's GDP by 2025, with the digital economy's proportion in each industry or field reaching a minimum of 10%. Moreover, the annual labor productivity should increase by at least 7%, and Vietnam should rank among the 50 leading countries in information technology. The "Vietnam's future digital economy towards 2030 and 2045" (Cameron et al., 2019) report asserts that Vietnam's digital economy is growing rapidly and that digital development is transforming various economic sectors, including manufacturing, agriculture, trade, banking, transportation, finance, and education. In 2020, the Vietnam Chamber of Commerce and Industry (VCCI) conducted a survey of over 400 small and medium-sized enterprises (SMEs) and large-sized companies on "The reality of digital transformation in enterprises in the context of COVID-19." The survey results indicate that Vietnamese businesses have initiated the implementation of digital technologies in stages such as internal management, purchasing, logistics, production, marketing, sales, and payment. The pandemic has prompted stricter regulations and social distancing measures, compelling businesses to adopt more digital

technologies in company operations (Binh & Phuong, 2020). Digital technologies, such as internal management, electronic payment, and online marketing, have become increasingly vital. As a result, the number of businesses initiating the application of digital technologies is nearly as high as those that have implemented them for a more extended period. The survey above demonstrates that most Vietnamese enterprises have high expectations for digital transformation. Almost 98% of businesses anticipate a significant transformation in their production and business activities upon the implementation of digital technologies, with cost reduction (71%), paperwork reduction (61.4%), and improvement in product and service quality (45.3%) being the areas of the highest priority. However, variations in digital transformation efficiency exist between large enterprises and SMEs (Hai, 2021) and among industries. These issues pose challenges for businesses when dealing with the digital transformation threshold (Tien & Minh, 2019). There has been no extensive investigation into digitalization capability and its impact on financial efficiency at the firm level in Vietnam; most previous research focuses on affecting operating performance. This shortfall highlights the need for a comprehensive understanding of the capability of digitalization and its overall impact on financial management before embarking on digital transformation decisions.

1.2 Research aims

The current research project aims to bridge the research gaps by measuring factors that affect digitalization capability and examining the impact of digitalization on the financial performance of enterprises in Vietnam. The study is expected to contribute significantly to the existing literature on this subject matter and provide insights to policymakers and business leaders when deciding to apply digitalization. The main objective of this research is to address three fundamental parts, and based on that, the thesis is conducted to answer the following research questions (show in Table 1).

To address the first research objective, this thesis conducts a comprehensive review of existing theories and frameworks related to enterprise performance in the context of digitalization, encompassing theories from fields such as strategic management, organizational behavior, innovation management, and information systems. The identified theories and frameworks are analyzed and synthesized to understand their applicability and relevance to digital transformation within enterprises. The study seeks to identify common themes, guiding principles, and key factors contributing to enterprises' financial performance and overall success in the digital era. Additionally, the strengths and limitations of each theory or framework in explaining and predicting enterprise performance in the context of digitalization are critically evaluated.

Table 1: The research objectives and research questions

Research objective	Research question
1. To examine relevant theories related to enterprise performance in the context of digitalization.	1. What are the key theories and frameworks related to enterprise performance in the context of digitalization? 2. How do theories of organizational change and innovation apply to digital transformation within enterprises?
2. To investigate which factors affect the digitalization capabilities of the enterprise.	1. What factors influence the digitalization capabilities of enterprises? 2. To what extent do investment in IT infrastructure and digital skills correlate with digitalization capabilities within enterprises?
3. To examine the relationship between digitalization and the financial performance of enterprises in Vietnam.	1. What is the relationship between digitalization initiatives and the financial performance metrics of enterprises in Vietnam? 2. How does the level of digital maturity within enterprises correlate with their financial performance? 3. Are there specific industry sectors in Vietnam where the effect of digitalization on financial results is more pronounced?

Source: own research

The second research objective involves collecting data through surveys or interviews from a sample of enterprises to identify the factors influencing their digitalization capability. The collected data is analyzed quantitatively to identify patterns, correlations, and relationships between different factors and the digitalization capability of enterprises. Furthermore, an analysis is conducted to examine the extent to which investment in IT infrastructure and digital skills correlates with digitalization capability within enterprises.

For the third research objective, financial performance data and information on digitalization initiatives are gathered from a sample of enterprises in Vietnam. The collected data is analyzed to determine the relationship between digitalization initiatives and enterprises' financial performance metrics. This involves conducting correlation analysis to measure the strength and direction of the relationship. Additionally, the level of digital maturity within enterprises is assessed using established frameworks or models to evaluate factors such as digital strategy, technology adoption, and organizational readiness. Furthermore, an exploration is conducted to determine whether there are specific industry sectors in Vietnam where the impact of digitalization on financial performance is more pronounced. This could involve comparing financial performance metrics across different sectors and analyzing any sector-specific trends or patterns.

1.3 Structure of the dissertation

The structure of the dissertation includes seven chapters shown in Figure 1:

1. Introduction and research objectives: This chapter explains the digitalization trend in society and the global economy. Additionally, it highlights the importance of applying digitalization to transform business models and improve operational and financial efficiency, globally and in Vietnam. The research purpose and questions are briefly presented, along with proposed solutions. Finally, the chapter outlines the structure of the thesis.
2. Digitalization, Financial performance, and Vietnam enterprises status: This chapter provides detailed insights into digitalization, including its definition, comprehensive metrics for measurement, and proposed solutions for evaluating digitalization. It outlines the financial performance of businesses when implementing digitalization and the indicators used to measure them. Moreover, the chapter elaborates on the current situation of digitalization adoption in businesses in Vietnam.
3. Literature review: This chapter focuses on the literature review, conducting a systematic and comprehensive review. By presenting relevant theories on leveraging technology to enhance business efficiency, it highlights the advantages, disadvantages, and applicability of these theories to the thesis's research topic. Additionally, the literature review identifies research gaps addressed by the thesis.
4. Scientific concept and research hypothesis: This chapter presents the proposed research model and research hypotheses. The research model suggests the relationship between enterprise resources and digitalization, as well as the impact of digitalization on enterprise financial performance. It also considers the mediating role of digitalization in utilizing resources to enhance the financial performance of enterprises.
5. Research methodology*:* This chapter introduces the methodology employed in the thesis. It outlines the data utilized for quantitative analysis, the method of collecting survey questionnaire data, and the use of PLS-SEM to analyze the data. Additionally, it discusses the qualitative method of semi-structured interviews as part of the methodology.
6. Result and discussion of research: Beginning with a review of the main analytical results derived from the quantitative approach, this chapter evaluates the measurements and structural models. It integrates insights gained from semi-structured interviews and discusses the findings, comparing them with previous studies conducted in the field.

7. Conclusions and novel findings: This chapter underscores the theoretical contributions of the research to the current understanding within the research field, as well as its practical implications for businesses. It also acknowledges limitations and provides suggestions for further research.

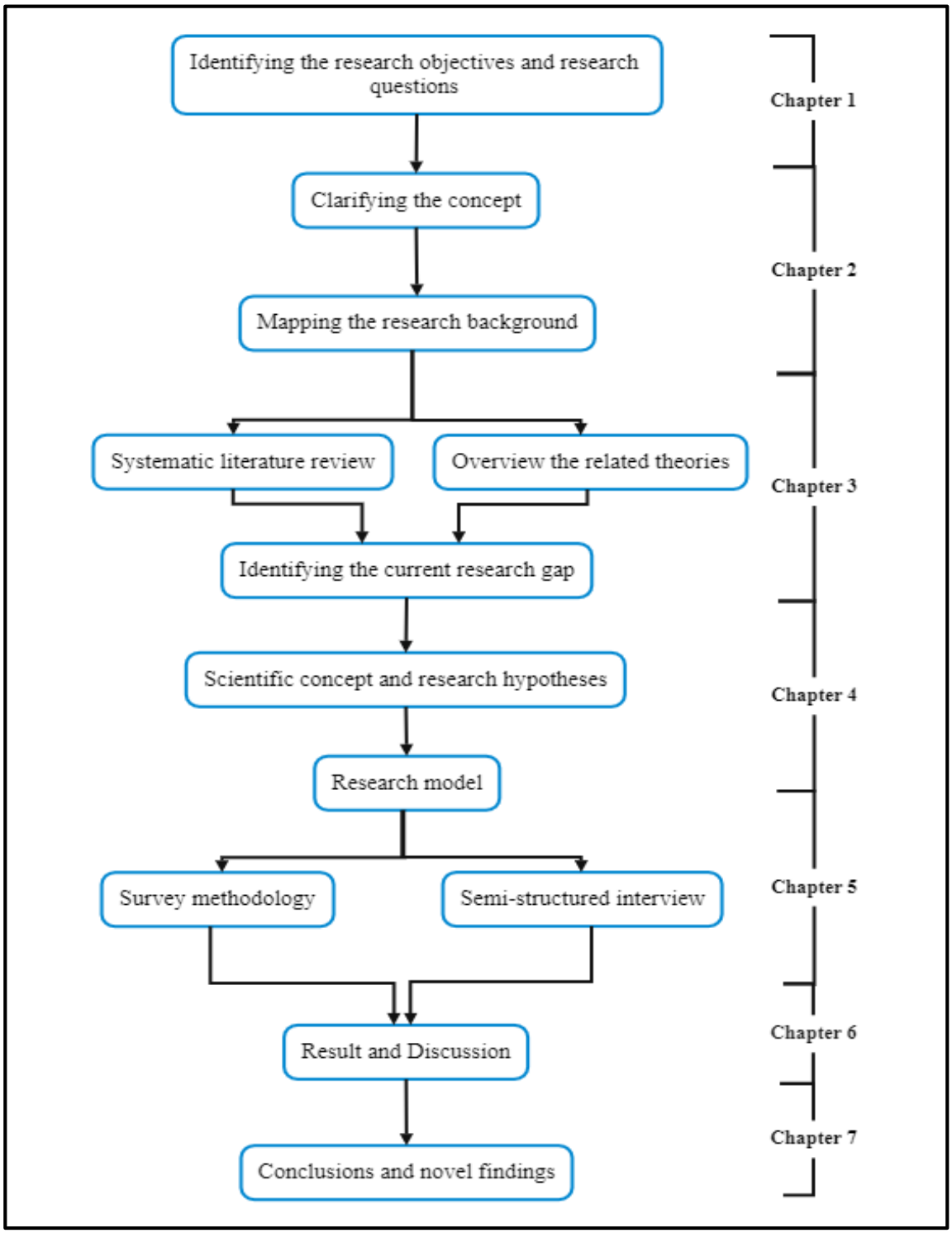


Figure 1: The structure of the dissertation

Source: own research

2. DIGITALIZATION, FINANCIAL PERFORMANCE, AND VIETNAM ENTERPRISES STATUS

2.1 Digitalization

2.1.1 Definition and clarification

In recent years of Industry 4.0, the discussion regarding the use of data in businesses, the concepts of Digitization, Digitalization, and Digital transformation are increasingly mentioned by many researchers as new directions, opening the era of technology (Brennen & Kreiss, 2016; Schallmo & Williams, 2018). These terms often need clarification and have various interpretations in both academia and business (Table 2).

Table 2: The clarification of Digitization, Digitalization, and Digital transformation.

Concept	Definitions	Purpose of outcome
Digitization	Digitization refers to the application of digital technologies to establish connections among individuals, systems, organizations, products, and services (Coreynen et al., 2017). Additionally, it entails the technical transformation of analog information streams into digital data (Brennen & Kreiss, 2016). This process is frequently linked to achieving cost efficiency and enhancing operational performance, as it includes the standardization of business operations (Ross, 2017).	To support data processing, it is essential to create the most favorable conditions. Additionally, progress towards improving visibility and eliminating inefficient activities from businesses can be achieved.
Digitalization	Digitalization entails the reorganization of various aspects of social life through the integration of digital communication systems and media infrastructures (Brennen & Kreiss, 2016). It also encompasses the adoption of digital technologies to innovate business models, thereby generating new opportunities for revenue and value creation (Gartner, 2018). Additionally, digitalization refers to the transformation of business operations facilitated by the application of digital technologies (Schallmo & Williams, 2018).	Involves fundamentally changing previous business processes, helping businesses generate higher revenue streams, and creating opportunities to increase production value. It also helps improve processes and workflows through new sources of knowledge and information.
Digital transformation	Digital transformation refers to the modification of a business model to enhance customer service through the integration of digital technologies (Bloomberg, 2018; Schallmo & Williams, 2018). This process also encompasses adopting a new management framework and organizational philosophy that fosters innovation and the development of novel business models. Additionally, it leverages digital technologies to optimize the experiences of both internal stakeholders, such as employees, and external stakeholders, including customers (Janssens, 2019).	Digital transformation can help drive creativity and innovation at scale, as well as open up potential opportunities for businesses, expand their scales, improve business efficiency, and approach customers at a more cost-effective rate.

Source: own research

Different from “Digitization”, and “Digital transformation”, “Digitalization” is the act of increasing the degree of automation in processes through the use of digital technologies (Legner et al., 2017). It deals with information processing or how digitized data can be used to improve workflows by automating existing processes. In business, digitalization is used to accomplish many goals, such as increasing operational efficiency, reducing costs, minimizing human errors, and enabling data analysis (Parida et al., 2019). Through digitalization, businesses can create new revenues and value-producing opportunities.

2.1.2 Comprehensive metrics in measuring digitalization

Digitalization is a phenomenon characterized by integrating digital technologies into organizational processes, leading to transformation and improved performance (Sebastian et al., 2017; Vial, 2019). Various organizations have developed metrics using different aggregated scales to measure and evaluate digitalization. One such metric is the Digital Density Index (DDI), Oxford economics and accenture jointly developed to measure the impact of digital technologies on economic growth. Additionally, the European commission has developed the Digital Economy and Society Index (DESI), a composite index comprising five primary measures: human capital, connectivity, integration of digital technology, and digital public service. Furthermore, the McKinsey global institute (MGI) has suggested the Industry Digitalization Index (IDI), which covers three groups of metrics: assets, usage, and labor. These indicators are synthesized through a set of survey questions and are suitable for measuring digitalization, digital technologies, and digital competitiveness at the national, industry, and sectoral levels. Table 3 provides a detailed description and metrics of these three indexes.

Each of these digitalization metrics (DDI, DESI, and IDI) offers unique advantages and disadvantages in assessing the digitalization of firms. While DDI provides a firm-level focus and quantitative measurement approach, DESI offers a comprehensive assessment at the national or regional level, and IDI provides industry-specific insights. Understanding the strengths and limitations of these metrics is essential for policymakers, researchers, and businesses seeking to leverage digitalization for sustainable growth and competitiveness.

From a technical perspective, existing measurement frameworks are predominantly Internet-centric. To enhance their comprehensiveness, it is essential that these systems integrate both technological (Internet-focused) and consumer-oriented (client-centric) dimensions. Establishing digital performance indicators in tandem with the development of the associated business case is critical. Furthermore, continuous monitoring of these metrics is necessary to evaluate whether the anticipated outcomes are achieved effectively.

Table 3: Digitalization measurement indexes metrics

Index	Description	Metrics	Advantage	Disadvantage
Digital Density Index (DDI)	Designed to guide investment decisions by assessing digital adoption and its economic impact. Comprises 50 indicators categorized into four activity areas and 18 metric groups, with a scoring system (0–100) for benchmarking economies.	*Making markets:* Customer activity cycle, digitally contestable markets, interfirm collaboration. *Sourcing inputs:* Plant, property, equipment, labor, finance. *Running enterprises:* Technology, strategy, R&D, innovation. *Fostering enablers:* Connectivity, government spending, ease of business.	• Provides firm-level insights. • Employs structured quantitative indicators. • Enables industry benchmarking	• Limited focus beyond firm-level aspects. • Challenges in data reliability, especially for SMEs. • Lacks qualitative insights.
Digital Economy and Society Index (DESI)	A composite measure tracking EU member states' digital competitiveness. Considers economic and social dimensions, including eGovernment efficiency, ICT usage, and human capital.	*Connectivity:* Broadband access, speed, affordability. *Human capital:* Basic and advanced digital skills. *Digital technology integration:* E-commerce, business digitization. *Public services:* E-Government adoption.	• Offers comprehensive digitalization assessment. • Informs policymaking. • Facilitates cross -country learning.	• Aggregate measures can mask intra-country disparities. • Limited firm-level analysis. • Subjectivity in scoring weights.
Industry Digitalization Index (IDI)	Evaluates industries' digital adoption with a focus on internal and external processes and infrastructure, emphasizing ERP and CRM integration.	*Assets:* Digital spending, asset stock. *Usage:* Transactions, interfirm interactions, internal processes. *Labor:* Digital spending per worker, work digitization	- Provides sector-specific insights. - Enables sectoral benchmarking. - Aligns metrics with industry trends..	• Neglects broader societal impacts. • Data inconsistencies across industries. • Limited focus on cross-sectoral themes.

Source: own research

2.1.3 Proposal for measuring digitalization capabilities

Based on these comprehensive metrics, numerous scholarly studies propose various methods and scales to measure digitalization capabilities of enterprises. The assessment of digitalization capability can be achieved by the digital maturity model (Valdez-de-Leon's, 2016), which encompasses seven dimensions: strategy, organization, customer, ecosystem, operations, technology, and innovation. Rossmann (2018) proposes a measurement model comprising eight dimensions for digital maturity: strategy, leadership, business model, operating model, people, culture, governance, and technology. Kotarba (2017) also suggests Key Performance Indicators (KPIs) that describe the status and performance of E-commerce and digital customer dialogue in an enterprise. Furthermore, Cherkasova (2021) utilizes six parameters, digital marketing, digital product experience, E-commerce, electronic customer relationship management (E-CRM), and social networks, to calculate the digitalization index.

As digitalization continues to grow in importance, the development of robust methodologies to assess its breadth and impact becomes increasingly critical. This assessment can be effectively conducted through two complementary perspectives: the degree of digitalization and the level of digitalization. The manifestation of digitalization degree in organizations includes digital artifacts, digital platforms, digital infrastructures, digital business and digital management models (von Briel et al., 2018; Giones & Brem, 2017; Nambisan, 2017; Nambisan et al., 2019; Srinivasan & Venkatraman, 2018; Yi et al., 2019). Additionally, the level of digital technologies comprise a blend of computerized ICTs, and they can be classified into seven dimensions, including social, mobile, Big data, Cloud computing, IoT, platform development, and AI-related technologies (Sebastian et al., 2017; Sturgeon, 2021; Vial, 2019). Therefore, the digitalization level can be measured through the adoption of digital technology (Bharadwaj et al., 2013; Guo et al., 2020; Sebastian et al., 2017; Vial, 2019).

1. Digitalization overall degree

- Digital artifacts

  Digital artifacts encompass digital products, services, and content created, distributed, and consumed digitally. von Briel et al. (2018) emphasize the significance of digital artifacts in facilitating innovation and value creation. These artifacts often leverage advanced technologies such as AI, the IoT, and blockchain to enhance functionality, accessibility,

and user experience. The proliferation of digital artifacts has led to novel business models and revenue streams, challenging traditional industry practices.

- Digital platforms

  Digital platforms serve as intermediaries that connect producers and consumers, enabling transactions, interactions, and collaborations in digital ecosystems. Giones & Brem (2017) explore the dynamics of digital platforms and their role in fostering innovation and entrepreneurship. These platforms leverage network effects and data-driven insights to create value and capture market share. Moreover, platform-based business models facilitate rapid scaling and customization, driving agility and competitiveness in the digital age.

- Digital infrastructures

  Digital infrastructures encompass the technological foundations and architectures that support digital activities and processes. Nambisan (2017) highlights the importance of robust infrastructures in enabling seamless connectivity, interoperability, and security across digital systems. Cloud computing, Big data analytics, and cybersecurity are central components of modern digital infrastructures, enabling organizations to harness data-driven insights, optimize operations, and mitigate risks. Investment in digital infrastructures is essential for building resilience and competitiveness in a rapidly evolving digital landscape.

- Digital business

  Digitalization has profound implications for business models, strategies, and operations. Nambisan et al. (2019) examine the transformative potential of digital technologies in reshaping industries and value chains. Digitalization facilitates agile, customer-centric approaches to business, enabling real-time responsiveness and personalized experiences. Moreover, digital business models such as subscription services, platform-based ecosystems, and outcome-based pricing are disrupting traditional paradigms and fostering disrupt traditional paradigms and foster innovation.

- Digital management models

  Effective management is critical for harnessing the benefits of digitalization while mitigating risks and challenges. Srinivasan & Venkatraman (2018) discuss strategic frameworks and management models for navigating digital transformation. These models emphasize the integration of digital capabilities into organizational processes, culture, and leadership. Agile methodologies, design thinking, and digital governance structures are essential for driving digital initiatives and fostering a culture of continuous innovation and

learning (Yi et al., 2019). By embracing digital technologies and adopting adaptive strategies, organizations can unlock new opportunities for growth, innovation, and sustainable development in the digital age.

2. Digitalization technology adoption

   The adoption of digitalization technologies serves as a critical indicator of organizational readiness and capability to embrace digital transformation. Organizations can enhance agility, innovation, and customer-centricity by leveraging Big data, AI, Mobile, Cloud computing, IoT, Social, and Platform development technologies. Moreover, technology adoption metrics such as usage, penetration, and integration provide insights into the extent and impact of digitalization efforts. Monitoring technology adoption enables organizations to identify gaps, opportunities, and best practices, guiding strategic investments and initiatives for sustainable digitalization.

- Big data technology

  Big data technology enables storing, processing, and analyzing large and complex datasets to extract valuable insights and support decision-making processes. Sebastian et al. (2017) discuss the adoption of Big data analytics in diverse domains such as healthcare, finance, and marketing. Organizations leverage Big data technologies to uncover patterns, trends, and correlations hidden within vast amounts of data, driving innovation, efficiency, and competitive advantage.

- Artificial intelligence (AI) technology

  AI technology encompasses machine learning, natural language processing, and robotics, enabling machines to perform cognitive tasks traditionally requiring human intelligence. Sturgeon (2021) examines the adoption of AI in various industries, highlighting its transformative potential in automation, personalization, and predictive analytics. AI technologies empower organizations to streamline processes, enhance customer experiences, and gain actionable insights from data.

- Mobile technology

  Mobile technology refers to devices, applications, and services for portable and wireless communication and computing. Vial (2019) explores the adoption of mobile technologies in digital commerce, education, and healthcare, emphasizing their role in enhancing accessibility, convenience, and connectivity. Mobile devices ubiquitous platforms for

accessing information, conducting transactions, engaging with content, and driving innovation and societal transformation.

- Cloud computing technology

  Cloud computing technology provides on-demand access to computing resources such as storage, processing, and networking over the Internet. Bharadwaj et al., (2013) discuss the adoption of cloud computing in enterprises, highlighting its benefits in scalability, flexibility, and cost-efficiency. Cloud-based services enable organizations to rapidly deploy and scale applications, optimize infrastructure utilization, and enhance collaboration and agility in a dynamic business environment.

- Internet of Things (IoT) technology

  IoT technology connects physical objects and devices to the Internet, enabling data collection, monitoring, and control in diverse domains such as smart homes, transportation, and manufacturing. Guo et al. (2020) examine the adoption of IoT in supply chain management, emphasizing its role in enabling real-time visibility, tracking, and optimization of logistics processes. IoT technologies facilitate automation, predictive maintenance, and data-driven decision-making, enhancing efficiency and competitiveness.

- Social technology

  Social technology encompasses platforms, applications, and services that facilitate online social interaction, collaboration, and content sharing. Vial (2019) discusses the adoption of social technologies in marketing, customer engagement, and organizational communication. Social media platforms enable organizations to build communities, foster brand awareness, and gather customer feedback, driving engagement and brand loyalty.

- Platform development technology

  Platform development technology enables the creation and management of digital platforms that connect users, content, and services in ecosystems. Sebastian et al. (2017) explore the adoption of platform development technologies in the sharing economy, digital marketplaces, and collaborative ecosystems. Platform-based business models enable organizations to harness network effects, scale rapidly, and create value through ecosystem orchestration and innovation. By embracing key digital technologies, organizations can open new opportunities for innovation, efficiency, and growth. However, addressing challenges related to data governance, security, and ethical considerations is essential for realizing the full potential of digitalization technology adoption.

2.2 Financial performance of enterprise – key indicators

Financial ratios are effective KPIs that can be used to measure a firm's performance over time and in comparison, to its competitors and the industry. Accurately calculating and interpreting financial ratios is crucial for making informed decisions, as emphasized by Fridson & Alvarez (2022).

Table 4: Key indicators of Financial performance

Indicator	Definition	Use in measuring	Research support
Revenue growth	Revenue growth refers to the increase in a company's sales or income over a specified period. It is a critical indicator of a firm's ability to expand its business operations, attract new customers, and generate higher sales volumes.	Revenue growth is used to measure a company's top-line expansion and overall market performance. It indicates the effectiveness of business strategies, market demand for products or services, and the company's capacity to scale its operations. High revenue growth often signals robust business health and market competitiveness.	An & Yoon (2023); Jardak & Ben Hamad (2022); Abou-Foul et al. (2021); Kohtamäki et al. (2020)
Profitability ratios	Profitability ratios, such as return on assets (ROA) and return on equity (ROE), measure a company's ability to generate profit relative to its assets or shareholders' equity. These ratios provide insights into how effectively a company is using its resources to generate earnings.	Profitability ratios are essential for assessing a company's financial health and operational efficiency. ROA measures the net income generated by (or on) total assets, while ROE evaluates the return generated on shareholders' equity. These ratios help stakeholders understand the efficiency of management in utilizing assets and equity to produce profits.	Ribeiro-Navarrete et al. (2021); Cherkasova & Slepushenko (2021); Scafarto et al. (2023); Abou-Foul et al. (2021)
Cost efficiency	Cost efficiency refers to the ability of a firm to minimize its costs while maintaining a high level of productivity and service quality. It is often measured through cost-to-income ratios or reductions in operational expenses.	Cost efficiency is crucial for assessing a firm's ability to manage its resources and control expenses relative to its income. Lower operational costs relative to income signify more efficient use of resources and better financial management.	Betaneli et al. (2021); Kohtamäki et al. (2020); Doran et al. (2022); Ekinci (2021)
Market-based valuation	Market-based valuation refers to the market's perception of a company's value, typically assessed through metrics such as market-to-book ratios and stock price performance. It reflects the collective judgment of investors about the firm's future earning potential and growth prospects.	Market-based valuation metrics are used to gauge investor confidence and the market's expectations of a firm's future financial performance. High market-based valuation indicates positive investor sentiment and a strong outlook for future profitability and growth.	Cherkasova & Slepushenko (2021); , Ekinci (2021); Theiri & Hadoussa (2023); Eller et al. (2020)

Source: own research

Financial ratios are fundamental calculations that utilize quantitative data from a company's financial statements and provide valuable insights into its performance, profitability, and financial health, as noted by Rist & Pizzica (2014). Table 4 shows the definion, use in measuring, advantages and disavantages of some key financial indicators in measuring the relationship between digitalization and financial performance.

2.2.1 Revenue growth

Revenue growth is a fundamental indicator for assessing the financial impact of digitalization. An & Yoon (2023) compared digitalized and undigitalized firms, discovering that digital transformation initiatives significantly enhance revenue streams by enabling firms to penetrate new markets and improve customer engagement through digital channels. Similarly, Jardak & Ben Hamad (2022) found that companies adopting digital technologies experienced notable revenue increases, which they attributed to improved operational efficiencies and the introduction of innovative products and services. Abou-Foul et al. (2021) and Kohtamäki et al. (2020) further support these findings, emphasizing that digitalization initiatives, such as the adoption of digital platforms and enhanced customer relationship management systems, lead to substantial revenue growth. These technologies enable firms to reach broader markets, personalize offerings, and improve customer engagement, directly contributing to increased sales volumes and growth rates.

2.2.2 Profitability ratios

Profitability ratios, including ROA and ROE, are critical metrics for evaluating the financial benefits of digitalization. Ribeiro-Navarrete et al. (2021) demonstrated that knowledge-intensive business services (KIBS) firms leveraging digital technologies exhibited higher ROA and ROE compared to their less digitalized counterparts. Cherkasova & Slepushenko (2021) found that Russian companies with high levels of digital transformation showed improved profitability ratios. Similarly, Scafarto et al. (2023) noted that digitalization in the healthcare sector enhanced intellectual capital efficiency, which subsequently improved profitability metrics. This finding is corroborated by Abou-Foul et al. (2021), who observed significant improvements in profitability metrics for firms engaged in both digitalization and servitization strategies, owing to cost savings and enhanced value propositions.

2.2.3 Cost efficiency

Cost efficiency, often measured through cost-to-income ratios or reductions in operational expenses, is another key indicator of digitalization's financial impact. Betaneli et al. (2021) highlighted that digitalization efforts enhance financial stability by reducing transaction costs and optimizing resource allocation. Similarly, Kohtamäki et al. (2020) found that servitization - integrating digital services into traditional product offerings - helps firms capture financial potential by lowering operational costs and improving customer satisfaction. Doran et al. (2022) demonstrated that digitization in the banking sector during the COVID-19 pandemic led to significant reductions in operational costs. Ekinci (2021) supports this view, indicating that digitalization improves cost efficiency through automation and better resource allocation. By reducing manual processes and optimizing workflows, firms can achieve more effective cost management and operational efficiency.

2.2.4 Market-based valuation

Market-based valuation metrics, such as market-to-book ratios and stock price performance, are employed to gauge the impact of digital transformation. Cherkasova & Slepushenko (2021) observed that Russian companies undergoing digital transformation had higher market-based valuations, suggesting investor confidence in the long-term benefits of digital initiatives. Additionally, Ekinci (2021) noted that the financial sector, particularly banks, experienced positive stock price reactions to digitalization efforts, reflecting market perceptions of improved future profitability and efficiency. Research by Theiri & Hadoussa (2023) on African banks found that digitalization efforts positively influenced market-based valuation and investor confidence. This correlation is further corroborated by Eller et al. (2020), who reported that SMEs engaging in digital transformation saw enhanced market performance, reflecting investor perceptions of future growth potential.

2.3 Digitalization in enterprises in Vietnam

Over the past few decades, Vietnam has undergone a profound transformation in its economic landscape, driven by the rapid advancement of technology and the extensive implementation of digitalization across numerous sectors (Nguyen et al., 2022). The incorporation of digital technologies into business processes has become a pivotal factor in fostering growth, enhancing operational efficiency, and increasing the competitiveness of enterprises within the nation.

2.3.1 Evolution of digitalization in Vietnamese enterprises

With its young and tech-savvy population, abundant labor force, and favorable government policies, Vietnam has become a burgeoning hub for digital innovation and entrepreneurship in Southeast Asia (Klingler-Vidra & Wade, 2020). The journey towards digital transformation in Vietnamese enterprises can be traced back to the early 2000s when the government initiated economic reforms to liberalize markets and promote private sector development. Subsequent investments in infrastructure, particularly in telecommunications and internet connectivity, laid the groundwork for the digital revolution that followed. In a 2023 global evaluation called Digital quality of life index covering 121 countries, Vietnam scored an average of 0.5 of 1 point in five digital aspects, including internet affordability, internet quality, E-infrastructure, E-security, and E-Government using 14 indicators (SurfShark, 2024). Electronic infrastructure and E-Government were Vietnam's strengths. Vietnam is recognized as one of the fastest-growing digital economies in Southeast Asia. Projections suggest that by 2030, Vietnam's digital sector will contribute 30% to the nation's GDP (Vietnamnet Global, 2020).

The evolution of digitalization in Vietnamese enterprises can be delineated into distinct phases, each marked by significant milestones and developments. In the early stages of digitalization in Vietnam, digital technologies were primarily adopted by large multinational corporations operating in Vietnam, leveraging them to streamline operations, enhance customer experiences, and gain a competitive edge in the market. Enterprises primarily focused on essential digital tools and infrastructure, such as email communication, basic websites, and computerization of administrative tasks. However, with the proliferation of affordable digital solutions and the rise of local startups, SMEs also began embracing digitalization to modernize their business processes and expand their reach. Vu & Nguyen (2022) noted the gradual adoption of digital technologies by Vietnamese SMEs, driven by increasing internet penetration and government initiatives to promote ICT development. The evolution of E-commerce has been a significant driver of digitalization in Vietnam's enterprises. Nguyen (2021) highlighted the rapid growth of online retail platforms and the emergence of new digital business models, such as online marketplaces and digital payment systems. Figure 2 shows the proportion of enterprises that use the E-commerce channel to sell products, have a website, and advertise on social media in Vietnam from 2019 to 2022.

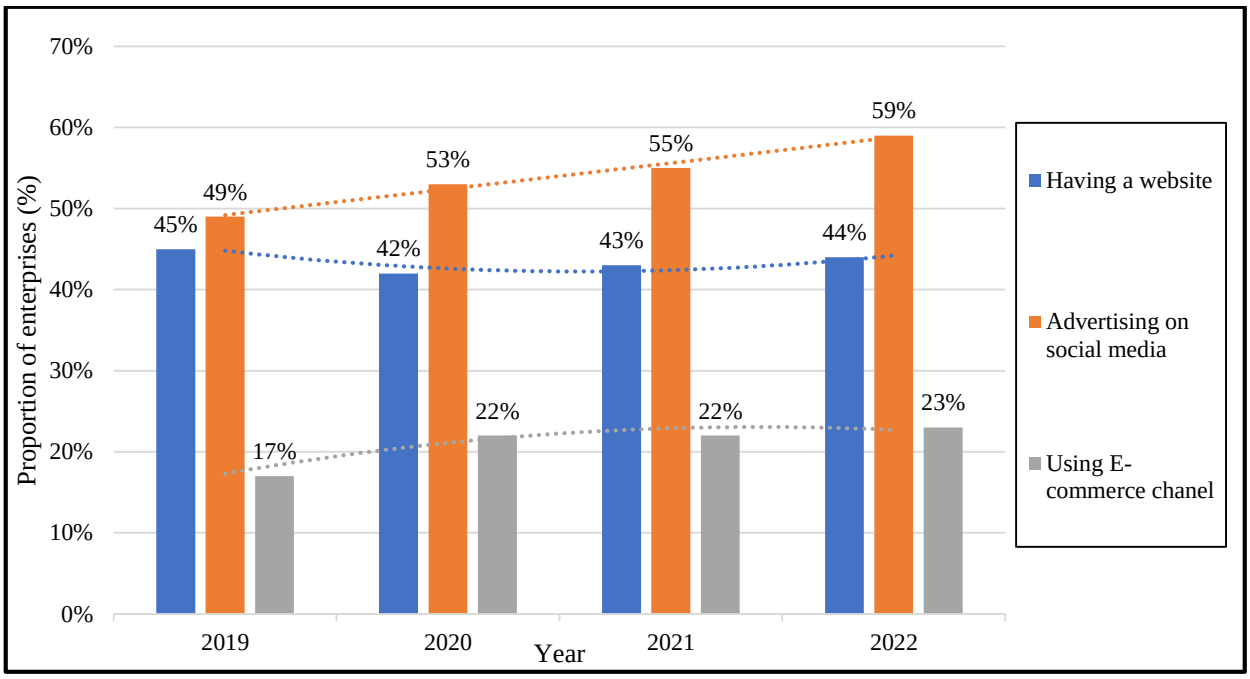


Figure 2: Enterprises use E-commerce, have a website, and advertise on social media

Source: Own research used data from Vietnam Ministry of Industry and Trade

Current development trends indicate that businesses are increasingly prioritizing E-commerce platforms for conducting transactions and utilizing social networking platforms for advertising rather than relying on traditional websites for product sales and marketing. Research by Trieu et al. (2023) emphasized the role of digital platforms in enabling SMEs to access new markets, expand their customer base, and improve sales performance. A growing emphasis has accompanied the increasing of digitalization in Vietnam's enterprises on digital skills development and human capital investment. Thuan (2023) identified the need for workforce training programs to enhance digital literacy, technical skills, and adaptability to technological change. In conclusion, the evolution of digitalization in Vietnam's enterprises has been marked by significant progress and transformation, driven by technological advancements, government support, and changing consumer behavior. While challenges remain, the increasing adoption of digital technologies presents immense opportunities for Vietnamese enterprises to enhance competitiveness, improve efficiency, and drive sustainable growth in the digital age.

2.3.2 Key trends and drivers

Several key trends and drivers have shaped the trajectory of digitalization in Vietnamese enterprises. These include:

1. Expansion of E-commerce

The rapid growth of E-commerce platforms has revolutionized how Vietnamese consumers shop, prompting businesses to establish an online presence and adopt digital marketing strategies to capitalize on this trend. The emergence of e-commerce in Vietnam can be traced back to the early 2000s when online marketplaces were established, and internet-based payment systems were introduced. Initially, E-commerce adoption faced challenges related to infrastructure limitations, low consumer trust, and regulatory constraints. However, with technological advancements and supportive government policies, the E-commerce landscape in Vietnam began to evolve rapidly. The proliferation of mobile internet and the rise of social media platforms further accelerated E-commerce growth, facilitating greater online connectivity and digital commerce transactions. The utilization of digital platforms, E-commerce websites, social networks, and specialized applications in Vietnam has expanded significantly. The percentage of enterprises with a digital presence increased from 48% in June 2020 to 73% in January 2021 (Vietnam Ministry of Information and Communications, 2021). E-commerce has experienced significant growth in Vietnam, with platforms like Shopee, Lazada, and Tiki leading the market. According to the Vietnam Ministry of Industry and Trade report (2023), Vietnam's E-commerce market value based on B2C revenue amounted to approximately 16.4 billion U.S. dollars (Figure 3), accounting for approximately 7.5 percent of the total retail sales of goods and services in the country that year.

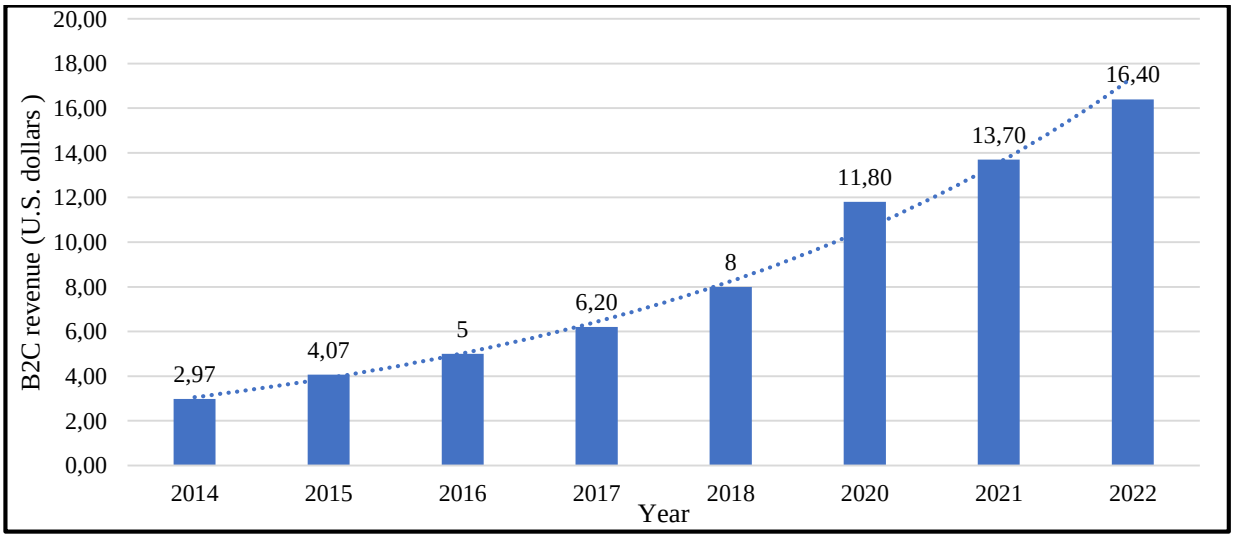


Figure 3: E-commerce market value in Vietnam 2014-2022

Source: Data from Vietnam Ministry of Industry and Trade

The expansion of e-commerce in Vietnam has had significant socio-economic impacts. It has created employment opportunities, particularly in areas such as E-commerce logistics, digital marketing, and online retail. Moreover, E-commerce has facilitated greater market access for small businesses and artisans, enabling them to reach a wider customer base beyond traditional brick-and-mortar channels. Additionally, E-commerce has contributed to the digitalization of the economy, promoting innovation and efficiency in business processes.

2. Internet penetration

   Internet penetration in Vietnam has steadily increased, providing businesses with a broader reach for digital marketing and E-commerce. As of 2024, Vietnam had the top internet penetration rate at 79.1% (DataReportal, 2024). The adoption of internet technologies by Vietnamese enterprises has witnessed a transformative evolution over the years. Internet penetration was limited primarily to large corporations and multinational firms, leveraging connectivity for international trade and communication purposes. However, with the proliferation of affordable broadband infrastructure and the advent of mobile internet technologies, internet access has become more pervasive across enterprises of all sizes and sectors. SMEs have increasingly embraced internet technologies for E-commerce, digital marketing, and online collaboration, leveraging these tools to enhance their competitiveness and market reach. The increasing internet penetration among Vietnamese enterprises has profound implications for competitiveness and innovation. By leveraging internet technologies, businesses can streamline operations, access global markets, and enhance customer engagement, thereby improving their competitiveness in domestic and international contexts. Furthermore, internet-enabled platforms and digital tools facilitate innovation and entrepreneurship, enabling enterprises to develop new products, services, and business models to meet evolving market demands. Moreover, internet penetration fosters knowledge sharing and collaboration among enterprises, driving industry-wide innovation and productivity gains.

3. Embrace of Industry 4.0 technologies

   In Vietnam, the embrace of Industry 4.0 technologies represents a strategic imperative for enhancing productivity, innovation, and competitiveness across various sectors. Moreover, changing consumer preferences, evolving market dynamics, and increasing competition have incentivized enterprises to adopt Industry 4.0 technologies to stay relevant and

competitive in the digital economy. By integrating automation, data analytics, and smart manufacturing techniques, businesses can enhance operational efficiency, reduce production costs, and improve product quality. Despite the promotion of digital technology adoption following the epidemic, the integration of key Industry 4.0 technologies in Vietnam remains in its nascent stages. Currently, digital platforms are primarily utilized to streamline basic commercial processes such as sales, accounting, and payment methods.

A 2021 survey conducted by the World Bank (Figure 4) indicates that only 6.9% of businesses in Vietnam employ cloud computing for work-related operations. Furthermore, merely 1.5% of businesses utilize Big data or AI for marketing purposes, while 6.1% use robots for fabrication. In comparison, 5.9% of businesses adopt modern manufacturing techniques (World Bank, 2021).

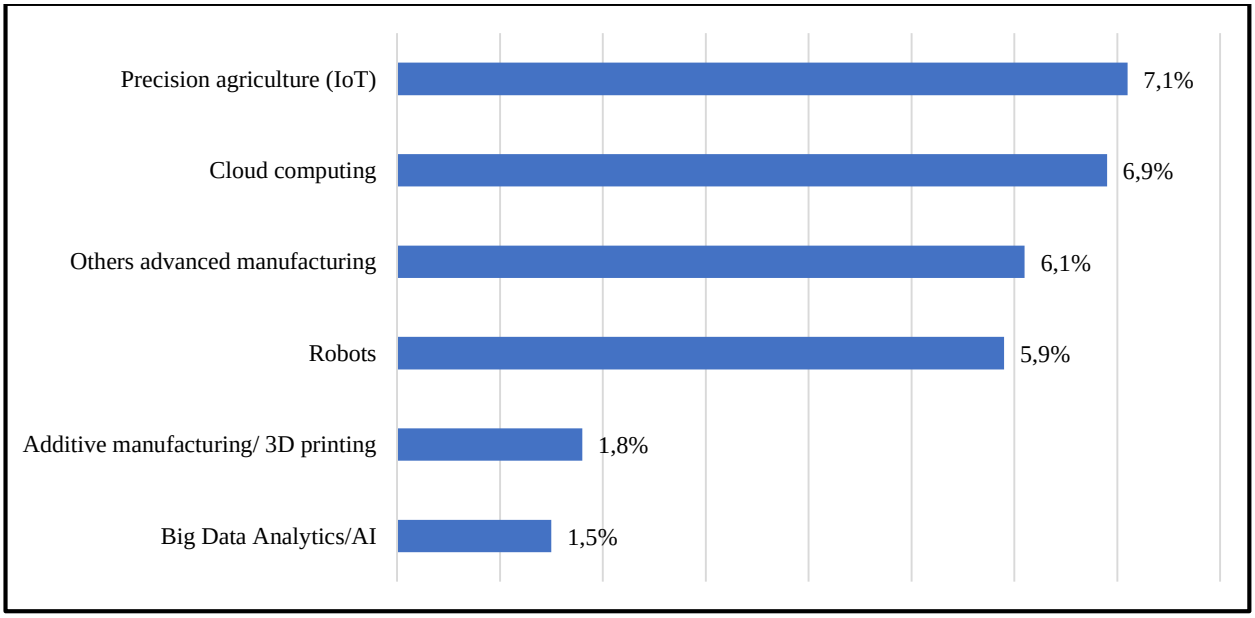


Figure 4: Share of firm adopting Industry 4.0 technologies

Source: World Bank, 2021

Recently, technological advancements have made Industry 4.0 solutions more accessible and affordable for businesses of all sizes. Enterprises are increasingly integrating advanced technologies into their operations to drive efficiency, productivity, and decision-making. Along with that, the adoption of digital payment methods has been on the rise, driven by the growth of E-commerce and mobile wallets. In 2023, the value of digital payment transactions in Vietnam reached 27.83 billion U.S. dollars (Statista Digital Market Insights, 2024), the fourth highest in Southeast Asia. Despite the momentum toward Industry 4.0

adoption, Vietnamese enterprises face various challenges and barriers. These include issues related to digital infrastructure, cybersecurity risks, talent shortages, and organizational readiness. Concerns about data security and privacy deter some enterprises from fully embracing Industry 4.0 technologies. Additionally, skills gaps and the need for workforce upskilling and reskilling present challenges for enterprises seeking to leverage advanced technologies effectively. While challenges remain, concerted efforts from policymakers, businesses, and other stakeholders can accelerate Industry 4.0 adoption and unlock new growth opportunities for Vietnam's economy. By leveraging advanced technologies and fostering a culture of innovation, Vietnamese enterprises can position themselves for sustainable success in the digital era.

4. Start-up ecosystem

   The start-up ecosystem in Vietnam has experienced remarkable growth in recent years, fueled by factors such as increasing digitalization, rising investor interest, and government support for entrepreneurship. In recent years, the ecosystem has witnessed significant expansion, driven by a proliferation of incubators, accelerators, co-working spaces, and venture capital funds. As noted in a report by KPMG and HSBC (2022), data provided by the start-up platform Tracxn indicated that Vietnam was home to approximately 1,600 start-ups at the beginning of the COVID-19 pandemic. This figure has more than doubled, with the number of start-ups surpassing 3,000 in subsequent years (KPMG & HSBC, 2022). Among these startups, four were valued at over one billion U.S. dollars (Vietnam Investment Review, 2022) with sectors like commerce, fintech, and logistics experiencing significant growth. Several key drivers have contributed to the growth of the start-up ecosystem in Vietnam. Firstly, the country's young and dynamic population, coupled with increasing digital literacy and access to technology, has created fertile ground for entrepreneurship. Moreover, the availability of venture capital funding, both from domestic and international investors, has provided much-needed capital for start-up ventures to scale and expand. The growth of the start-up ecosystem in Vietnam has significant implications for economic development, including job creation, innovation, and competitiveness. Start-ups contribute to job creation, particularly in high-growth sectors such as technology, digital services, and E-commerce. Moreover, start-ups drive innovation and productivity gains through the development of new products, services, and business models. By

fostering entrepreneurship and innovation, Vietnam can enhance its competitiveness and position itself as a dynamic player in the global digital economy.

5. Government initiatives

   The Vietnamese government has prioritized digitalization as a key driver of economic growth and competitiveness. Over the years, various initiatives have been introduced to promote digital transformation across sectors. The establishment of policy frameworks such as the National digital transformation rogram (Vietnam Government, 2020a) and the National Strategy on the Fourth Industrial Revolution (Vietnam Government, 2020a) reflects the government's commitment to fostering a digital economy. Additionally, sector-specific initiatives targeting industries such as finance, telecommunications, and E-commerce have been implemented to accelerate digitalization efforts.

   Several key policies and programs have been introduced to support the digitalization of enterprises in Vietnam. These include initiatives aimed at improving digital infrastructure, enhancing digital skills and literacy, promoting innovation and entrepreneurship, and fostering a supportive regulatory environment. For instance, investments in broadband infrastructure and 5G deployment aim to improve internet connectivity and accessibility, facilitating digitalization efforts across industries. Programs such as the National innovation center (NIC) and the National technology innovation fund (NATIF) provide funding and support for research and development activities, fostering innovation-led growth. Government-led digitalization initiatives have had significant impacts on enterprise transformation in Vietnam. By providing funding, infrastructure, and support services, these initiatives have enabled enterprises to adopt digital technologies, streamline operations, and enhance competitiveness. SMEs have particularly benefited from government support programs, gaining access to resources and expertise to navigate digital transformation challenges. Moreover, initiatives aimed at promoting digital literacy and skills development have empowered the workforce to leverage digital technologies effectively, driving productivity gains and innovation within enterprises.

2.3.3 Summary the current situation of Vietnam enterprises

The current state of Vietnamese enterprises in the context of digitalization reflects a dynamic and transformative landscape driven by technological advancements, government initiatives, and evolving market trends. Over recent decades, Vietnam has embraced digitalization as a catalyst for

economic modernization, with enterprises adopting digital technologies to enhance efficiency, competitiveness, and market reach. Key developments include the rapid growth of E-commerce platforms, increasing internet penetration, and the gradual adoption of Industry 4.0 technologies. While large corporations initially led the digital transformation, SMEs have progressively joined the trend, leveraging affordable digital solutions to modernize operations and access new markets. The government's proactive role through policies like the National digital transformation program has provided crucial support, particularly for infrastructure development and digital skill-building. However, challenges such as cybersecurity risks, digital literacy gaps, and uneven adoption of advanced technologies persist, indicating that the journey toward comprehensive digital integration is ongoing. Overall, the digitalization of Vietnam enterprises offers immense potential for driving innovation, economic growth, and global competitiveness, provided these barriers are effectively addressed.

2.3.4 Challenges and opportunities

The digitalization journey of enterprises in Vietnam presents a landscape marked by both challenges and opportunities. As the country advances towards becoming a digital economy, it is crucial to address key challenges while leveraging emerging opportunities to drive sustainable growth and competitiveness.

Despite the significant progress made in digitalization, Vietnamese enterprises face several challenges on their journey toward full-scale adoption. These include inadequate digital infrastructure in rural areas, cybersecurity threats, talent shortages in emerging technologies, and resistance to change within traditional business models. However, these challenges also present opportunities for collaboration, innovation, and investment in addressing critical gaps and driving sustainable digital growth.

Looking ahead, the pace of digitalization in Vietnamese enterprises is expected to accelerate further, fueled by continued advancements in technology, evolving consumer behaviors, and a supportive regulatory environment. However, realizing the full potential of digital transformation will require concerted efforts from all stakeholders, including government bodies, businesses, educational institutions, and civil society, to address existing barriers and foster digital technologies effectively. Vietnamese enterprises can unlock new opportunities, enhance competitiveness, and contribute to the country's sustainable development goals in the digital age.

Investment in digital infrastructure, including broadband connectivity and 5G deployment, is essential to ensure equitable access to digital technologies across urban and rural areas. Streamlining regulatory frameworks and reducing administrative burdens can enhance the ease of doing business, fostering a conducive environment for digital innovation and entrepreneurship. Moreover, efforts to bridge the digital divide through skills development programs and inclusive policies are vital to ensure that all segments of society can benefit from the opportunities afforded by digitalization. By addressing key challenges, leveraging supportive policies, and fostering a culture of innovation and collaboration, Vietnam can harness the transformative power of digitalization to build a resilient, inclusive, and competitive economy in the years to come.

3. LITERATURE REVIEW

3.1 Overview of firm performance research in the context of digitalization

3.1.1 The classification of research of firm performance in the context of digitalization

The procedure for examining studies on firm performance in the context of digitalization is outlined in Figure 5. This review was based on combining two large databases, Elsevier's Scopus (Scopus) and Clarivate Analytics' Web of Science (WoS), which are currently regarded as two of the most prestigious scientific databases.

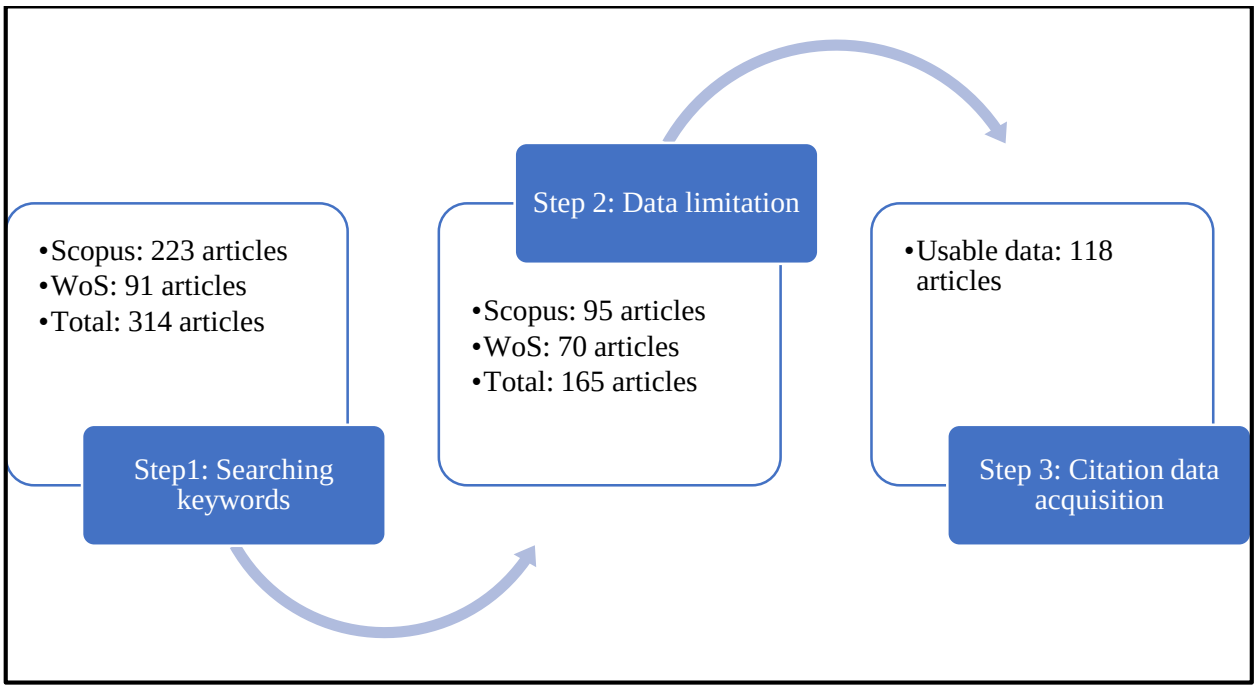


Figure 5: The literature selection process

Source: own research

Note: In Step 1: Search query on Scopus: TITLE-ABS-KEY-AUTH ((Digitalization OR "digital technology") AND ("firm performance" OR "company performance" OR "enterprise performance" OR "bank performance")) and on WoS: (AK=(Digitalization OR "digital technology") AND AK=("firm performance" OR "enterprise performance" OR "company performance" OR "bank performance")) OR (AB=(Digitalization OR "digital technology") AND AB=("firm performance" OR "enterprise performance" OR "company performance" OR "bank performance")). In Step 2: Data limitation by language, document types, time criteria, and areas. In Step 3: Use Zotero and R program for checking duplicate and bibliometric information.

During the data search steps (Step 1), the author found relevant studies based on keyword searches on Scopus and WoS, respectively, such as "digitalization," "digital technology," "firm performance," "company performance", "enterprise performance", and "bank performance." A total of 314 studies were identified. At the data selection stage, two sub-steps were adopted to exclude/include relevant studies. In the data limitation step (step 2), studies had to meet the

language, document types, publication time criteria, and areas, such as studies should be published in English, in article types, from 2012 to 2022 and in "Business, Management and Accounting" and "Economics, Econometrics and Finance" areas. There were 165 publications after this step. In step 3, by using some tools such as Zotero, R program, 2 data from 2 different databases were combined and duplicate studies in the two databases were removed. Finally, 118 articles related to firm performance in the context of digitalization were used in the systematic literature review.

The literature review in this study is presented in two parts. The first part shows the overview of bibliometric information from previous studies. The main aims of the first part highlight the distribution of previous studies by produced countries, investigated publication years, high impacted authors and journals. The first part is conducted by utilizing R programming with a bibliometric package. The second part of the comprehensive literature review is based mainly on content analysis, and the graphic demonstration is presented using Zotero and VOSviewer software.

3.1.2 The distribution of previous studies by publication year and source

In Figure 6, the study synthesizes the annual publication from 2017 to 2022. Accordingly, there are 118 studies on firm performance in the context of digitalization and the number of studies has increased rapidly in recent years.

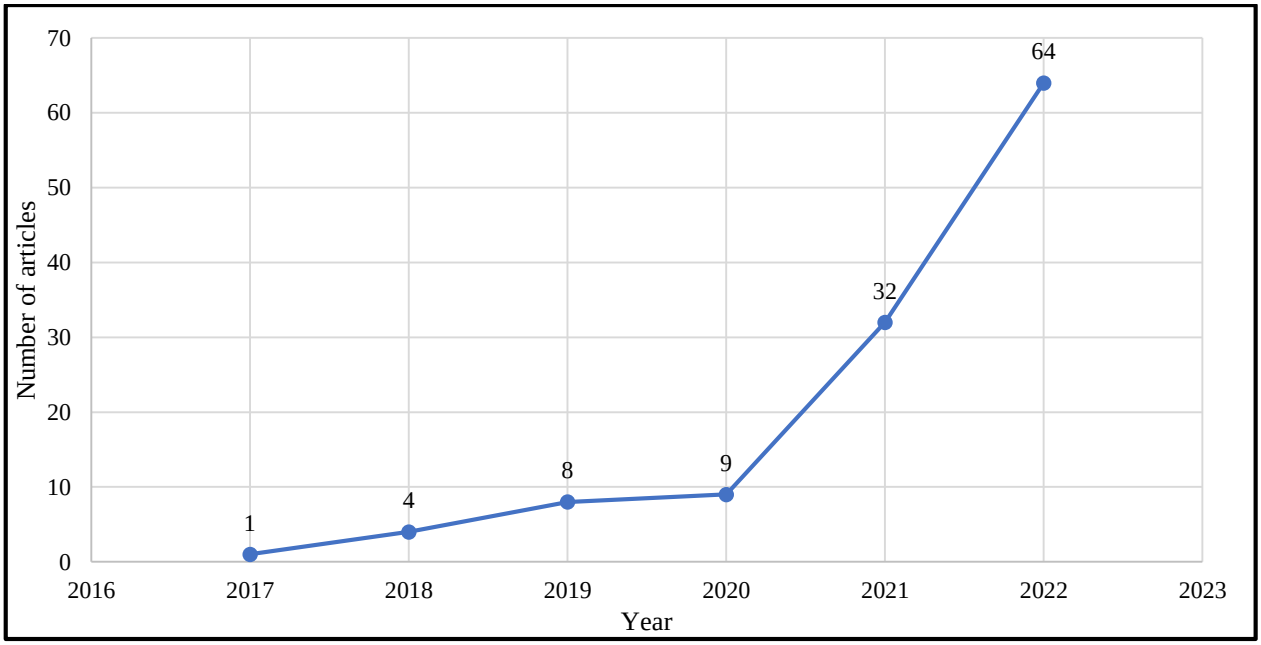


Figure 6: The annual publication research on firm performance in context of digitalization

Source: own research

While in 2017 there was only 1 study, in 2021 there are 32 articles and in 2022 the number of articles is up to 64 articles. With this momentum, there will be more research on digitalization at the enterprise level in the coming years. It shows that the research topic of firm performance in the context of digitalization is receiving more and more attention from scholars. The development of technology will lead to a multidimensional impact on firm performance in general and financial performance in particular. Therefore, the research needs to be one step ahead as a theoretical premise for businesses to have an overview when conducting digitalization.

Figure 7 shows the most popular journal with at least 2 articles dealing with this topic. 10 journals with a total number of published articles accounted for 45% of the total number of articles on the same topic. These include Sustainability with 8 articles, Journal of Business Research with 7 articles, International Journal of Production Economics with 4 articles, etc.

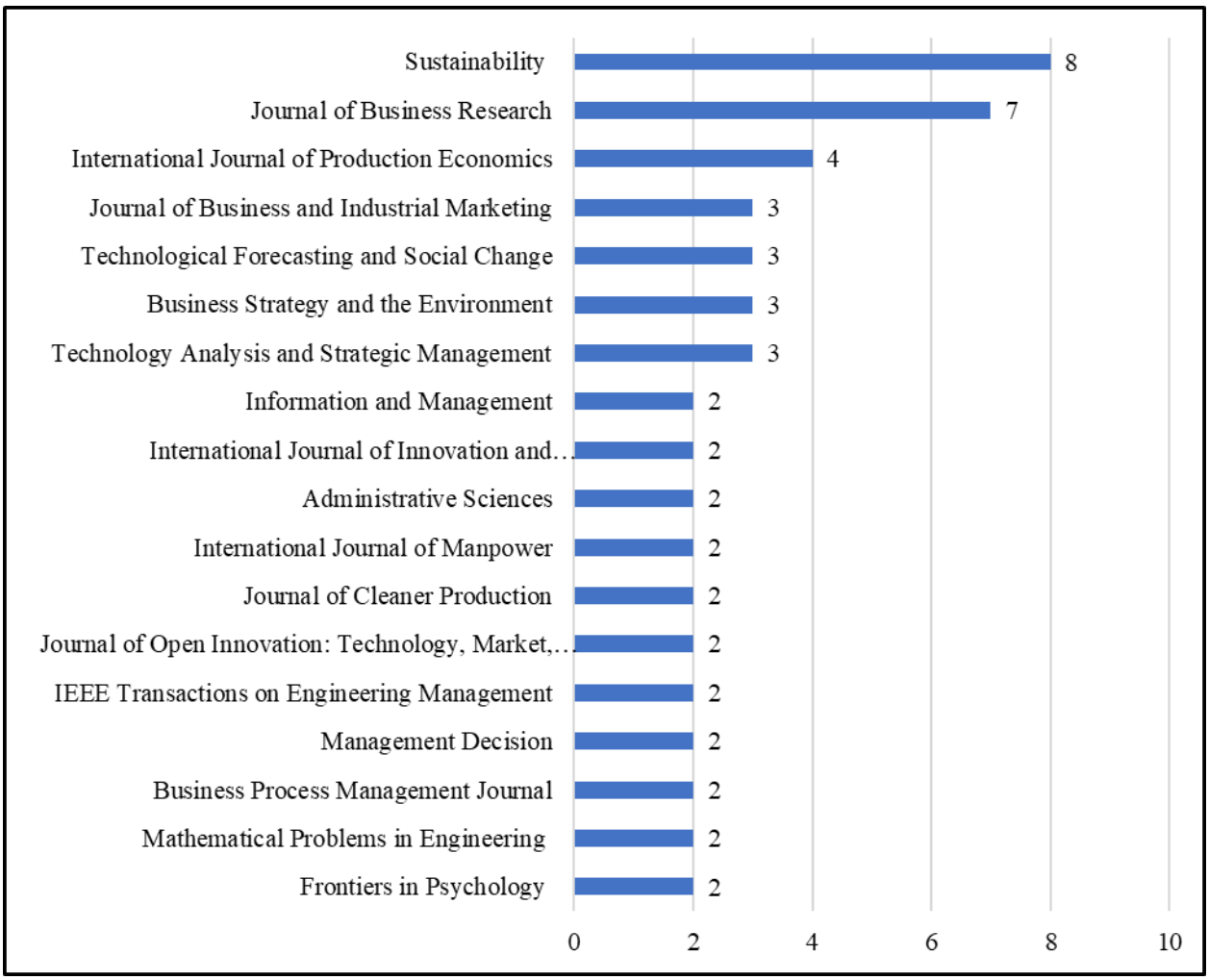


Figure 7: The most popular journal (only presenting journals with more than 2 articles)

Source: own research

3.1.3 The presence of relevant authors and influence of the study

Among the reviewed studies, Bouwman et al. (2019), Khin and Ho (2019), and Eller et al. (2020) stand out for their high citation counts, with 157, 153, and 115 citations, respectively. Bouwman et al. (2019) focus on the role of business model innovation practices in enhancing the performance of digitalizing SMEs. Similarly, Khin and Ho (2019) explore the impact of digital innovation on digital technology, organizational capabilities, and overall performance. Notably, Eller et al. (2020) examine the antecedents, consequences, and challenges associated with SME digitalization. In addition to these highly cited works, 17 other articles have garnered over 30 citations, as illustrated in Figure 8.

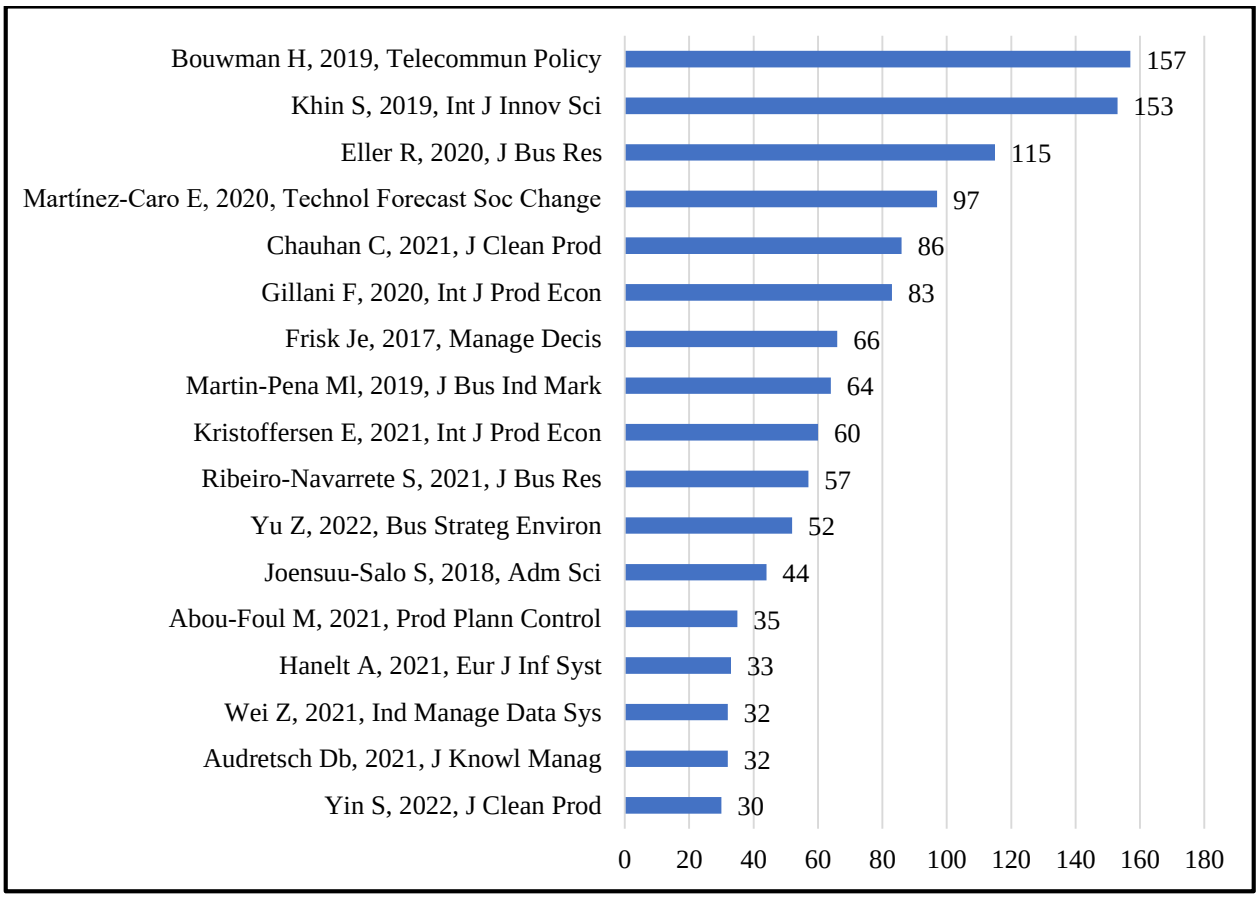


Figure 8: The most cited articles

Source: own research

3.1.4 The distribution of previous studies by scientific product countries

The majority of research on this topic originates from Asian countries, particularly China, which accounts for 58 articles, and India, with 15 articles. Similarly, significant contributions come from European nations, including Germany (22 articles) and Spain (15 articles), as well as the United

States, which produced 12 articles. Notably, China's contributions, comprising 58 articles, represent nearly 50% of the total studies conducted. In contrast, African countries appear to be underrepresented in research on firm performance within the context of digitalization. These findings broadly mirror the varying levels of digitalization adoption and its progression among enterprises across different countries and regions (refer to Figure 9).

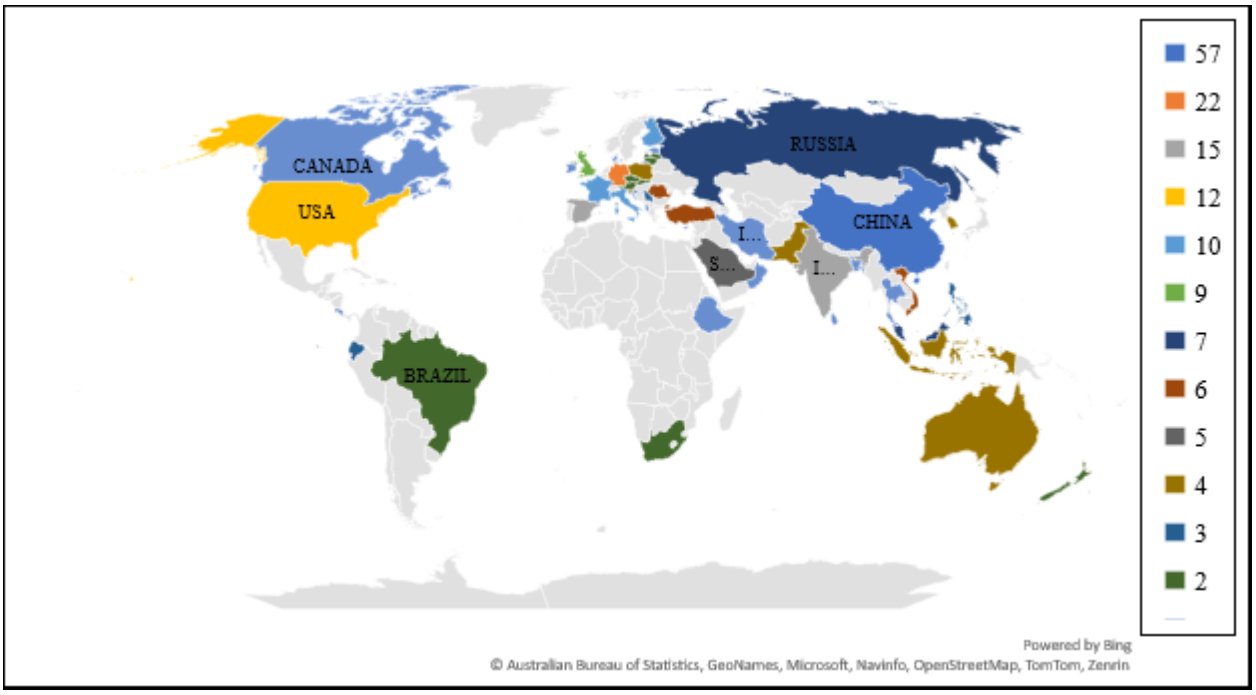


Figure 9: Global distribution of articles on the subject

Source: own research

3.1.5 The allocation of research according to research methods

Figure 10 shows the classification by research methodology. Of these, the majority is up to 85%, with 101 articles using the empirical method. These studies focus on analyzing the factors affecting digitalization and the how digitalization influences organizational performance. A few articles used other methods such as case study (2 articles), Literature review (10 articles), and Conceptual framework (6 articles).

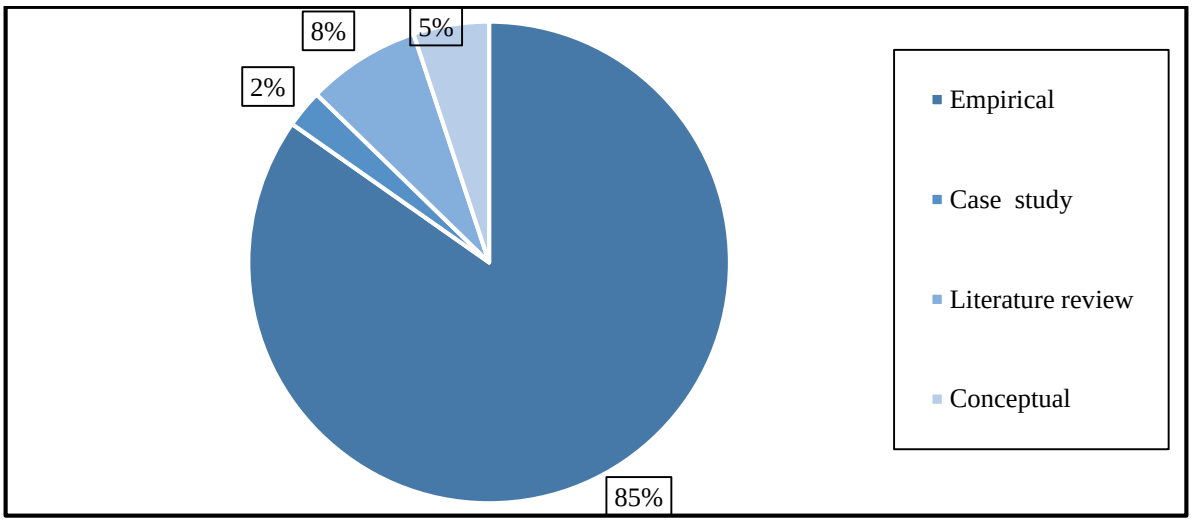


Figure 10: The classification by research methodology

Source: own research

3.1.6 The evolution of topic trend

The Figure 11 below shows trending themes of past studies from 2017 to the end of 2022, as revealed by overlay visualization analysis (from VOSviewer).

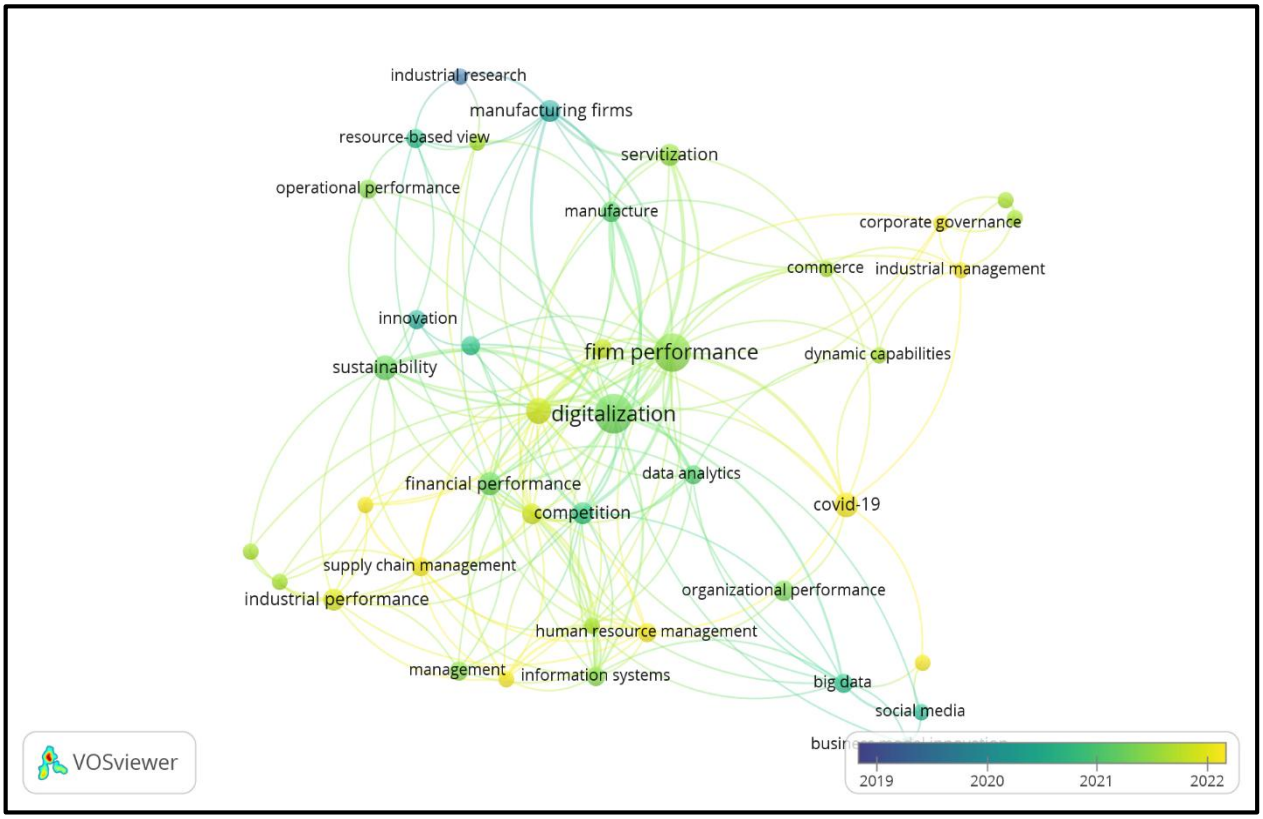


Figure 11: The evolution of the topic trend

Source: own research

The results indicate that the research topics are related to firm performance in the context of digitalization (see Figure 11 trending dynamic topics). Around 2020, researchers focused on applying the Resource-Based View (RBV) theory to assess the digitalization's impact on corporate outcomes, operational performance, and financial performance. Subsequently, researchers devoted considerable attention to topics related to the digitalization process. Many studies have used the Dynamic Capabilities (DC) theory (around 2021) to evaluate the impact on a company's competitive advantage and innovation performance when adopting digitalization. Recently, researchers have paid much attention to the direction of research focusing on sustainability assessment to better clarify the impact of digitalization on businesses.

3.2 Categorization of studies according to research area

Based on the systematic literature review and keywords cluster analysis by VOSviewer, research revealed three main themes for studies on firm performance in the context of digitalization: (1) the digitalization process in an enterprise (2) the impact of digitalization on firm performance and (3) Digitalization and sustainability

3.2.1 First main theme: Digitalization process in enterprises

Digitalization is a complex process that requires thorough research to ensure maximum efficiency. While the cost of implementing digitalization can be relatively high, Rantala et al. (2019) and Li et al. (2022) highlight the importance of incorporating digitality into a company's strategy and existing business model to generate benefits. However, the adoption of digitalization can be influenced by various intrinsic and extrinsic barriers. Chauhan et al. (2021) found that these barriers harm digitalization, with the study revealing the contingency effects of extrinsic barriers. Abou-foul et al. (2021) provide insight for managers to understand digitalization in servitization and emphasize the importance of integrating digital and service-specific capabilities. The main factors affecting the digitalization process in enterprises include Leadership, organizational culture, Technological integration, innovation, and Strategic implications.

1. Leadership and organizational culture

   Effective leadership and organizational culture are identified as critical determinants of successful digital transformation. Alasiri & AlKubaisy (2022) and Yopan et al. (2022) explore the role of leadership, work environment, and IT alignment in facilitating digital transformation initiatives, emphasizing the importance of strategic leadership in driving

organizational change. Additionally, studies by Harrmann et al. (2023) and Vardarlier & Ozsahin (2021) highlight the transformative potential of digital technology usage and digital transformation in shaping organizational culture and human resource management practices.

2. Technological integration and innovation

   Digitalization facilitates technological integration and innovation within enterprises, offering new avenues for value creation and competitive advantage. Aversa et al. (2021) and Ribeiro-Navarrete (2021) advocate for a behavioral perspective of flexible manufacturing, emphasizing the role of digital machines in redefining spatial and temporal dimensions of production processes. Furthermore, Wei & Sun (2021) and Lichtenthaler (2022) examine the leveraging of digitalization for process innovation, underscoring the importance of information processing capabilities - an aspect often overlooked in driving sustainable innovation practices.

3. Strategic implications

   A strategic orientation towards digitalization is essential for navigating the complexities of the digital age and achieving sustainable competitive advantage. Studies by Hautala-Kankaanpää (2022) and Ulrich & Fibitz (2020) investigate the impact of digital culture, supply chain capability, and business model innovation on firm performance, highlighting the need for strategic alignment with digitalization objectives. Moreover, Wang (2022) explores the implications of digital strategic orientation on enterprise sustainable performance, emphasizing the importance of aligning digitalization efforts with broader sustainability goals.

From its implications for leadership, organizational culture, and strategic orientation, digitalization emerges as a transformative force reshaping the way businesses operate and compete in the contemporary landscape. By embracing digitalization as a strategic imperative and leveraging its potential for innovation and value creation, enterprises can position themselves for long-term success in an increasingly digital world.

3.2.2 Second main theme: Digitalization and firm performance

This theme includes studies that have examined the aspects related to the relationship between digitalization and company performance.

1. Implications of digitalization on firm performance

   The effect of digital transformation on business performance is multifaceted, with empirical studies revealing both direct and indirect effects mediated by factors such as organizational capabilities and external environments. digitalization positively influences firm performance by enhancing operational efficiency, product/service quality, and customer satisfaction (Chatterjee et al., 2022; Yang & Yee, 2022; Bouwman et al., 2019). Moreover, firms leveraging digital technologies exhibit higher levels of innovation, agility, and resilience, which contribute to long-term competitiveness (Liu & Chiu, 2021; Wei & Sun, 2021).

2. Mediating mechanisms: organizational capabilities and environmental factors

   Organizational capabilities play a crucial role in mediating the relationship between digitalization and firm performance. Studies suggest that firms with strong digital capabilities, such as digital marketing, analytics, and innovation, are better positioned to capitalize on digitalization opportunities and achieve superior performance outcomes (Eller et al., 2020; Gillani et al., 2020; Li et al., 2022; Rajala & Hautala-Kankaanpää, 2022). Additionally, environmental factors, including industry turbulence and regulatory frameworks, moderate the digitalization-performance nexus, highlighting the importance of contextual factors in shaping firm outcomes (Gyurák Babeľová et al., 2022; Sanchez-Riofrio et al., 2022).

3. Challenges and limitations

   Despite its transformative potential, digitalization poses challenges and limitations for firms, ranging from resource constraints to organizational inertia and cybersecurity risks (Dong & Wang, 2022; Malodia et al., 2023). Overcoming these challenges requires proactive management strategies, including investment in digital capabilities, talent development, and strategic partnerships (Joensuu-Salo et al., 2018; Manresa et al., 2021). As digitalization continues to evolve, firms should focus on exploring emerging trends such as AI, blockchain, and IoT and their implications for firm performance (Ronaghi, 2022; Zeng et al., 2022). Moreover, comparative studies across industries and geographical regions can provide valuable insights into the generalizability of findings and the effectiveness of digitalization strategies in diverse contexts (Zhang, 2022; Zhou et al., 2021).

The literature on digitalization and its impact on firm performance highlights the transformative potential of digital technologies in driving organizational success. By understanding the mechanisms through which digitalization influences firm outcomes and addressing associated challenges, firms can harness the full potential of digitalization to achieve sustainable growth and competitive advantage in today's dynamic business environment.

3.2.3 Third main theme: Digitalization and Sustainability

Studies presented in this theme examine the relatively new area of sustainable development.

1. Sustainability practices and organizational outcomes

   The integration of sustainability practices into business operations has become imperative for firms seeking long-term viability and resilience. Nayal, Kumar et al. (2022) investigated the impact of sustainable development strategies on supply chain firm performance, emphasizing the role of circular economy principles and digital transformation in achieving sustainable development goals. Moreover, Klumpp & Loske (2021) examined the resilience implications of sustainability practices in mitigating the impact of information technology disruptions on retail logistics efficiency. These studies underscore the pivotal role of sustainability initiatives in fostering environmental stewardship, social responsibility, and economic value creation.

2. Digitalization - sustainability synergies

   The intersection of digitalization and sustainability presents unique opportunities for organizations to drive innovation and create shared value. For instance, Lichtenthaler (2022) identified data management efficiency as a key enabler of shared value innovation, highlighting the potential for organizations to leverage data analytics and digital platforms to address societal challenges while achieving business objectives. Similarly, Wang (2022) explored the impact of digital strategic orientation on enterprise sustainable performance, emphasizing the role of digital technologies in advancing sustainability agendas and aligning organizational practices with the 2030 Sustainable.

3. Development goals

   It can be said that the research on the relationship between digitalization and sustainability is currently quite limited, but it is a very important topic in the current context of green economy and sustainable development (Gul et al., 2021; Nayal, Kumar et al., 2022; Nayal,

Raut et al., 2022; Yin & Yu, 2022). Moving forward, businesses must strategically integrate digital technologies and sustainability practices into their operations to navigate complex challenges, capitalize on emerging opportunities, and foster sustainable growth in an increasingly digitalized world.

3.3 Overview of related theories

3.3.1 Resource-Base View Theory

The Resource-Based View (RBV) theory has emerged as the most popular and effective approach to examining how information technology effects firm performance (Wang & Ahmed, 2007). According to RBV, organizational resources and capabilities serve as the cornerstone for achieving and maintaining a competitive advantage (Barney, 1986). Specifically, resources that satisfy the criteria of being valuable, rare, imperfectly imitable, and non-substitutable are instrumental in fostering a sustainable competitive edge (Barney, 1986). The theory suggests that a firm's competitive advantage lies primarily in its efficient use of a valuable set of tangible and/or intangible resources, with human and physical capital being critical resources affecting firm outcomes (Barney, 1991). To clarify resources, Mahoney & Pandian (1992) added five types of resources that affect competitive advantages: financial resources, physical resources, human resources, organizational resources, and technological capabilities, while Grant (1991) included intangible resources. Although there is often no distinction between resources and capabilities (Braganza et al., 2017), Grant (1991) argues that capabilities are the combination of resources.

According to RBV, firms in the market differ because they possess different resources, and businesses succeed if they are equipped with the most suitable resources and can combine them more effectively than competitors. RBV focuses on analyzing the internal resources of the business as well as linking internal resources with the external environment. Thus, competitive advantage is related to the development and exploitation of the core resources and competencies of the enterprise. Ghasemaghaei (2018) suggests that a combination of key firm resources/capabilities, including human resources, IT intangible resources, and IT infrastructure, will positively impact firm performance.

However, RBV has some limitations, including its focus on internal factors and the lack of clear distinction between internal resources and capabilities (Eisenhardt & Martin, 2000). Additionally, RBV's assumption that bundles of resources create a competitive advantage that will not change

over time may not explain firm performance in dynamic environments (Eisenhardt & Martin, 2000). Digitalization presents new opportunities for businesses, increases work efficiency, expands creative boundaries, and allows better allocation of resources (Manyika et al., 2015). On the other hand, resources can also be barriers to digitalization, such as data security issues and the need for competencies and training (Marcon et al., 2019).

The theory is widely regarded as a foundational framework for examining the effects of digitalization on firm performance (Räisänen & Tuovinen, 2020; Ten, 2019; Putra & Santoso, 2020). Research employing RBV frequently emphasizes a firm's resources and capabilities through diverse analytical lenses. For instance, Eller et al. (2020) highlight that the adoption of IT, development of employee skills, and implementation of a digital strategy are critical factors driving digitalization, which subsequently enhances the financial performance of SMEs. Similarly, Oberländer et al. (2021) explore the resource base-encompassing both assets and liabilities-and investigate how the interaction between incumbents' existing resources and emerging digital opportunities facilitates the realization of digitalization's potential benefits.. This nuanced understanding highlights both the strengths and limitations of RBV in comprehensively explaining the role of digitalization in enhancing firm success.

3.3.2 Technology-Organization-Environment Framework

The Technology-Organization-Environment (TOE) framework, introduced by Tornatzky & Fleischer in 1990, is widely utilized to explain the adoption of information technology at the firm level (Lei et al., 2021; Low et al., 2022; Nguyen et al., 2022). This framework categorizes the factors influencing innovation adoption into three contexts: technological, organizational, and environmental. The technological context encompasses the relevant technologies available to firms, where innovations can either enhance existing competencies or render them obsolete (Baker, 2012). The organizational context involves internal factors such as communication styles, reporting relationships, work structures, and managerial support. The environmental context includes external factors like industry competition, customer and supplier technology usage, and regulatory conditions. Studies leveraging the TOE framework have assessed various IT adoptions, such as Big data (Maroufkhani et al., 2020), Cloud computing (Al Hadwer et al., 2021), Blockchain (Malik et al., 2021), and social media (Wulandari et al., 2020) showing significant explanatory power in diverse settings.

The TOE framework's advantage lies in its comprehensive approach to identifying and evaluating the determinants of technology adoption adaptable to the specific characteristics of different technologies (Oliveira & Martins, 2010). However, TOE primarily focuses on adoption factors rather than the impact of these innovations on firm performance, often treating these factors as prerequisites for successful implementation rather than direct performance drivers (Awa et al., 2017). This limitation suggests that while TOE effectively explains adoption processes, it may be less suited for analyzing the subsequent performance impacts of technological innovations.

3.3.3 Dynamic capabilities

According to the RBV theory, the analysis of capabilities in business models centers on a firm's unique resources and activities (Barney, 1991; Wernerfelt, 1984). Teece et al. (1997) define Dynamic capabilities (DC) as a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. DC emphasize two critical aspects of competitive advantage that have been neglected in prior strategy studies, namely the ability to adapt, integrate, and reconfigure all resources, skills, and functional competencies in response to changing circumstances (Teece & Pisano, 2003). DC refer to a firm's capacity to renew competencies to achieve congruence with the changing business environment (Teece et al., 1997).

Ambrosini & Bowman (2009) further clarify the term "Dynamic capabilities," stating that they are -solving not an ad-hoc problem event or a spontaneous reaction. Instead, their use is intentional, deliberate, and describes intentional efforts to change the firm's resource base. DC are not a resource but a process that impacts resources, referring to developing the most adequate resource base and renewing resources. Wang and Ahmed (2007) posit that resources are the foundation of a firm, and core capabilities are bundles of capabilities and resources that help a firm achieve competitive advantages in the short-term. To achieve a sustainable competitive advantage, a firm should have dynamic capabilities that include all resources, capabilities, and core capabilities, which are purposeful, organized, and oriented combinations of results.

DC differ from operational capabilities, which focus on capabilities to make a living. DC, on the other hand, are capabilities to make a sustained competitive advantage (Pavlou & El Sawy, 2011). Eisenhardt & Martin (2000) suggest that DC are idiosyncratic and have commonalities such as "best practices" among firms, and researchers have identified several attribute assumptions of dynamic capabilities, including homogeneous, fungible, equifinal, and substitutable.

According to Wang & Ahmed (2007), DC are composed of three key elements: adaptive capability, absorptive capability, and innovative capability. Adaptive capability reflects a firm's capacity to recognize and leverage emerging opportunities within the market environment. Absorptive capability pertains to the firm's ability to identify, assimilate, and utilize valuable external information for commercial purposes, which is heavily influenced by the extent of the firm's pre-existing knowledge base. Finally, innovative capability is characterized by the firm's ability to create new products or access new markets by integrating strategic innovation orientation with corresponding behaviors and processes..

3.3.4 Applying relevant theories to research topic

RBV theory provides a comprehensive lens through which to examine how the resources and capabilities of a firm influence its competitive advantage and ultimately its financial performance. According to RBV, a firm's competitive advantage is derived from its ability to effectively leverage valuable, rare, and non-substitutable resources. These resources can be tangible, such as physical assets, or intangible, such as technological capabilities or human capital. Therefore, studies applying RBV to the study of digitalization and firm performance often focus on identifying the key resources and capabilities that enable firms to capitalize on digital opportunities. However, RBV also has its limitations. It primarily focuses on internal factors and may not adequately account for the dynamic nature of digitalization and its impact on firm performance over time. Additionally, the distinction between resources and capabilities within the RBV framework can sometimes be unclear.

The TOE framework offers a structured approach to understanding the adoption of technology within firms, taking into account technological, organizational, and environmental factors. While TOE is often used to explain the adoption of innovations, it can also provide insights into how these innovations affect firm performance. Studies leveraging the TOE framework in the context of digitalization and firm performance often examine factors such as technological capabilities, organizational structures, and external environmental conditions. However, TOE's primary focus on adoption factors may limit its ability to directly address the performance implications of technological innovations.

DC theory emphasizes a firm's ability to adapt, integrate, and reconfigure its resources and capabilities in response to changing environments. This theory provides a lens through which to understand how firms can sustain competitive advantage in the face of digitalization and other

external disruptions. Studies applying DC theory often focus on the firm's capacity to innovate, adapt to market changes, and absorb new information. These capabilities are crucial for firms seeking to leverage digitalization to improve their financial performance.

In summary, the RBV theory, TOE framework, and DC theory offer valuable perspectives for researching the interplay between enterprise resources, digitalization, and financial performance of firms. By applying these theories in empirical study, research can gain deeper insights into how firms can effectively navigate the challenges and opportunities of the digital age.

3.4. Summary of literature review and research gap

3.4.1 Summary of literature review

The academic content provides a comprehensive overview of research trends and themes regarding firm performance in the context of digitalization. A significant increase in research output, particularly from 2017 to 2022, signifies the growing attention to this area of study. Notably, the research highlights the emergence of digitalization as a crucial determinant of organizational success, influencing various aspects of firm performance, including operational efficiency, innovation, and competitive advantage.

The analysis reveals three main themes: the digitalization process in enterprises, the impact of digitalization on firm performance, and the intersection of digitalization and sustainability. Studies within these themes underscore the importance of leadership, organizational culture, technological integration, and strategic orientation in driving successful digital transformation initiatives. Moreover, digitalization's role in fostering sustainability practices and creating shared value is emphasized, reflecting the growing imperative for businesses to integrate digital technologies and sustainability principles into their operations.

The theoretical assessment incorporates the RBV theory, TOE framework, and DC theory to elucidate the mechanisms through which digitalization influences firm performance. While RBV emphasizes leveraging valuable, rare, inimitable resources for competitive advantage but struggles with dynamic environments. The TOE framework explains technology adoption through technological, organizational, and environmental factors but focuses more on adoption than performance impact. DC theory highlights a firm's ability to adapt and reconfigure resources to sustain competitive advantage in changing environments, offering a dynamic perspective on firm performance.

Overall, the academic content underscores the transformative potential of digitalization in reshaping business models, enhancing organizational capabilities, and driving sustainable growth. By embracing digital technologies and fostering a culture of innovation, businesses can navigate the complexities of the digital age and position themselves for long-term success in an increasingly digitalized world.

3.4.2 Identifying the current research gaps

The RBV theory stands as a prominent framework within the literature for elucidating the mechanisms by which company resources contribute to competitive advantage. However, a dearth of comprehensive exploration exists regarding the influence of diverse resource types on the process of digitalization within organizational contexts. Specifically, a research gap emerges in the systematic examination of tangible and intangible resources, encompassing financial resources, human capital, technological infrastructure, and organizational capabilities, in driving successful digital transformation initiatives. An understanding of the interplay and utilization of these resources to bolster digitalization endeavors holds paramount importance for guiding strategic decision-making and resource allocation within organizations.

Furthermore, while extant literature abounds in delineating the positive ramifications of digitalization on firm performance, encompassing facets such as operational efficiency, innovation, and competitive advantage, a lacuna exists in studies that undertake a comprehensive assessment of digitalization's impact on financial performance metrics. Prevailing research often directs its focus towards specific dimensions of financial performance, such as profitability or revenue growth, neglecting the broader array of financial indicators encapsulated within comprehensive financial performance ratios. An exploration of how digitalization initiatives influence these comprehensive financial performance metrics could furnish a more holistic comprehension of the financial implications attendant to digital transformation endeavors within organizations.

Additionally, while the discourse traverses various industries, a paucity of exploration pervades cross-industry comparative studies that scrutinize the ramifications of digitalization on firm performance across divergent sectors. Such comparative analyses could furnish invaluable insights into sector-specific challenges and opportunities entailed in digital transformation endeavors, thereby enabling organizations to glean lessons from exemplary practices and tailor their strategic initiatives accordingly.

Addressing these research gaps holds promise for enriching the understanding of how organizations can judiciously allocate resources, implement efficacious digitalization strategies, and ultimately fortify their financial performance within an increasingly digitalized business landscape.

4. SCIENTIFIC CONCEPT AND RESEARCH HYPOTHESIS

4.1 Scientific concept

The digitalization of businesses has become a crucial strategic imperative in today's rapidly evolving global economy. These applications are seen as transformative, causing substantial changes in both economic and social interactions. Rogers (2016) argues that digital transformation is fundamentally a matter of strategy rather than merely a technological shift. This perspective is supported by Verhoef et al. (2021), who emphasize that digitalization is inherently multidisciplinary, requiring adjustments across various domains such as strategy, organizational structure, information technology, supply chain management, and marketing. As organizations endeavor to leverage digital technologies to improve efficiency, foster innovation, and strengthen competitiveness, it becomes essential to examine the mechanisms and determinants driving digitalization and to evaluate its effects on financial performance. In the Vietnamese context, where digitalization is gaining increasing momentum, examining the relationship between firm resources, digitalization capabilities, and financial performance assumes particular significance.

This research aims to delve into the intricate relationship between firm resources, digitalization capabilities, and financial performance, considering the moderating effect field-sector of firm. In the contemporary business landscape, digitalization has emerged as a critical determinant of organizational success, profoundly impacting firms' operational efficiency, strategic positioning, and financial outcomes. However, the mechanisms through which firm resources influence digitalization capabilities and subsequently affect financial performance remain complex and multifaceted.

Drawing upon an extensive literature review, this study proposes a comprehensive conceptual framework that elucidates the interplay among key constructs. Firm resources, encompassing ***IT infrastructure, digital skills,*** and ***leadership management***, serve as foundational elements shaping a firm's ability to undertake digitalization initiatives effectively. The digitalization capabilities of a firm, comprising ***digitalization overall degree*** and ***digitalization technology adoption***, reflect its proficiency in leveraging digital technologies to enhance business processes, innovate

products/services, and engage with stakeholders in the digital ecosystem. Furthermore, this research investigates the direct impact of digitalization on financial performance, elucidating how firms' investments in digital transformation initiatives translate into tangible financial outcomes, such as revenue growth, profitability, and market-based valuation. Additionally, it examines the contingent effects of field/sector on the relationship between digitalization capabilities and financial performance. These contextual factors may moderate the strength and direction of the digitalization-financial performance nexus, thereby shaping firms' competitive advantages and resilience in the digital era.

4.2 Hypotheses on antecedents of digitalization and its mediation roles

4.2.1 IT infrastructure

Jia et al. (2024) and Schwertner (2017) emphasize the pivotal role of network infrastructure in facilitating enterprise digital transformation. They suggest that robust network infrastructure provides the foundational support necessary for firms to effectively adopt and leverage digital technologies. Research by Saengchai & Jermsittiparsert (2019) also underscores the importance of IT infrastructure in enhancing supply chain performance in the digital era. They argue that investments in IT infrastructure enable seamless connectivity and data exchange among supply chain partners, thereby improving coordination, efficiency, and responsiveness.

Brieger et al. (2022) and Urbach et al. (2019) shed light on the transformative impact of IT infrastructure on organizational processes and capabilities. They suggest that modern IT infrastructure not only enables firms to streamline operations and enhance productivity but also empowers them to innovate and internationalize their ventures effectively. Furthermore, Kronblad (2020) highlights how digitalization reshapes the nature of professional service firms, emphasizing the role of IT infrastructure in enabling new modes of service delivery and client engagement.

Additionally, Özsoy et al. (2022) and Manny et al. (2021) point out the significance of IT infrastructure in facilitating the digitalization of export-oriented industries and infrastructure sectors, respectively. They argue that investments in digital infrastructure are essential for enhancing competitiveness, enabling market access, and addressing barriers to digital transformation. Robust IT infrastructure not only serves as the backbone for digitalization but also enables firms to capitalize on emerging opportunities, overcome challenges, and achieve sustainable growth in an increasingly digitized global economy. Thus, the thesis supports the ideas:

- H1: IT infrastructure has a significant impact on digitalization overall degree and digitalization technology adoption.

In accordance with the RBV theory, IT infrastructure plays an important role in directly influencing a firm's financial performance. IT infrastructure, encompassing hardware, software, and data systems, enhances operational efficiency by automating processes and reducing costs (Ramirez et al., 2010). Additionally, it facilitates revenue generation by developing and delivering innovative products and services, expanding market competitiveness (Čater & Čater, 2009). Moreover, robust IT infrastructure supports informed decision-making by providing timely and accurate information. This alignment between IT infrastructure and business objectives enhances strategic effectiveness and operational agility (Huang et al., 2012). Ultimately, the quality and effectiveness of IT infrastructure directly contribute to a firm's financial performance by optimizing operations, reducing costs, and driving revenue growth. A hypothesis is suggested:

- H2: IT infrastructure has a direct significant impact on financial performance.

IT infrastructure constitutes the foundational backbone supporting digitalization efforts within organizations (Carcary et al., 2017). The components of IT infrastructure facilitate the digitization of processes, products, and services, enhancing operational efficiency, agility, and innovation (Saengchai & Jermsittiparsert, 2019). By fostering digitalization capabilities, IT infrastructure enables organizations to leverage emerging technologies, data analytics, and automation, leading to improved decision-making and strategic alignment (Ghosh et al., 2022). Consequently, enhanced digitalization capabilities contribute to increased revenue generation, cost reduction, and market competitiveness. Thus, while IT infrastructure itself may not directly impact financial performance, its role as a facilitator of digitalization capabilities mediates the relationship between IT infrastructure investments and improved financial outcomes for firms. The thesis conduct proposes hypotheses:

- H3: Digitalization capabilities has a mediating role in the relationship between IT infrastructure and Financial performance.

4.2.2 Digital skills

Recent academic studies highlight the crucial role of digital skills in firms' digitalization efforts across industries. Abou-Foul et al. (2021) emphasize the link between digitalization, servitization, and financial performance, stressing the need for firms to equip their workforce with digital skills to leverage technology and emerging business models effectively. Ciarli et al. (2021) assert that

fostering digital skills is essential for driving innovation and maintaining competitiveness in the digital economy. Cirillo et al. (2021) and Demir (2019) further underscore the significance of digital skills in shaping organizational behavior and transformation processes. Dethine et al. (2020), Eller et al. (2020), and Ribeiro-Navarrete et al. (2021) highlight the importance of digital skills for SMEs and KIBS, aiding them in managing exports, navigating challenges, and enhancing performance. Molla et al. (2024) and Shakina et al. (2021) extend the discussion to emphasize the organizational impact and value creation of digital skills across various functions. Insights from Zhou et al. (2021) and Cirillo et al. (2023) highlight the strategic implications of digitalization for firms in the financial services sector. By investing in digital skill development, firms can empower their workforce to drive innovation, adapt to market changes, and achieve sustainable growth, affirming the hypothesis that digital skill development is crucial for firms' success in a digitalized world. Thus,

- H4: Digital skills have a significant impact on digitalization overall degree and digitalization technology adoption.

Digital skills, including proficiency in digital technologies and data analytics, are essential in today's digital-driven business environment. Employees possessing these skills drive innovation, efficiency, and productivity within organizations (Sidhu, 2015). Furthermore, digital-savvy employees enable firms to capitalize on digital opportunities, expand their customer base, and differentiate themselves in the market (Kotler et al., 2021). Their adaptability to technological advancements ensures the firm's relevance and competitiveness (Kotler et al., 2021). Thus, within the RBV framework, human resources with digital skills play a crucial role in directly shaping a firm's financial performance by fostering innovation, efficiency, and adaptability in the digital age.

- H5: Digital skills have a direct significant impact on financial performance.

Digital skills empower employees to drive digitalization efforts within the organization, facilitating the adoption and integration of digital technologies across various business functions (Trenerry et al., 2021). By enhancing digitalization capabilities, human resources with digital skills enable organizations to streamline processes, improve operational efficiency, and innovate in product development and service delivery(Cantoni & Mangia, 2018). Accordingly, improved digitalization capabilities contribute to increased revenue generation, cost reduction, and market competitiveness. Thus, while the direct impact of digital skills on financial performance may not be readily apparent, their mediation of digitalization capabilities serves as a critical pathway

through which human resources indirectly influence a firm's financial outcomes in today's digitally-driven business environment.

- H6: Digitalization capability has a mediating role in the relationship between Digital skills and Financial performance.

4.2.3 Leadership

Leadership emerges as a linchpin in driving the digitalization of firms, as evidenced by Larjovuori et al. (2016), who emphasize its role in enhancing employee well-being and facilitating digital transformation. Ruel et al. (2021) further assert that effective leadership is essential for formulating digital business strategies and fostering organizational learning. Magesa & Jonathan (2022) highlight the significance of visionary leadership and strategic foresight in navigating digital complexities. Additionally, Senadjki et al. (2024) demonstrate that firms led by digitally adept leaders exhibit superior performance outcomes through successful digital transformations. Škare & Soriano (2021) underscore the mediating role of leadership in enhancing firms' agility amidst digitalization. In essence, leadership not only drives the adoption of digital technologies but also cultivates a culture of innovation and adaptability critical for organizational success in digitalization. Therefore the thesis suggests hypotheses:

- H7: Leadership has a significant impact on digitalization overall degree and digitalization technology adoption.

Leadership, as a tangible resource, encompasses the strategic direction, decision-making prowess, and organizational culture established by top executives and management teams (Ulrich & Ulrich, 2015). Effective leadership fosters a vision that guides resource allocation, innovation, and strategic alignment, directly influencing revenue generation, cost management, and profitability. Moreover, strong leadership cultivates a culture of accountability, collaboration, and adaptability, enhancing operational efficiency and resilience in dynamic market environments (Surroca et al., 2010). Additionally, adept leadership facilitates talent development and retention, ensuring the organization possesses the requisite human capital to execute strategies effectively and sustain competitive advantage (Srivastava et al., 2013). Thus, within the RBV framework, leadership directly shapes financial performance by providing strategic direction, fostering organizational capabilities, and driving excellence throughout the firm. Accordingly, the thesis supports a hypothesis:

- H8: Leadership has a direct significant impact on financial performance.

Effective leadership fosters an environment conducive to digital transformation initiatives, instilling a vision that prioritizes innovation, agility, and adaptability (Ismail et al., 2023; Senadjki et al., 2024). This vision guides the development and deployment of digitalization capabilities across various business functions, enabling the organization to leverage digital technologies for enhanced operational efficiency, customer engagement (AlNuaimi et al., 2022). Based on that, digitalization capabilities facilitate revenue growth, cost reduction, and market expansion, ultimately bolstering financial performance. Thus, the thesis suggests hypotheses:

- H9: Digitalization capabilities has a mediating role in the relationship between Leadership and Financial performance.

4.3 Hypotheses on the impact of digitalization capabilities on financial performance

4.3.1 Digitalization overall degree

The degree of digitalization within firms has garnered significant attention due to its potential impact on financial performance. Several studies have explored this relationship from various perspectives. For instance, Ekinci (2021) examines the impact of digitalization degree on the financial sector's performance, highlighting its implications for governance, economics, and finance. Ribeiro-Navarrete et al. (2021) focus on knowledge-intensive business services (KIBS) and empirically analyze the effect of digitalization degree on business performance. Truant et al. (2021) provide an overview of the relationship between the degree of digitalization and company performance, showcasing how digitalization positively affects performance metrics. Similarly, Zeng et al. (2022) offer evidence demonstrating the financial benefits associated with a firm digitalization degree. Zugrav (2019) underscores the degree of digitization as a means to enhance financial performance, emphasizing its importance as a strategic direction for companies. Bouwman et al. (2017), based on interviews with companies from 11 countries, demonstrate that companies with a higher degree of digitalization generally have more efficient and innovative business models. Similarly, Kohtamäki et al. (2020) find that at low to moderate levels of digitalization, its interaction with servitization negatively affects financial performance. However, at higher levels of digitalization, this interaction positively enhances financial outcomes. Collectively, these studies highlight the complex and multifaceted relationship between digitalization degree and financial performance, emphasizing the need for further research to fully understand the mechanisms at play.

Accordingly, a hypothesis regarding this topic is proposed:

- H10: There is a significant impact of digitalization overall degree on financial performance.

4.3.2 Digitalization technology adoption

The adoption of digital technologies has become increasingly prevalent across firms, with notable implications for their financial performance. Research indicates that such adoption can significantly influence various aspects of a firm's operations and outcomes. For instance, Autio et al. (2021) highlight the relationship between the adoption of digital technologies, business model innovation, and financial performance, particularly in startup firms. Similarly, Blichfeldt & Faullant (2021) examine the performance effects of digital technology adoption and product/service innovation, emphasizing its relevance from a process-industry perspective. Furthermore, studies like Fernández-Portillo et al. (2022) and Kallmuenzer et al. (2024) delve into the antecedents and outcomes of digitalization technology adoption in SMEs, shedding light on its impact on financial performance. Additionally, Li et al. (2022) explore the effects of digital technology adoption on sustainability performance, suggesting potential mediating mechanisms such as stakeholder collaboration. Luu et al. (2023) present empirical findings highlighting the influence of digitalization technology adoption on the financial performance of SMEs, with a specific focus on businesses operating in emerging economies. Their research underscores the transformative potential of digital tools in enhancing financial outcomes and driving growth in these contexts. To further understand the complex interplay between digitalization technology adoption and financial performance, the thesis suggests a hypothesis:

- H11: There is a significant impact of digitalization technology adoption on financial performance.

4.3.3 Field - sector of firm

In different sectors, the degree of reliance on digital tools varies, suggesting that the digital advancements and their impact on organizational efficiency may also differ across fields. Enterprises in the service sector often rely heavily on customer interactions and experiences, making digitalization crucial for enhancing customer satisfaction and loyalty (Holmlund et al., 2017). Digital tools such as customer relationship management systems, online booking platforms, and personalized recommendation engines can optimize service delivery, leading to increased customer retention and higher revenues. Secondly, digitalization enables service enterprises to

streamline internal processes, reducing operational costs and improving efficiency (Kitsios et al., 2021). Automated workflows, data analytics, and cloud-based solutions can enhance productivity and resource allocation, resulting in lower overheads and higher profit margins. Additionally, digitalization facilitates scalability and agility in service enterprises, allowing them to adapt quickly to changing market demands and expand their reach (Favoretto et al., 2022). With digital platforms, services can be easily replicated and customized, enabling enterprises to enter new markets and capitalize on emerging opportunities swiftly (Fasnacht & Fasnacht, 2018). The integration of digital technologies in service enterprises not only enhances customer satisfaction and operational efficiency but also may drive the most significant improvements in financial performance among sectors. Therefore, the thesis aims to investigate whether this finding holds and proposes hypotheses:

- H12: The greatest impact of digitalization is among enterprises in the service sector.

The proposed model, presented in Figure 12, illustrates the direct and indirect relationships among the aforementioned variables.

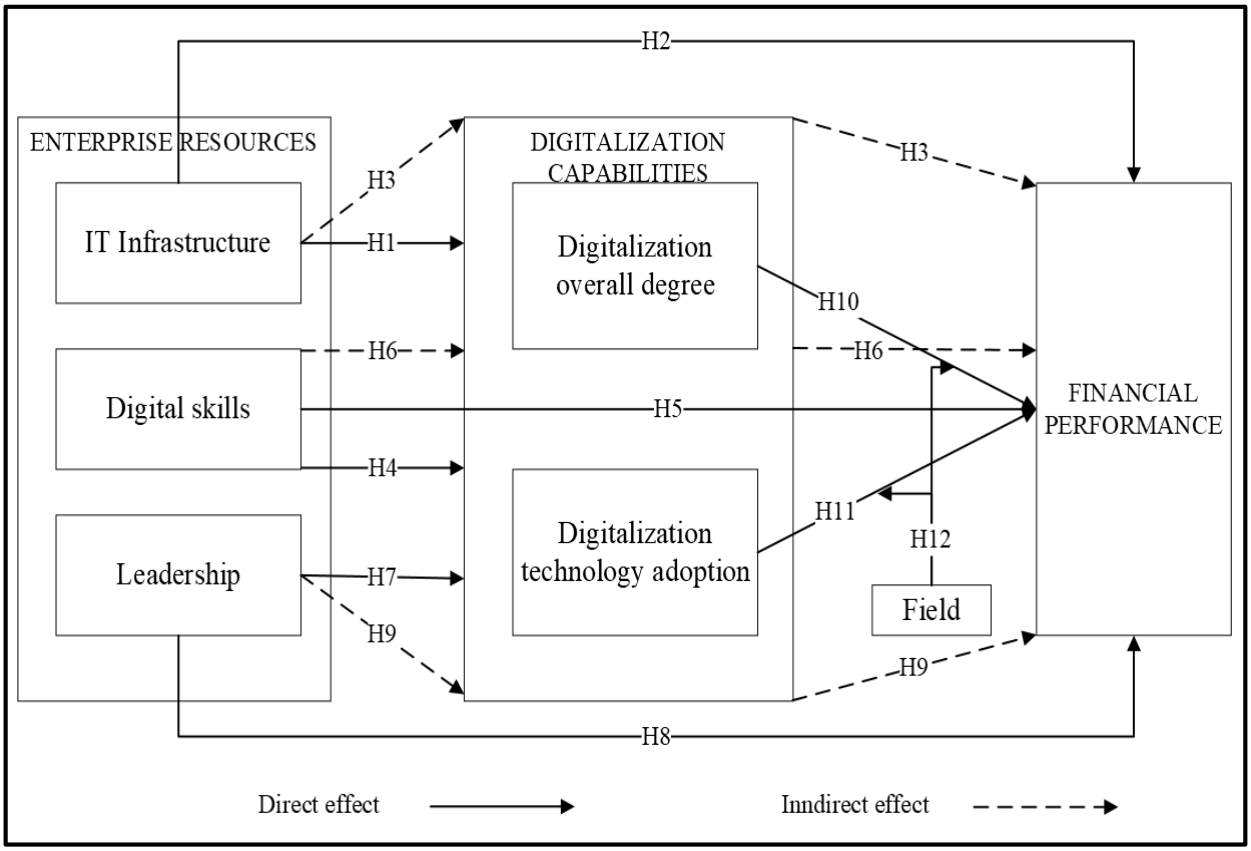


Figure 12: The research model

Source: own research

The model displays the direct relationship between enterprise resources and digitalization capabilities, as well as the direct relationship between digitalization and financial performance. Furthermore, this model also establishes the mediating role of digitalization capabilities.

5. RESEARCH METHODOLOGY

5.1 Structural equation modeling methodology

The evolution of digital technologies has significantly transformed organizational operations, prompting research into the complex relationships between digitalization and firm performance. To explore these relationships, Structural equation modeling (SEM) has become a key analytical tool. SEM offers a flexible framework for testing theoretical constructs and understanding how digitalization affects firm performance. Two primary SEM methodologies, Covariance-Based Structural Equation Modeling (CB-SEM) and Partial Least Squares Structural Equation Modeling (PLS-SEM), have received significant attention. Table 5 summarizes the strengths and limitations of each method based on research objectives and context.

Table 5 : Summarizing the differences between CB-SEM and PLS-SEM

Aspect	CB-SEM	PLS-SEM
Analytical basis	Based on covariance matrix analysis; aims to minimize the difference between observed and model-implied covariance matrices (Hair et al., 2017).	Focuses on maximizing the predictive accuracy of latent constructs; prioritizes the estimation of path coefficients over covariance matrices (Hair et al., 2017).
Purpose	Suitable for confirmatory research, testing predefined theoretical models, and evaluating specific hypotheses.	Ideal for exploratory research where theoretical models are under development or involve complex and multidimensional constructs (Hair et al., 2017).
Assumptions	Requires large sample sizes and assumes data adhere to normal distribution. Sensitive to non-normality (Hair et al., 2017).	Tolerant of non-normality and small sample sizes; does not rely on strict distributional assumptions (Hair et al., 2017).
Fit evaluation	Evaluates model fit by comparing observed data to model-implied covariance matrices.	Focuses on predictive relevance and does not emphasize model fit as in CB-SEM.
Application context	Robust for confirmatory analyses involving established theoretical frameworks.	Particularly useful for dynamic, evolving contexts, such as digital transformation research, where non-linear relationships and complex interactions are present.
Handling of non-linearity & complexity	Limited ability to accommodate non-linear relationships and complex interactions; challenges arise in studies involving dynamic digital transformation.	Well-suited for capturing non-linear relationships and complex causal pathways; supports the exploration of direct and indirect effects.
Measurement model tolerance	Less tolerant of measurement error and requires precise model specification.	Allows for greater flexibility in handling measurement error and diverse model specifications.
Strengths in research contexts	Strong in confirming and validating existing theories with robust statistical properties.	Effective for predictive modeling and exploring relationships in interdisciplinary research, such as assessing the influence of digitalization on financial success.

Source: own research

In the context of studying the influence of digitalization on financial outcomes within firms, PLS-SEM presents several distinct advantages. The multidimensional and evolving nature of digital transformation demands a flexible and adaptive analytical approach, which PLS-SEM provides through its emphasis on predictive modeling and exploratory analysis. This methodology accommodates non-linear relationships and complex causal pathways, thereby allowing researchers to capture the nuanced interplay between digital initiatives and financial outcomes. By offering insights into both direct and indirect effects through mediating or moderating variables, PLS-SEM facilitates a comprehensive understanding of the mechanisms driving digitalization's impact on firm performance.

Moreover, digital transformation research often involves the integration of diverse data sources and measurement scales. PLS-SEM's tolerance for measurement error and its capability to handle diverse model specifications make it particularly well-suited for such interdisciplinary research. By enabling the simultaneous estimation of multiple latent constructs and their indicators, PLS-SEM provides valuable insights into how various aspects of digitalization influence financial performance.

Given these considerations, this thesis employed the PLS-SEM technique to test research hypotheses, aligning with the survey research method deemed appropriate for the study's objectives (Creswell, 2009). By leveraging the strengths of PLS-SEM, the research effectively addressed the complexities associated with digital transformation and its impact on organizational outcomes, offering actionable insights for both academics and practitioners in the field.

5.2 Research survey methodology

5.2.1 Introduction to the survey methodology

In recent scholarly investigations, the survey research approach has established itself as a prevalent methodology for examining the intricate relationships between firm resources, digitalization, and financial performance. This methodological framework is characterized by the systematic collection of data from a sample of respondents, often through structured questionnaires or interviews, followed by comprehensive statistical analysis. The survey research approach offers several notable advantages that make it particularly effective for exploring these complex interrelationships at the enterprise level.

1. Comprehensive data collection

   The multifaceted nature of digitalization and its potential implications for financial performance necessitate a thorough and nuanced approach to data collection. The survey research methodology excels in this regard by enabling researchers to gather a wide array of data from a diverse sample of enterprises. This systematic collection process encompasses various dimensions, including firm resources, digitalization strategies, and financial metrics. By capturing these variables from multiple perspectives, researchers are able to construct a holistic understanding of the mechanisms driving organizational performance in the digital era. This comprehensive data collection is crucial for elucidating how different elements of digitalization interact with firm resources to influence financial outcomes.

2. Quantitative analysis capability

   One of the key strengths of the survey research approach is its ability to provide quantitative rigor, essential for analyzing complex relationships among variables. Through the use of statistical analysis techniques, researchers can rigorously quantify the effects of firm resources on digitalization and financial performance. This capability enables the identification of significant predictors, assessment of the strength and direction of relationships, and detection of underlying patterns that inform both theoretical development and practical applications. The quantitative nature of survey research allows for precise measurement and analysis, facilitating a detailed understanding of how various factors contribute to organizational success in the context of digital transformation.

3. Scalability and replicability

   Surveys are inherently scalable, providing the flexibility to administer the same questionnaire to a large number of enterprises across different industries and geographical regions. This scalability enhances the generalizability of findings, as it allows researchers to obtain a broad and representative sample of data. Additionally, the standardization of data collection procedures and the use of rigorous sampling techniques contribute to the replicability of research results. By ensuring that data collection methods are consistent and robust, researchers can produce findings that are applicable across diverse organizational contexts. This replicability is crucial for validating results and drawing generalized

conclusions about the relationships between digitalization, firm resources, and financial performance.

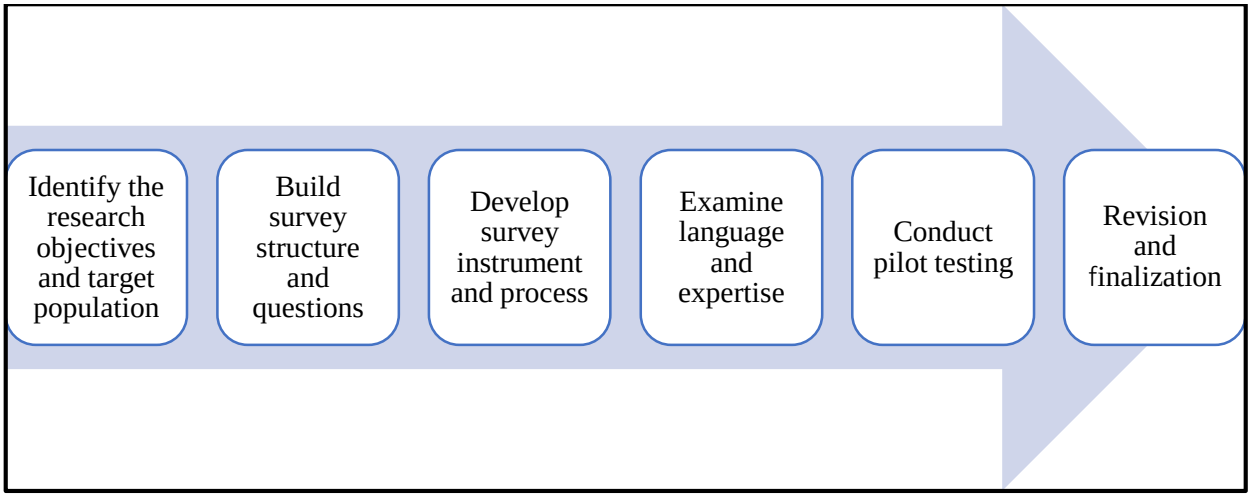


Figure 13: The survey method workflow

Source: own research

Figure 13 shows the workflow of the survey method used in the thesis The survey research approach offers a comprehensive, quantitative, and scalable framework for investigating the complex dynamics of digitalization and its impact on firm performance. By systematically collecting and analyzing data from a broad range of enterprises, researchers can gain valuable insights into how digitalization strategies and firm resources interact to shape financial outcomes. This methodological approach not only enhances our understanding of digital transformation but also provides practical implications for organizations seeking to leverage digital technologies for improved performance.

5.2.2 Survey questionnaire design

1. Research objectives and target population

   This research is primarily designed to explore the relationship between firm resources and digitalization capabilities and to assess how these capabilities impact the financial performance of businesses. The investigation is grounded in an extensive review of existing literature, which has highlighted the need to understand the interplay between organizational resources and digital transformation. To achieve this aim, a carefully designed survey questionnaire was developed and distributed to respondents at the firm level. The target population for this survey includes business executives and managers who

are well-positioned to provide insights into their organizations' resources, digitalization strategies, and financial outcomes.

2. Survey structure and questions

The survey is methodically structured into three distinct sections to comprehensively capture the relevant data:

- Introductory section: This initial section offers an overview of the research objectives and details about the authorship. It sets the context for the survey and informs respondents about the purpose of the study, ensuring transparency and clarity regarding the research goals.
- Demographic section: This section is divided into two parts:

  Part 1: Collect data on the respondents' demographics, including age, years of work experience, and current organizational role. This information helps contextualize the responses and understand the background of the individuals providing the data.

  Part 2: Gather information about the surveyed businesses, such as their age, size, and sector. This part of the survey aims to capture organizational characteristics that may influence the relationship between firm resources, digitalization capabilities, and financial performance.
- Main section: The core of the survey consists of three components, each measured using a 5-point Likert scale ranging from 1 (strongly disagree/very low) to 5 (strongly agree/very high) (see Table 6 for details):

  Part 1: Assess organizational resources through five indicators. This part allows businesses to evaluate both tangible resources (such as physical assets) and intangible resources (such as human capital and intellectual property).

  Part 2: Evaluate digitalization capabilities with two indicators. Respondents are asked to assess their organizations' digital transformation efforts based on the degree of digitalization and technology adoption.

  Part 3: Focus on the financial performance of businesses through five indicators. This section aims to capture various aspects of financial performance, including profitability, revenue growth, and cost efficiency.

By structuring the survey in this manner, the research ensures a comprehensive collection of data relevant to understanding how firm resources and digitalization capabilities influence financial

performance. The use of a structured questionnaire and a Likert scale enables precise measurement and facilitates robust statistical analysis, thereby supporting the investigation's objectives.

Table 6: The constructs, items, and supporting references

Construct	Item	Supporting theory	Supporting reference
IT infrastructure	INF1-3	RBV-TOE	Scuotto et al. (2017); Eller et al. (2020)
Digital skills	SKI1-4	RBV-TOE	Eller et al. (2020)
Leadership	LED1-3	RBV-TOE	Estensoro et al. (2022)
Digitalization overall degree	DIGO1-5	DC	Guo et al. (2020)
Digitalization technology adoption	DIGT1-7	DC	Guo et al. (2020)
Financial performance	FINP1-5	RBV-DC	Eller et al. (2020); Zhang et al. (2023)

Source: own research

3. Survey instrument and development process

- Assessment of enterprise resources

  To evaluate the various dimensions of enterprise resources, this study utilizes a meticulously designed structured questionnaire. The questionnaire encompasses several key dimensions critical for understanding firm resources and their role in digital transformation.

  IT Infrastructure: The assessment of IT infrastructure is based on three specific items derived from the foundational works of Scuotto et al. (2017) and Eller et al. (2020). These items are crafted to measure the robustness and adequacy of the technological backbone that supports digital operations within the enterprise.

  Digital Skills: To gauge the digital competencies of employees, four items adapted from Eller et al. (2020) are employed. These items are intended to assess the extent to which employees possess the necessary skills to effectively utilize digital tools and technologies.

  Leadership: The evaluation of leadership, a crucial element for steering digital transformation, is conducted using three items. These items are partly based on the framework proposed by Estensoro et al. (2022) and supplemented with internal developments tailored to the specific context of the study. The focus is on assessing leadership’s role in fostering and supporting digital initiatives.

  Each dimension of enterprise resources is evaluated using a 5-point Likert scale. Respondents are asked to indicate their level of agreement with each statement, ranging

from 1 (strongly disagree) to 5 (strongly agree). This scale provides a nuanced measure of the perceived adequacy and effectiveness of the resources in question.

- Evaluation of digitalization capabilities

  The questionnaire also incorporates dimensions specifically designed to evaluate the digitalization capabilities of enterprises. These dimensions are adapted from the research of Guo et al. (2020), ensuring that the assessment captures both the breadth and depth of digital transformation within organizations.

  Digitalization overall degree: Five items are used to evaluate the overall digitalization of the enterprise. This dimension aims to measure the extent to which digital technologies and processes have been integrated into various aspects of the organization. The responses are captured on a 5-point Likert scale, where 1 indicates strong disagreement with the digitalization statements and 5 indicates strong agreement.

  Digitalization technology adoption: An expanded set of seven items assesses the adoption of technology within the enterprise. This dimension is designed to evaluate how extensively different digital technologies are utilized within the organization. Similar to digitalization overall degree, the digitalization technology adoption is measured on a 5-point Likert scale, with lower scores reflecting lower levels of technology adoption.

  The inclusion of these dimensions allows for a comprehensive understanding of both the overall level of digital integration and the specific adoption of technological tools and solutions.

- Measurement of Financial performance

  To assess financial performance, the questionnaire includes five items adapted from Eller et al. (2020) and Zhang et al. (2023). These items address several critical financial metrics:

  Profit margin: Evaluates the profitability of the enterprise by measuring the proportion of revenue that remains after accounting for all expenses.

  Return on Equity (ROE): Assesses the efficiency with which the enterprise utilizes shareholders' equity to generate profit.

  Return on Assets (ROA): Measures how effectively the enterprise is using its assets to produce earnings.

Cost efficiency: Evaluates the ability of the enterprise to manage and minimize costs while maintaining operational effectiveness.

Market share: Assesses the enterprise's share of the total market within its industry, providing insight into its competitive position.

Responses to these items are solicited on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This approach enables a detailed analysis of various aspects of financial performance.

4. Language and expertise

The development of the questionnaire began with its formulation in English, guided by a comprehensive review of existing literature. To ensure that the questions were both accurate and relevant, the draft questionnaire was reviewed and refined with input from two experts specializing in digital transformation solutions. These experts provided critical insights into the technical aspects of the survey, ensuring that specialized terminology was clearly defined and understandable to the target audience. Following this review, the questionnaire was translated into Vietnamese to accommodate the linguistic needs of the study's target population. The translation process involved scrutiny by two Vietnamese professors affiliated with universities in the United States, who verified the accuracy and appropriateness of the language used in the questionnaire.

5. Pilot testing

A pilot test was conducted to evaluate the effectiveness of the survey instrument. The pilot phase involved administering the questionnaire to four experts, including two professors and two industry professionals, to gather feedback on its structural appropriateness and clarity. Additionally, a sample of 10 respondents, representative of the target population, participated in this pilot test from September 1, 2022, to September 30, 2022. The primary objectives of the pilot test were to identify potential ambiguities, misunderstandings, or issues related to question-wording, sequence, or response options. Feedback from this phase was instrumental in refining the survey to ensure that it accurately captured the intended information and was free from any issues that could affect the reliability and validity of the results.

6. Revision and finalization

   Based on the feedback obtained from the pilot test, several revisions were made to the questionnaire to enhance its clarity, validity, and reliability. This process involved refining questions to eliminate any ambiguities and ensuring that the instrument was well-aligned with the research objectives. The final version of the questionnaire was designed to ensure that it effectively captured the necessary data while maintaining respondent engagement and adhering to an appropriate length. The comprehensive development process, including expert reviews, translation, pilot testing, and subsequent revisions, ensures that the final questionnaire is robust and suitable for addressing the research aims. This rigorous approach contributes to the overall quality and reliability of the data collected in the study.

5.2.3 Data collection

Upon finalizing the survey design and questionnaire, the initial data collection plan involved distributing the survey to businesses via postal mail. However, this approach presented several critical limitations that hindered its feasibility. Firstly, Vietnamese businesses generally demonstrate a low response rate to surveys distributed by postal mail, especially when the survey pertains to sensitive information related to their operations. Moreover, the process of printing, mailing, and receiving survey responses proved to be not only time-consuming and expensive but also environmentally unsustainable due to the substantial use of paper resources. Consequently, the decision was made to opt for online distribution as a more efficient and practical alternative. The survey was designed and administered through the Google Forms platform, enabling a convenient, rapid, and cost-effective means of reaching target respondents.

The survey questionnaire was distributed online to enterprises in Vietnam, leveraging professional networks to ensure wide-reaching participation. To maximize the relevance and depth of the insights, the distribution strategy included a clear offering to forward the survey to individuals within each organization who were well-equipped to address the research questions. This approach emphasized the identification and engagement of domain experts in digitalization, specifically senior managers and executives, whose expertise and strategic oversight positioned them as ideal respondents. By targeting these high-level professionals, the research aimed to capture informed perspectives on the interplay between digitalization and financial performance. Their responses were expected to reflect a nuanced understanding of their organization's digital transformation strategies, challenges, and outcomes. This methodological choice ensured the collection of high-

quality, contextually rich data that could meaningfully contribute to the study's objectives of examining the impact of digitalization on enterprise performance.

The survey was administered over a three-month period, from October 31st, 2022, to January 31st, 2023, allowing for a comprehensive data collection window. During this period, a total of 1,940 companies were identified as potential participants and contacted to participate in the study. Of these, 260 companies ultimately responded to the survey, resulting in a response rate of 13.4%. This rigorous data collection process was designed to gather a diverse range of perspectives from key stakeholders actively involved in digitalization efforts, thereby enhancing the robustness and validity of the study’s findings.

Of the 260 responses collected, 12 were excluded due to missing or invalid data, which left a final sample size of 248 valid responses for analysis. This final dataset represented 248 distinct companies and was deemed sufficient for conducting a comprehensive analysis of the research questions. The detailed demographic information about the participating enterprises and the characteristics of the responding representatives is presented in Figures 14 and 15.

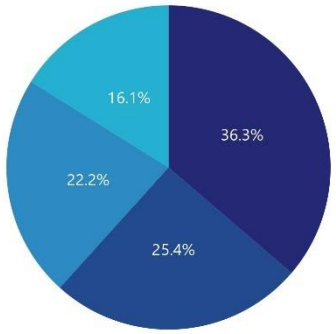
The analysis revealed that a predominant proportion of the surveyed companies (51.6%) were classified as large enterprises, characterized by a workforce of over 200 employees. This distribution reflects the study's focus on understanding digitalization capabilities within more established and complex organizational structures, where resource allocation, strategic planning, and operational capacity are critical to digital transformation success.

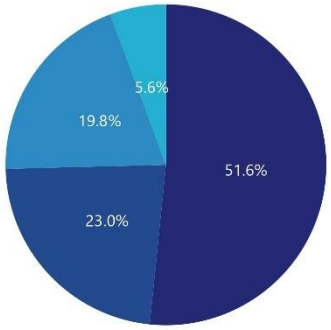
Additionally, a substantial portion of the companies surveyed, representing more than one-third of the sample, reported an organizational maturity level of over 25 years. This finding underscores the significance of digital transformation across a wide range of enterprise maturities, illustrating that both newly established and long-standing companies are engaging in digitalization initiatives.

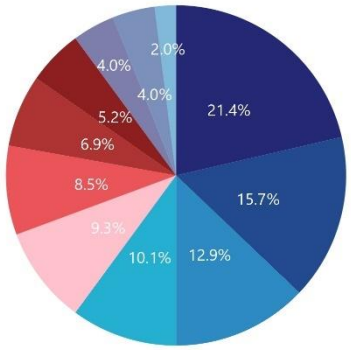
The surveyed companies were drawn from a diverse array of industry sectors, with a significant concentration in certain fields. The Real Estate and Construction sector accounted for the largest proportion of respondents (21.4%), followed by the Banking and Finance sector (15.7%), IT and Communication (12.9%), and Manufacturing (10.1%). This diverse industry representation ensures that the study captures a comprehensive range of digitalization practices and challenges across different economic contexts, thereby enhancing the generalizability and relevance of the study's findings.

The demographic profile of the respondents further reinforces the credibility and relevance of the data collected. A majority of the respondents (50.8%) were within the age range of 36 to 50 years, indicating a mature, experienced cohort of professionals. Notably, 43.5% of the respondents had more than a decade of experience in their respective industries, underscoring the depth of expertise brought to the survey responses. Additionally, a significant proportion (78.6%) of the respondents held senior-level positions within their organizations, with 21.4% occupying top managerial roles, such as Chief Executive Officer (CEO), Chief Financial Officer (CFO), Chief Technology Officer (CTO), or members of the Board of Directors (BOD).

By transitioning to an online distribution strategy and focusing on respondents with substantial expertise and decision-making authority within their organizations, the study successfully gathered data from a broad and representative sample of companies. The final dataset, comprising 248 valid responses from diverse sectors and organizational sizes, provides a robust foundation for examining the complex relationships between firm resources, digitalization capabilities, and financial performance. This methodological approach ensures that the study's findings are both comprehensive and grounded in the practical realities of digital transformation in the contemporary business environment.







Field
- Real estate and constr...
- Banking and finance
- IT and communication
- Manufacturing
- Retail and distribution
- Other services
- Tourism and hospitality
- Transportation and sto...
- Agriculture, Forestry, Fi...
- Food and beverage
- Utilities

Maturity ● Over 25 ... ● 16-25 y... ● 6-15 ye... ● Below 6 ...

Maturity	Number of company
Over 25 years	90
16-25 years	63
6-15 years	55
Below 6 years	40
Total	**248**

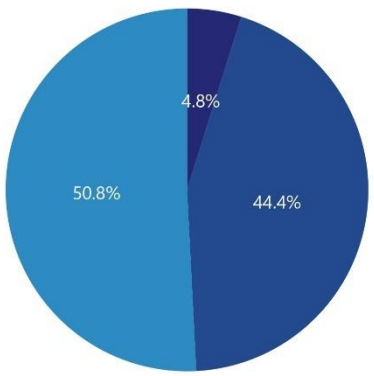
Size ● Large ● Medium ● Small ● Micro

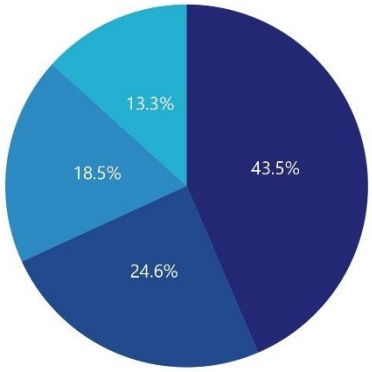
Size	Number of company
Large	128
Medium	57
Small	49
Micro	14
Total	**248**

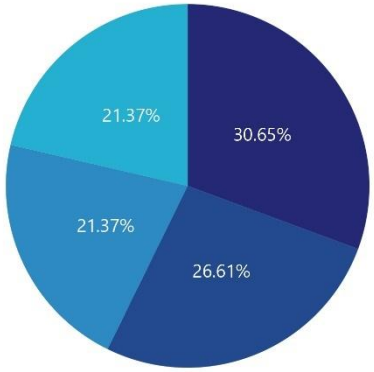
Field	Number of company
Real estate and construction	53
Banking and finance	39
IT and communication	32
Manufacturing	25
Retail and distribution	23
Other services	21
Tourism and hospitality	17
Transportation and storage	13
Agriculture, Forestry, Fishery and Mining	10
Food and beverage	10
Total	**248**

Figure 14: Distribution of companies characteristics

Source: own research







Age ● Over 50 years old ● 25-35 years old ● 36-50 years old

Age	Number of respondent
36-50 years old	126
25-35 years old	110
Over 50 years old	12
Total	**248**

Experience ● Over 10 years ● 6-10 years ● 3-5 years ● Below 3 ye...

Experience	Number of respondent
Over 10 years	108
6-10 years	61
3-5 years	46
Below 3 years	33
Total	**248**

Role ● Head department ● Senior staff ● Staff ● Top manager

Role	Number of respondent
Head department	76
Senior staff	66
Staff	53
Top manager	53
Total	**248**

Figure 15: Distribution of respondents characteristics

Source: own research

5.2.4 Data description

Table 7 provides a comprehensive summary of the descriptive statistics for the variables used in the study. The dataset demonstrates completeness with no missing values, ensuring the reliability of the analysis. The variables encompass constructs including IT infrastructure, digital skills, leadership, overall digitalization degree, digital technology adoption, financial performance, and the field variable. All constructs, except for the field variable, were measured on a 5-point scale, with values ranging from a minimum of 1 to a maximum of 5. The field variable, measured as a dichotomous item, ranges from 1 (service) to 2 (non-service).

Table 7: The descriptive statistics of variables

	No.	Mean	Median	Min	Max	Std.Dev.
INF1	1	3.5202	4	1	5	1.1662
INF2	2	3.4395	3	1	5	1.2191
INF3	3	3.3992	3	1	5	1.2097
SKI1	4	3.4879	4	1	5	1.1628
SKI2	5	3.2903	3	1	5	1.1223
SKI3	6	3.2903	3	1	5	1.2124
SKI4	7	3.5000	4	1	5	1.1167
LED1	8	3.8427	4	1	5	1.1037
LED2	9	3.9315	4	1	5	1.0177
LED3	10	3.7379	4	1	5	1.1130
DIGO1	11	3.2540	3	1	5	1.1988
DIGO2	12	3.2742	3	1	5	1.1512
DIGO3	13	3.3710	3	1	5	1.1626
DIGO4	14	3.2621	3	1	5	1.1903
DIGO5	15	3.2621	3	1	5	1.1732
DIGT1	16	2.8427	3	1	5	1.2220
DIGT2	17	2.6411	3	1	5	1.2290
DIGT3	18	3.2661	3	1	5	1.2046
DIGT4	19	3.1935	3	1	5	1.1882
DIGT5	20	3.0685	3	1	5	1.2302
DIGT6	21	3.1532	3	1	5	1.1242
DIGT7	22	3.0363	3	1	5	1.1675
FINP1	23	3.5202	4	1	5	1.0376
FINP2	24	3.3790	3	1	5	1.0768
FINP3	25	3.3992	3	1	5	1.0675
FINP4	26	3.4637	4	1	5	1.1197
FINP5	27	3.4919	3	1	5	1.1166
Field	28	1.5081	2	1	2	0.5009

Source: own research

The mean values for IT infrastructure (INF1, INF2, INF3) and digital skills (SKI1–SKI4) indicate a general tendency toward the upper half of the scale, suggesting positive perceptions or availability within the sample. Leadership items (LED1–LED3) exhibit slightly higher mean values, reflecting relatively strong leadership characteristics. In contrast, digitalization technology adoption (DIGT1–DIGT7) presents slightly lower mean scores compared to other constructs, with the lowest being DIGT2 (mean = 2.6411), indicating room for improvement in technology adoption practices.

Financial performance items (FINP1–FINP5) show consistency in their means, clustered near the midpoint of the scale, with relatively low standard deviations compared to other constructs, suggesting homogeneous responses within the sample. Similarly, the field variable has a mean value of 1.5081, highlighting a balanced representation of service and non-service sectors.

The standard deviation values range from 0.5009 (Field) to 1.2302 (DIGT5), illustrating variability in responses across items. The relatively high standard deviations for technology adoption constructs suggest greater diversity in organizational practices or perceptions in this area.

In summary, the descriptive statistics in Table 7 highlight the variability and central tendencies of the constructs under examination. These findings provide foundational insights into the dataset, facilitating further inferential analyses.

5.3 Semi-structured interview methodology

To examine the impact of digitalization on firms' financial performance, this thesis employs semi-structured interviews, a qualitative research method that offers a comprehensive and context-sensitive approach to understanding the complexities of this phenomenon. Semi-structured interviews are characterized by a flexible and open-ended format, allowing the interviewer to deviate from a predefined set of questions and pursue areas of interest that emerge during the conversation (Creswell & Creswell, 2017). Unlike structured interviews, which follow a rigid script, semi-structured interviews enable researchers to delve deeper into specific topics and uncover more nuanced insights (Gill et al., 2008).

The choice of the semi-structured interview method is particularly appropriate for investigating the role of digitalization in shaping financial performance for several reasons. First, this approach enables a nuanced understanding of how digitalization is implemented within firms, capturing the diversity in strategies and practices that quantitative methods may fail to reveal (Kvale & Brinkmann, 2009). Digital transformation initiatives can vary significantly across organizations

due to differences in resources, industry contexts, and strategic priorities. By using semi-structured interviews, researchers can obtain a detailed view of these variations and understand how they shape financial outcomes.

Second, semi-structured interviews facilitate the exploration of complex causal relationships and contextual factors that influence financial outcomes (DiCicco-Bloom & Crabtree, 2006). Digitalization often involves multifaceted changes across different organizational domains, such as operations, marketing, customer service, and supply chain management. These changes can have both direct and indirect effects on financial performance, making it essential to understand not only the direct impact of specific digital initiatives but also how various organizational factors interact to influence financial results.

Third, the method allows researchers to collect rich, detailed data directly from key stakeholders, providing insights into both the perceived benefits and challenges associated with digitalization (Edwards & Holland, 2013). By engaging with senior managers and other decision-makers, this research gains access to informed perspectives on the strategic decisions and operational adjustments that underlie successful digital transformation efforts. Stakeholders can provide firsthand accounts of their experiences, elaborating on both the tangible and intangible effects of digital initiatives on firm performance.

The flexibility inherent in semi-structured interviews allows for a deep exploration of individual experiences and organizational practices related to digitalization, thereby capturing the diversity and complexity of different industry contexts. For example, a firm in the manufacturing sector may focus on automating production processes, while a financial services company might prioritize the development of digital customer interfaces. Each firm's context and digital strategy can differ substantially, and a semi-structured interview format allows for these unique aspects to be fully explored. Moreover, semi-structured interviews enable the identification of emergent themes and insights that might not be immediately apparent through more structured or quantitative approaches. This method supports a more inductive approach to data collection, where patterns, themes, and insights can surface naturally from the participants' narratives. Such an approach is particularly valuable when examining a rapidly evolving field like digitalization, where new trends and practices continuously emerge.

This qualitative approach also serves to complement existing quantitative studies on digitalization's impact, offering a richer, more nuanced understanding of how digital

transformation drives financial performance. While quantitative methods are effective in measuring the correlation between digitalization and financial outcomes, they may not fully capture the underlying mechanisms or the contextual variables that mediate or moderate these relationships. Semi-structured interviews address this gap by providing a deeper insight into the reasons behind the observed outcomes, thus helping to refine theoretical models and contributing to a more comprehensive understanding of the phenomena under study.

To ensure that the research captures the most relevant and accurate information, this study engages with senior management and other key informants who are directly involved in the digitalization efforts within their organizations. These informants are typically in positions of strategic oversight, such as Chief Information Officers (CIOs), Chief Digital Officers (CDOs), or other senior executives responsible for digital strategy and implementation. By targeting these respondents, the study is able to gain insights into the strategic priorities, decision-making processes, and operational adjustments that firms undertake to optimize their digitalization initiatives.

The insights derived from semi-structured interviews are essential for developing a holistic understanding of digitalization's impact on financial performance. This method not only provides a platform for stakeholders to voice their perspectives and experiences but also enables researchers to explore how different dimensions of digitalization - such as technology adoption, organizational change, and process innovation - collectively influence financial outcomes. The findings from these interviews can inform both academic research and business practice by identifying best practices, potential pitfalls, and the contextual factors that moderate the effectiveness of digital strategies.

5.3.1 Design interview questions

The primary objective of this research is to undertake a comprehensive analysis of digitalization processes within a diverse range of organizational contexts. This study aims to investigate various aspects of digital transformation, including the motivations behind digital initiatives, the strategies adopted, the processes of implementation, and the technological infrastructures employed. Additionally, it focuses on understanding the organizational changes brought about by digitalization, the methodologies used to measure performance, the financial impacts observed, lessons learned from past experiences, future outlooks, external factors influencing digitalization, and prevailing industry trends. By conducting in-depth interviews with key stakeholders involved in digitalization initiatives, the research seeks to uncover insights into how different organizations

approach and execute digital transformation across various sectors and organizational sizes. Furthermore, the study aims to identify best practices and provide actionable recommendations to help organizations maximize the financial and operational benefits derived from digitalization.

This research is oriented towards developing a thorough understanding of the multifaceted nature of digitalization within organizations. It emphasizes a holistic examination of digital transformation, encompassing the full spectrum of activities from strategic planning through to implementation and performance evaluation. The study is both descriptive and analytical in nature: it seeks to provide a detailed portrayal of the current state of digitalization within different organizational contexts while also critically analyzing the factors that contribute to successful outcomes or pose challenges to digital transformation efforts.

The study's descriptive component aims to capture a snapshot of how organizations currently approach digitalization, including their motivations, strategies, and implementation processes. This aspect of the research is concerned with mapping out the digital landscape across various industries and organizational types, offering a comprehensive view of how digital transformation initiatives are currently being deployed. The analytical component, on the other hand, delves deeper into understanding the causal relationships between digitalization strategies and organizational outcomes, identifying key success factors, barriers, and lessons learned.

Moreover, the study adopts a forward-looking perspective, considering the future trajectory of digitalization and anticipating the potential impacts of emerging technologies and evolving industry trends. By doing so, it aims to provide a roadmap for organizations to navigate future digital challenges and opportunities, fostering sustainable digital growth and innovation.

To achieve these objectives, the study employs a qualitative research approach through in-depth, semi-structured interviews with key stakeholders involved in digitalization initiatives within their organizations. The interview methodology is designed to elicit rich, detailed data that captures the diverse experiences and perspectives of participants, allowing for a comprehensive exploration of the digitalization phenomenon. The key stakeholders interviewed include senior executives, digital transformation leaders, technology managers, and other decision-makers who have direct involvement in the planning, execution, and management of digital initiatives.

The study proposes a structured set of interview questions organized around several key themes to guide the exploration of digitalization practices and outcomes. These themes include: Digitalization strategy, Implementation process, Technological infrastructure, Organizational

change and culture, Performance measurement and metrics, Financial impact, Lessons learned and future outlook, External factors and industry trends, and Recommendations and advices. Table 8 in the study outlines these interview themes along with the specific objectives each theme aims to address. This structured framework is designed to guide the research toward a comprehensive understanding of digitalization practices and outcomes in contemporary organizational settings. By systematically exploring these themes, the study aims to develop a holistic picture of how digital transformation is approached and executed across different organizational contexts, providing valuable insights for both academic research and practical applications.

Table 8: The interview theme and its key points

Interview theme	Key points
Digitalization strategy	*Motivations*: Primary motivations behind initiating digitalization efforts. *Key components*: Outline of the main components of the digitalization strategy. *Evolution*: How the digitalization strategy has evolved over time.
Implementation process	*Process*: Steps and processes involved in implementing digitalization initiatives. *Challenges*: Major challenges or obstacles encountered during implementation. *Mitigation*: Methods used to address or mitigate these challenges.
Technological infrastructure	*Adopted technologies*: Technologies adopted as part of digitalization (e.g., Big data, IoT, AI, Cloud computing, social platforms). *Operational impact:* Impact of these technologies on day-to-day operations.
Organizational change & culture	*Cultural influence:* Influence of digitalization on organizational culture. *Employee engagement:* Steps taken to prepare and engage employees in the digitalization journey.
Performance measurement & metrics	*Success assessment:* Methods for assessing the success of digitalization initiatives. *KPIs:* Key performance indicators used to evaluate the impact on financial performance
Financial impact	*Observable effects*: Observable effects of digitalization on financial performance. *Financial metrics:* Improvements in revenue, cost savings, or other financial metrics attributed to digitalization.
Lessons learned & future outlook	*Lessons:* Key lessons learned from the digitalization journey. *Future vision:* Future outlook for digitalization within the organization. *Upcoming initiatives:* Upcoming digitalization initiatives or areas of focus.
External factors & industry trends	*External influences:* Role of external factors and industry trends in shaping the digitalization strategy. *Industry trends:* Notable trends or developments influencing the approach to digitalization.
Recommendations and Advice	*Advice:* Recommendations for other organizations embarking on a digitalization journey. *Best practices:* Specific strategies or best practices for maximizing financial benefits of digitalization.

Source: own research

5.3.2 Description of experts

During the empirical data collection phase, an optional question was included in the survey, inviting respondents to provide their email addresses if they wished to receive a summary of the survey findings. Subsequently, the thesis sent out summary sheets to respondents who opted to leave their emails, along with an invitation to participate in semi-structured interviews. Out of the 59 respondents who provided their email addresses, 4 individuals accepted the invitation to participate in these semi-structured interviews. This response rate underscores a modest but valuable engagement from respondents interested in further discussing the survey findings and sharing their insights through qualitative interviews.

This study explores digitalization in Vietnamese organizations through interviews with key executives from four leading companies. These organizations represent diverse sectors such as technology, digital media, real estate, and construction, providing a comprehensive overview of digital transformation across industries. The experts include the Chief Technology Officer (CTO) of technology company (Company A), the Chief Financial Officer (CFO) of Digital media company (Company B), a Board of Directors (BOD) member from Real estate company (Company C), and the Chief Accountant of Construction company (Company D). Table 9 summarizes background information about experts and their organization.

Table 9: The organizations of experts and their role

Sector	Enterprise charactoristics	Current state of digitalization	Role of Expert
Information technology	Vietnam leading technology company specializing in cybersecurity solutions, software development, and digital services. The enterprise considered a large-sized organization. (A company)	Company's digitalization is robust, with strong focus on leveraging technology to enhance cybersecurity solutions, improve software development processes, and deliver innovative digital services to customers.	Chief Technology Officer (CTO). Expert involves leading the technological direction of the company, overseeing research and development efforts, and ensuring the integration of cutting-edge technologies into products and services.
Digital media	A leading digital media company in Vietnam, specializing in content creation, digital advertising, and media production. Company operates in the medium-sized and has been serving clients in the digital media industry for over a decade. (B company)	NA	Chief Financial Officer (CFO). Expert involves overseeing the financial aspects of the organization, including budgeting, financial planning, and analysis, as well as ensuring compliance with regulatory requirements.
Real estate	A real estate development company based in Vietnam, specializing in residential, commercial, and industrial projects. As a medium-sized organization, company have been operating in the industry for over two decades, establishing a strong reputation for quality and innovation. (C company)	Company is in the process of digital transformation, recognizing the importance of leveraging technology to stay ahead in a rapidly evolving market.	Member of the Board of Directors. Expert's role involves overseeing the strategic direction of the company, including digitalization initiatives. Expert is actively involved in shaping digital strategies to enhance operational efficiency, customer engagement, and overall competitiveness.
Construction/ Energy	Company operates in various sectors including construction, infrastructure development, and renewable energy projects. It is a medium to large-sized organization with a significant presence in the Vietnamese market. (D company)	The digitalization within organization is progressive, with ongoing efforts to leverage technology to enhance financial management processes and drive operational efficiencies.	Chief Accountant. Expert involves overseeing financial operations, ensuring compliance with accounting standards, and providing financial insights to support strategic decision-making.

Source: own research

6. RESEARCH RESULTS AND DISCUSSIONS

6.1 The result of empirical research

The study employs the SEMinR package, a powerful and user-friendly tool in the R programming environment, to conduct PLS-SEM analysis. SEMinR offers a comprehensive suite of functions for constructing, estimating, and visualizing PLS-SEM models. The choice of SEMinR is motivated by its flexibility, reproducibility, and alignment with open-source practices, allowing for transparent and scalable research workflows.

6.1.1 The measurement model

To thoroughly evaluate the results of PLS-SEM, a comprehensive assessment of the measurement model is required, following the pertinent criteria delineated by Hair et al. (2019). These criteria encompass several key dimensions, including the examination of indicator reliability, internal consistency reliability, composite reliability (CR), and construct reliability. Each of these dimensions plays a crucial role in ensuring the robustness and validity of the measurement model.

Additionally, it is imperative to evaluate the discriminant validity of the measurement model to confirm that constructs are distinct and accurately represented. To achieve this, both the Fornell and Larcker criterion (Fornell & Larcker, 1981) and the Heterotrait-Monotrait ratio (HTMT) (Henseler et al., 2014) should be employed. These criteria provide a rigorous framework for assessing whether constructs differ sufficiently from one another within the model.Table 10 offers a comprehensive summary of these criteria, presenting recommended practices for the evaluation of the measurement model in research. This table serves as a valuable reference for ensuring that all necessary aspects of measurement validity are adequately addressed.

Table 10: Criteria of the measurement model characteristics

Criterion	Recommends	Reference
Indicator reliability	• Indicator loading > 0.7 • Indicator loading square > 0.5	Hair et al. (2019)
Internal consistency reliability	• Composite reliability > 0.7 • Cronbach's alpha > 0.7 • RhoA falling between Cronbach's alpha and CR	Hair & Alamer (2022)
Convergent reliability	• AVE > 0.5	Hair et al. (2021)
Discriminant validity	• AVE of each construct higher than the squared correlation between constructs • The HTMT value lower than the threshold value of 0.9	Fornell & Larcker (1981) Henseler et al. (2014)

Source: own research

Firstly, indicator reliability pertains to the communality of an indicator, as described by Hair et al. (2019). A benchmark for evaluating indicator reliability involves examining indicator loadings and their squared values. According to Hair et al. (2019), indicator loadings should exceed the threshold value of 0.7, while the squared loadings should surpass 0.5. The statistical results presented in Table 11 reveal that all indicator loadings, ranging from 0.8185 to 1, are above the recommended value of 0.7, and the minimum squared loading value is 0.6699, which is higher than 0.5. These findings confirm that all indicators demonstrate adequate reliability (Hair et al., 2019).

Table 11: The measurement model result

Variable/ Indicator	Loading factor	Factor loading square	Cronbach's alpha	CR	AVE	rho_A
IT infrastructures						
INF1	0.9106	0.8292				
INF2	0.9587	0.9191	0.9281	0.9544	0.8746	0.9280
INF3	0.9356	0.8754				
Digital skills						
SKI1	0.9174	0.8416				
SKI2	0.9058	0.8205	0.9301	0.9502	0.8266	0.9311
SKI3	0.9020	0.8136				
SKI4	0.9114	0.8306				
Leadership						
LED1	0.9527	0.9077				
LED2	0.9611	0.9236	0.9541	0.9703	0.9158	0.9561
LED3	0.9571	0.9161				
Digitalization overall degree						
DIGO1	0.9408	0.8852				
DIGO2	0.9610	0.9234				
DIGO3	0.9495	0.9016	0.9701	0.9767	0.8933	0.9703
DIGO4	0.9325	0.8695				
DIGO5	0.9418	0.8870				
Digitalization technology adoption						
DIGT1	0.8736	0.7631				
DIGT2	0.8210	0.6740				
DIGT3	0.8481	0.7193				
DIGT4	0.8680	0.7533	0.9403	0.9513	0.7362	0.9431
DIGT5	0.8549	0.7309				
DIGT6	0.8588	0.7375				
DIGT7	0.8804	0.7751				
Financial performance						
FINP1	0.9171	0.8412				
FINP2	0.9379	0.8796				
FINP3	0.9443	0.8916	0.9397	0.9544	0.8075	0.9449
FINP4	0.8185	0.6699				
FINP5	0.8691	0.7553				
Field/sector						
Field	1	1	1	1	1	1

Source: own research

Secondly, internal consistency reliability refers to the extent to which indicators within the same construct are correlated with each other (Hair et al., 2021). To evaluate this criterion, Hair & Alamer (2022) suggest assessing CR, Cronbach's alpha, and rho_A. Specifically, CR and Cronbach's alpha values should exceed 0.7, while rho_A should lie between the values of Cronbach's alpha and CR. The results in Table 11 indicate that all CR values are greater than 0.95, all Cronbach's alpha values exceed 0.92, and consequently, rho_A values fall within the range between Cronbach's alpha and CR. These results indicate that all constructs exhibit a high level of internal consistency reliability.

Thirdly, to evaluate the convergent validity of each construct, the average variance extracted (AVE) is examined. AVE represents the grand mean value of the squared loadings of each indicator within a construct (Hair et al., 2019). Hair et al. (2021) suggest that the AVE for each construct should be higher than the minimum acceptable value of 0.5. The AVE values in Table 11 range from 0.7362 to 0.9158, thereby meeting the recommended threshold and indicating satisfactory convergent validity for all constructs.

Finally, to assess the discriminant validity of the constructs, this study applied two well-established methods: the Fornell-Larcker criterion (Fornell & Larcker, 1981) and the Heterotrait-Monotrait ratio (HTMT) (Henseler et al., 2014). The Fornell-Larcker criterion requires that the AVE for each construct exceeds the squared correlations between that construct and others, ensuring that the construct shares more variance with its own indicators than with other constructs (Fornell & Larcker, 1981). As shown in Table 12, the square roots of the AVE values, displayed on the diagonal and italicized, surpass the inter-construct correlations, confirming compliance with the Fornell-Larcker criterion for discriminant validity.

Table 12: The Fornell and Larcker criterion result

	INF	**SKI**	**LED**	**DIGO**	**DIGT**	**FINP**
INF	*0.9352*					
SKI	0.8187	*0.9092*				
LED	0.6931	0.7738	*0.9570*			
DIGO	0.7360	0.7928	0.7297	*0.9452*		
DIGT	0.6353	0.6509	0.6032	0.7322	*0.8580*	
FINP	0.5216	0.5825	0.5605	0.5995	0.5865	*0.8986*

Source: own research

Henseler et al. (2014) recommended that the HTMT values should be below the threshold of 0.9 to confirm the absence of discriminant validity issues. As shown in Table 13, all HTMT values were below the threshold, with a maximum value of 0.88. To further ensure the robustness of these findings, this study conservatively tested the significance of all HTMT values to determine whether they were significantly different from 1 or below the cut-off value of 0.9, as suggested by Sarstedt et al. (2021). The results of this bootstrapped procedure confirmed the discriminant validity of all studied constructs, reinforcing the reliability and validity of the measurement model.

Table 13: The Heterotrait-Monotrait ratio result

	INF	SKI	LED	DIGO	DIGT	FINP
INF						
SKI	0.8816					
LED	0.7367	0.8202				
DIGO	0.7755	0.8335	0.7575			
DIGT	0.6758	0.6915	0.6345	0.7632		
FINP	0.5555	0.6208	0.5868	0.6258	0.6146	

Source: own research

6.1.2 The collinearity issues

The initial step in assessing the structural model involves evaluating potential collinearity issues.

Table 14: The VIF value of structure model

Variable	Indicator	VIF
Digitalization overall degree		
IT Infrastructure	INF	3.117
Digital skills	SKI	4.035
Leadership	LED	2.561
Digitalization technology adoption		
IT Infrastructure	INF	3.117
Digital skills	SKI	4.035
Leadership	LED	2.561
Financial performance		
IT Infrastructure	INF	3.354
Digital skills	SKI	4.587
Leadership	LED	2.857
Digitalization overall degree	DIGO	3.804
Digitalization technology adoption	DIGT	2.323
Field		1.159
Digitalization overall degree*Field	DIGO*Field	1.990
Digitalization technology adoption*Field	DIGT*Field	1.975

Source: own research

According to Hair et al. (2021), the Variance Inflation Factor (VIF) should be calculated and compared against the recommended threshold value of 5. The results presented in Table 14 indicate that all VIF values are below this threshold, confirming that collinearity is not a concern in this structural model assessment.

6.1.3 The structural model

To comprehensively assess the structural model, the research evaluates both the significance and relevance of the structural paths. The results from the statistical analysis, as detailed in Table 15 are derived from a bootstrapping procedure. In PLS-SEM, the selection of 10,000 samples for the bootstrapping procedure reflects an effort to enhance the precision and robustness of the statistical estimates. Bootstrapping, a non-parametric resampling method, is widely employed to estimate standard errors, derive confidence intervals (CIs), and assess the significance of path coefficients. The choice of 10,000 samples, though higher than the conventional threshold of 5,000 recommended by earlier literature (Hair et al., 2021), aligns with the guidance from Streukens and Leroi-Werelds (2016) emphasizing the benefits of higher resampling numbers. Specifically, a larger number of samples reduces the standard error and improves the stability and reliability of the results. This methodological choice ensures that the computed t-values and CIs are more accurate and less susceptible to variability introduced by smaller resampling sizes. Such rigor is particularly crucial in models with complex relationships or when the dataset exhibits high variability, as it bolsters the confidence in the inference drawn from the analysis. Furthermore, adopting a higher number of bootstrap samples aligns with recent best practices in PLS-SEM literature, emphasizing methodological rigor to achieve replicable and trustworthy results. This analysis provides the path coefficient estimates, t-values, and CIs.

The significance of each path is assessed by examining either the t-values of the path coefficients or the CIs, as suggested by Sarstedt et al. (2021). Specifically, if the value of zero does not fall within the 2.5% to 97.5% range of the confidence interval, the path coefficient is considered significant (Sarstedt et al., 2021). This criterion ensures that the paths in the structural model are both statistically significant and substantively meaningful.

1. Antecedents of digitalization

   The initial analysis investigates the influence of enterprise resources - specifically IT infrastructure (INF), digital skills (SKI), and leadership (LED) - on digitalization capability. According to the findings, INF significantly impacts both the digitalization overall degree

(DIGO) and digitalization technology adoption (DIGT), with path coefficients of 0.2172 and 0.2731, respectively. Similarly, SKI demonstrate significant effects on DIGO and DIGT, with path coefficients of 0.4158 and 0.2668. Moreover, LED shows a significant influence on DIGO and DIGT, with path coefficients of 0.2574 and 0.2075. Therefore, based on the results from Table 15, hypotheses H1, H4, and H7 are supported. This suggests that enterprise resources encompassing tangible, intangible, and human capital collectively form the foundational elements contributing to digitalization capability within organizations. These findings underscore the critical role of these resources in enabling and fostering digital transformation initiatives.

2. The mediation role of digitalization in the relationship between enterprise resources and financial performance

   The second set of analyses delved into examining both the direct and indirect impacts of enterprise resources on financial performance. By exploring the indirect effects, this research aimed to elucidate the intermediary role of digitalization in enhancing the financial performance of organizations. Initially, in terms of the direct influence on financial performance (FINP), INF, SKI, and LED exhibited insignificant impacts, with path coefficients of -0.0321, 0.1665, and 0.1717, respectively. Consequently, hypotheses H2, H5, and H8 were not supported.

   Subsequently, to explore whether the relationship between enterprise resources and financial performance is mediated by digitalization, this study employed mediation analysis, as recommended by Zhao et al. (2010). The mediation analysis conducted in this study aimed to ascertain the presence of a significant indirect relationship between independent variables and dependent variables (Zhao et al., 2010). As indicated in Table 15, the study identified a notable mediating effect of DIGT on the association between INF and FINP, with a path coefficient of 0.0713. Similarly, the study revealed an indirect effect between SKI and FINP with a path coefficient of 0.0697, as well as between LED and FINP with a path coefficient of 0.0542. However, no significant mediating effect of DIGO on the relationship between enterprise resources and financial performance was observed. Consequently, the study partial supports hypotheses H3, H6, and H9.

3. The impact of digitalization capabilities on financial performance

   The pivotal analysis in this study examines the influence of digitalization capabilities, specifically DIGO and DIGT, on enterprise FINP. The findings, detailed in Table 15,

underscore a significant positive impact of DIGT on FINP, characterized by a path coefficient of 0.2611. However, the study also reveals an insignificant impact of DIGO on FINP, with a path coefficient of 0.1504. Thus, indicating that among the two facets of digitalization capabilities examined, only DIGT exerts a discernible influence on FINP. This supports hypothesis H11 while rejecting hypothesis H10.

Furthermore, to assess the role of the Field/Sector variable in the relationship between digitalization capabilities and financial performance, the study incorporates the Field as a mediating variable. Analysis results presented in Table 15 indicate that the Field variable exhibits negligible influence on the relationships between DIGO, DIGT, and FINP, with path coefficients of -0.0293 and 0.0264, respectively. Consequently, the study rejects hypothesis H12 simultaneously, suggesting that Field does not significantly moderate the impact of digitalization capabilities on financial performance across different sectors.

Table 15: The result of the structural model

Hypothesis	Explanation	Original Est.	T Stat.	2.5% CI	97.5% CI	Result
H1	**INF -> DIGO**	**0.2172**	**2.8525**	**0.0715**	**0.3673**	**Supported**
	INF -> DIGT	**0.2731**	**3.1808**	**0.1000**	**0.4393**	
H2	INF -> FINP	-0.0321	-0.3078	-0.2292	0.1754	Rejected
H3	INF_DIGO_FINP	0.0327	1.1044	-0.0150	0.1022	**Partial supported**
	INF_DIGT_FINP	**0.0713**	**2.2807**	**0.0186**	**0.1391**	
H4	**SKI -> DIGO**	**0.4158**	**4.8687**	**0.2474**	**0.5833**	**Supported**
	SKI -> DIGT	**0.2668**	**2.6409**	**0.0717**	**0.4655**	
H5	SKI -> FINP	0.1665	1.6075	-0.0439	0.3615	Rejected
H6	SKI_DIGO_FINP	0.0625	1.2729	-0.0281	0.1660	**Partial supported**
	SKI_DIGT_FINP	**0.0697**	**2.0524**	**0.0136**	**0.1450**	
H7	**LED -> DIGO**	**0.2574**	**4.1045**	**0.1311**	**0.3787**	**Supported**
	LED -> DIGT	**0.2075**	**2.5295**	**0.0440**	**0.3640**	
H8	LED -> FINP	0.1717	1.9429	-0.0082	0.3409	Rejected
H9	LED_DIGO_FINP	0.0387	1.2611	-0.0182	0.1041	**Partial supported**
	LED_DIGT_FINP	**0.0542**	**1.9975**	**0.0085**	**0.1140**	
H10	DIGO -> FINP	0.1504	1.3406	-0.0704	0.3736	Rejected
H11	**DIGT -> FINP**	**0.2611**	**3.3239**	**0.0987**	**0.4085**	**Supported**
H12	DIGO*Field -> FINP	-0.0293	-0.3395	-0.1960	0.1422	Rejected
	DIGT*Field -> FINP	0.0264	0.3395	-0.1301	0.1732	

Source: own research

The empirical findings from this research are depicted in the Figure 16, providing a visual representation of the relationships and impacts elucidated through statistical analyses.

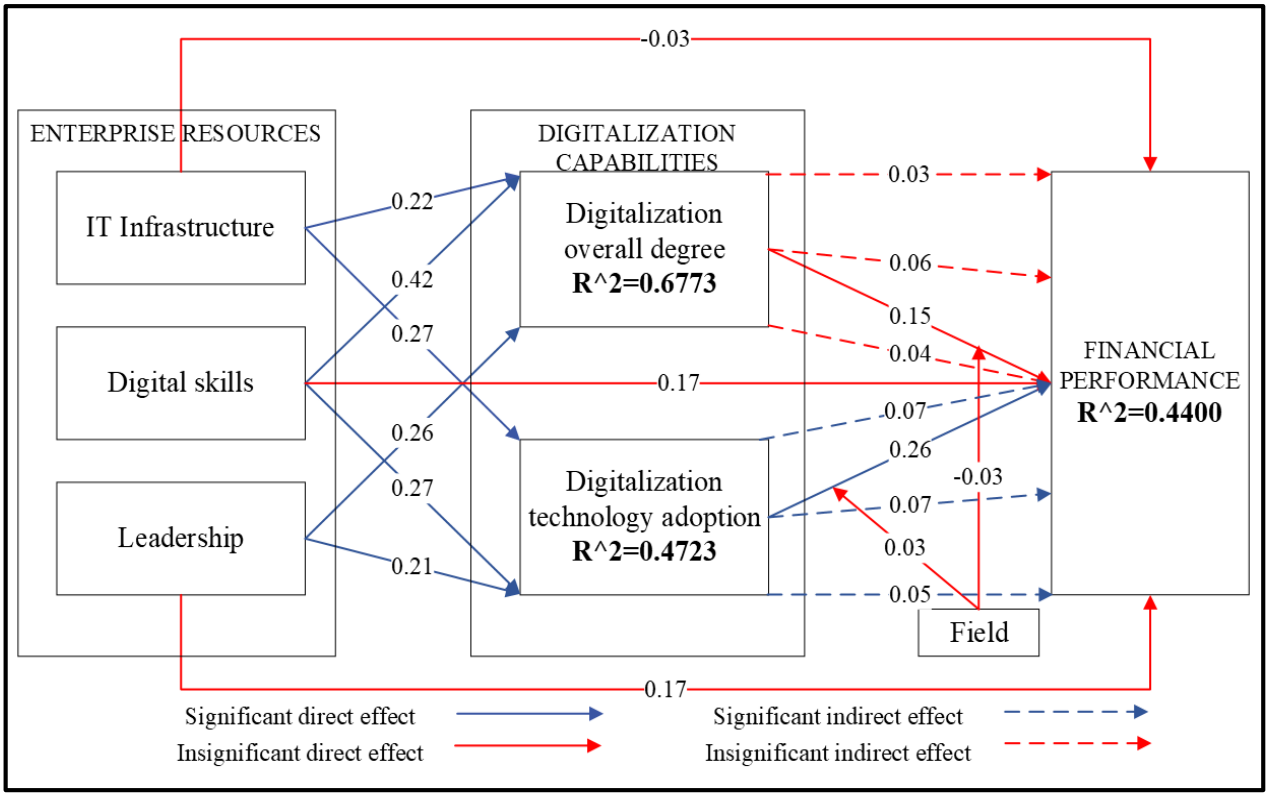


Figure 16: Research model results

Source: own research

6.1.4 The explanatory power and goodness of fit of the research model

While several researchers typically employ various model fit measures to evaluate the adequacy of structural equation models, Hair et al. (2021) and Henseler & Sarstedt (2013) argue that there are no universally accepted fit measures specifically tailored for PLS-SEM. Therefore, researchers often resort to alternative methods, such as assessing R-squared (R^2) values or the model's predictive capabilities (Hair et al., 2021), to comprehensively assess the quality of the model.

In the present study, R^2 values were adopted as a means to gauge the explanatory power of the examined model. According to the guidelines put forth by Hair et al. (2019) in social sciences research, R^2 values are typically interpreted as indicating substantial (75%), moderate (50%), and weak (25%) explanatory power. Based on the statistical outcomes obtained, it was found that INF, SKI, and LED collectively explain 67.73% of the variance in DIGO and 47.23% of the variance in DIGT. Furthermore, DIGO and DIGT together account for 44% of the variance in FINP. These R^2

values suggest that the research model possesses moderate explanatory power, illustrating a substantial proportion of the variability in the dependent variables.

Given that the SEMinR package utilized in this study does not include goodness-of-fit (GoF) measures, the research adhered to the recommendation proposed by Tenenhaus et al. (2005) to compute the global criterion GoF. This criterion involves calculating the geometric mean of average commonality and average R^2, providing a holistic assessment of model adequacy beyond traditional fit indices. This approach ensures that the study not only evaluates the individual contributions of predictors but also integrates them into a comprehensive assessment of the model's overall explanatory capabilities and predictive validity.

$$\text{GoF} = \sqrt{(average\ AVE * average\ R\text{^}2)} = \sqrt{(0.8649 * 0.5299)} = 0.6770$$

The GoF measure of 0.6770 obtained for the PLS model in this study was deemed satisfactory. According to Tenenhaus et al. (2005), who recommended a threshold of 0.36 for GoF, this value exceeds the suggested benchmark, indicating a robust fit of the model. The GoF value of 0.6770 signifies that the PLS model accounts for approximately 67.7% of the achievable fit, underscoring its ability to effectively explain and predict the relationships within the dataset. This finding reinforces the validity and reliability of the PLS-SEM approach adopted in the study, demonstrating its capability to adequately capture and model the complex relationships among variables under investigation.

6.2 The result of semi-structured interview

The main result of semi-structured interviews by experts involve:

- Digitalization is driven by several primary motivations, including enhancing operational efficiency, improving customer experiences, gaining competitive advantage, and fostering innovation. These motivations have evolved over time in response to emerging technologies and shifting market demands.
- Successful digitalization initiatives necessitate meticulous planning, robust cross-functional collaboration, and ongoing monitoring. Common challenges encountered include resistance to change, integration issues, and concerns about data privacy, which are typically mitigated through effective project management, targeted training programs, and active stakeholder engagement.

- Technological advancements central to digitalization efforts encompass AI, IoT, cloud computing, blockchain, data management platforms, content management systems, ERP systems, and financial analytics tools. These technologies play pivotal roles in enhancing organizational efficiency, facilitating informed decision-making processes, and augmenting customer engagement strategies.
- The adoption of digital technologies has also contributed to cultivating cultures of innovation, collaboration, and continuous learning within organizations. Significant investments in leadership management, employee training and knowledge-sharing initiatives have been pivotal in preparing workforces for the challenges of digital transformation.
- The success of digitalization initiatives is commonly assessed through KPIs such as operational efficiency gains, customer satisfaction levels, revenue growth rates, cost savings, and overall profitability improvements. These metrics provide valuable insights into the tangible impacts of digitalization on financial performance and operational outcomes.
- Organizations leveraging digitalization strategies have reported notable enhancements in revenue generation, cost efficiencies, and profitability, driven by improved operational processes and enriched customer interactions.
- Key lessons gleaned from digitalization experiences underscore the importance of agility, proactive stakeholder engagement strategies, and sustained investments in digital skills and technologies. Future strategic priorities include expanding capabilities in AI and machine learning applications, entering new markets, and exploring innovations in blockchain technology and sustainable finance.
- External factors such as regulatory changes, rapid technological advancements, and dynamic market conditions exert significant influences on digitalization strategies. Emerging trends such as smart city initiatives, cloud-based solutions, and the integration of Environmental, Social, and Governance (ESG) criteria are shaping the trajectory of digital transformation efforts.
- To maximize the benefits of digitalization, organizations are advised to prioritize cybersecurity measures, invest in advanced data analytics capabilities, foster a culture of

innovation, and maintain organizational agility. Strategic alignment with business objectives, proactive stakeholder engagement, and continuous adaptation to evolving market dynamics are critical success factors in achieving sustainable digitalization outcomes.

Table 16 details specific aspects of the experts' responses on digitalization strategy, technological infrastructure, and performance measurement & metrics.

Table 16: Result of semi-structured interview

Company	Digitalization strategy	Technological infrastructure	Performance measurement & metric
Company A	Focuses on AI-driven cybersecurity, agile development, and cloud computing. Implements culture stragegies and leadership management.	Uses AI, IoT, cloud computing, and blockchain for enhanced cybersecurity and software development.	Effectiveness of cybersecurity solutions, customer satisfaction, and operational efficiency.
Company B	Emphasizes data analytics, social media integration, and programmatic advertising. Provides digital skills traning program for employees.	Employs data management platforms, content management systems, and advertising technology platforms.	Audience engagement, advertising performance, and financial performance.
Company C	Prioritizes advanced CRM systems, cloud technologies, and data analytics. Focuses on ehancing the digital skills.	Utilizes cloud computing for smart building management, and data analytics.	Operational efficiency, customer satisfaction, and market share growth.
Company D	Leverages ERP systems, electronic invoicing, and financial analytics. Prioritizes in talents and leadership programs.	Implements ERP systems, electronic document management, and financial analytics.	Efficiency gains, error rate reduction, and financial reporting timeliness.

Source: own research

6.3 Discussion

6.3.1 The impact of enterprise resources on digitalization capabilities

1. IT infrastructure

   The findings from the empirical research and the semi-structured interviews underscore the critical importance of INF in advancing both the DIGO and the DIGT) within organizations. This is consistent with existing literature emphasizing the pivotal role of robust digital infrastructure in driving digital transformation. For instance, Brieger et al. (2022)

highlighted that a strong digital infrastructure is foundational for new ventures aiming for internationalization, as it supports seamless integration and enhances operational efficiency across borders. This perspective aligns with research findings, which suggest that a well-established IT infrastructure significantly enhances the degree of digitalization within organizations.

Similarly, Jia et al. (2024) provide evidence through a quasi-natural experiment based on the "Broadband China" strategy, demonstrating that improvements in network infrastructure substantially boost enterprise digital transformation. This reinforces thesis findings, which indicate that robust IT infrastructure is a critical enabler for the adoption of digital technologies within enterprises. The path coefficient of 0.2731 for DIGT in the study further validates this assertion, highlighting IT infrastructure as a crucial element in facilitating technological advancements in digitalization processes.

Prior research by Schwertner (2017) and Urbach et al. (2019) also support the transformative impact of digitalization on business operations and IT departments, respectively. The study findings agree, indicating that IT infrastructure plays a significant role in enhancing both the overall degree of digitalization and the rate of technology adoption. Additionally, Eller et al. (2020) and Scuotto et al. (2017) identify digital readiness, including the robustness of IT infrastructure, as a key determinant for successful digital transformation in SMEs. The study provides further empirical evidence that IT infrastructure is instrumental in strengthening digitalization capabilities, which are essential for achieving operational efficiency and maintaining a competitive edge.

The insights gathered from the interviews also reveal that successful digitalization initiatives are closely linked with specific technological components, such as AI, IoT, cloud computing, blockchain, and data management platforms. These technologies not only facilitate informed decision-making processes and enhance customer engagement strategies but also underpin the broader digital transformation efforts across various organizational contexts. As demonstrated in Table 16, companies with a strong focus on AI-driven cybersecurity, agile development, and cloud computing, or those emphasizing advanced data analytics and programmatic advertising, rely heavily on their technological infrastructure to measure performance metrics, such as operational efficiency, customer satisfaction, and financial performance.

Furthermore, the study by Manny et al. (2021) identify several barriers to digital transformation within infrastructure sectors, such as regulatory challenges and the lack of digital skills. While these barriers are significant, our findings suggest that a robust IT infrastructure can mitigate some of these challenges by facilitating smoother technology adoption and integration. This points to the necessity of continuous investment in IT infrastructure to ensure its alignment with evolving digital transformation needs.

2. Digital skills

   The findings from this study highlight the significant role of SKI in both the DIGO and the DIGT. These results are consistent with the broader academic literature, which emphasizes the critical role of digital skills in facilitating successful digital transformation efforts.

   Experts interviewed for this study noted that digitalization is driven by several motivations, such as enhancing operational efficiency, improving customer experiences, gaining competitive advantage, and fostering innovation. The importance of digital skills is evident in these areas, as they are essential for navigating emerging technologies and responding to shifting market demands. For instance, organizations that have successfully implemented digitalization initiatives have done so by investing in digital skills development, which has proven to be a crucial component in overcoming common challenges such as resistance to change, integration issues, and concerns about data privacy.

   This aligns with the findings of Ciarli et al. (2021), who argue that digital skills are fundamental for leveraging the potential of digital technologies and driving innovation within organizations. The thesis findings corroborate this perspective, showing that digital skills significantly contribute to the DIGO and the DIGT. Similarly, Cirillo et al. (2023) underscore the necessity for continuous investment in digital skills to facilitate effective technology adoption and integration, a sentiment that is reflected in the path coefficients observed in our study (0.4158 for DIGO and 0.2668 for DIGT). These coefficients highlight the substantial impact that digital skills have on both the extent of digitalization and the adoption of new digital technologies.

   Moreover, the research by Demir (2019) supports the view that digital skills are integral to organizational change and the transformation of human resources, suggesting that enhancing digital skills is essential for achieving comprehensive digital transformation. Our findings align with this perspective, as the significant effects of digital skills on both DIGO and DIGT demonstrate the need for organizations to invest in developing these

competencies across their workforce. Molla et al. (2024) extend this argument by emphasizing that digital skills are not solely the domain of IT departments but are crucial across all organizational levels. This broader perspective is echoed in our study, where the impact of digital skills on overall digitalization and technology adoption suggests that organizations must cultivate digital competencies across diverse functional areas to maximize the benefits of digitalization.

Furthermore, studies by Eller et al. (2020) and Abou-Foul et al. (2021) highlight digital skills as a key antecedent for successful digitalization in SMEs. Likewise, Ribeiro-Navarrete et al. (2021) and Zhou et al. (2021) focus on the effects of digitalization on business performance and the role of HRM digitalization in enhancing firm performance. These studies reinforce the importance of digital skills in improving organizational performance, a notion supported by our findings, which demonstrate the significant effects of digital skills on digitalization outcomes.

The qualitative insights obtained from semi-structured interviews further illustrate how different organizations approach the development and integration of digital skills within their digitalization strategies. For example, Company B places a strong emphasis on data analytics, social media integration, and programmatic advertising, accompanied by targeted digital skills training programs for employees to enhance their ability to use new technologies effectively. Similarly, Company C focuses on a strategic emphasis on the implementation of advanced CRM systems, cloud computing technologies, and data analytics tools, thus, it prioritizes the enhancement of digital skills across its workforce to leverage these technologies and support its overall digital transformation objectives. The semi-structured expert interviews also provided insights into both “soft” ROI and “hard” ROI dimensions of return on investment. “Soft” ROI, as illuminated through the expert interviews, captures the non-tangible yet impactful benefits of organizational initiatives. Better team collaboration and adherence to policies foster a cohesive work environment that aligns with organizational goals. These factors, while difficult to quantify, are instrumental in shaping higher employee satisfaction and morale, nurturing a positive company culture. A positive company culture and enhanced collaboration can directly impact productivity and process efficiency, ultimately translating into quantifiable gains. These approaches underscore the importance of continuous investment in digital competencies to adapt to technological changes and market dynamics.

3. Leadership

The results from the empirical research and semi-structured interviews highlight the crucial role of leadership in driving digital transformation within organizations. LED significantly influences both the DIGO and DIGT. This aligns with existing literature that emphasizes the importance of leadership in navigating the complexities of digital transformation and fostering an environment conducive to technology adoption and innovation.

The study confirms that effective leadership is central to the success of digital transformation efforts, resonating with findings from Larjovuori et al. (2016), who underscored the pivotal role of leadership in managing organizational change and maintaining employee engagement during digitalization processes. The research findings indicate that leadership not only supports the technical aspects of digitalization but also addresses organizational culture and employee well-being, which are essential for a successful transformation. The significant influence of LED on DIGO (0.2574) and DIGT (0.2075) in this study illustrates its impact on driving comprehensive digitalization and technology adoption.

Magesa & Jonathan (2022) identify several critical attributes of effective digital leadership, including visionary thinking, adaptability, and the capacity to foster a digital culture. These characteristics are reflected in the significant path coefficients observed in the study, underscoring the role of leadership in shaping an organization's digital capabilities. Leaders who exhibit these qualities are better positioned to steer their organizations through the evolving digital landscape, ensuring alignment with strategic digital objectives. Ruel et al. (2021) discuss the importance of leadership in promoting a culture of continuous learning and innovation, which is vital for navigating digital transformation. The findings of this study corroborate this view, demonstrating that leadership plays a crucial role in both setting strategic directions for digital growth and cultivating an environment that supports continuous technological adoption. This dual role of leadership is essential for organizations to maintain their competitive edge in rapidly changing technological and market environments. Škare and Soriano (2021) highlight the connection between digitalization and organizational agility, with leadership identified as a key factor in enhancing this agility. The study's findings, which show significant impacts of leadership on both DIGO and DIGT, align with their argument. Leadership facilitates digitalization processes that enable organizations to respond swiftly to technological changes and

dynamic market conditions, thereby fostering greater organizational agility. In examining the digital transformation of SMEs, Estensoro et al. (2022) argue that leadership is a critical resource in guiding these firms through the complexities of digitalization. The findings of this study reinforce this argument, demonstrating that strong leadership significantly impacts both the overall degree of digitalization and technology adoption. Effective leadership is thus essential for SMEs to overcome the challenges associated with digital transformation and achieve higher levels of digital maturity.

Overall, the research findings highlight leadership as a critical enabler of digital transformation. Effective leaders foster a culture of innovation, promote strategic alignment, and ensure that their organizations remain adaptable and responsive to technological advancements. This is further evidenced by the practices of organizations discussed in Table 16, where diverse digitalization strategies, technological infrastructures, and performance metrics underscore the central role of leadership in shaping digital initiatives. Leaders in these organizations have implemented strategies ranging from AI-driven cybersecurity and cloud computing to data analytics and financial management, illustrating the varied ways in which leadership drives digital transformation across different sectors.

6.3.2 The mediation role of digitalization

1. On the relationship between IT infrastructure and financial performance

   The research results indicate that INF exhibits an insignificant direct impact on FINP. However, the study identifies a notable mediating effect of DIGT on the association between INF and FINP, while no significant mediating effect of DIGO on this relationship was found.

- Firstly, the finding that IT infrastructure has an insignificant direct impact on financial performance is consistent with some previous studies that suggest the benefits of IT infrastructure may not always be directly observable in financial terms. Carcary et al. (2017) argue that while IT infrastructure is crucial for supporting digital transformation, its direct impact on financial performance may be less apparent because its primary role is enabling other capabilities rather than generating financial outcomes directly. This supports the notion that IT infrastructure serves as an enabler rather than a direct driver of financial performance. Ghosh et al. (2022) adopt a Dynamic capabilities approach and suggest that

IT infrastructure contributes to financial performance by enhancing the firm's ability to respond to environmental changes and by supporting other dynamic capabilities such as innovation and agility. This perspective aligns with our finding of an insignificant direct impact, as IT infrastructure's value may be realized through its interaction with other capabilities, such as digital technology adoption, rather than through direct financial outcomes.

- Secondly, the significant mediating effect of DIGT on the relationship between IT infrastructure and financial performance is a critical finding. This suggests that IT infrastructure contributes to financial performance primarily through its impact on the adoption of digital technologies. Ramirez et al. (2010) provide empirical evidence that IT infrastructure positively influences business value through its role in organizational process redesign and efficiency improvements. They argue that IT infrastructure enables the adoption of advanced technologies that enhance business processes, leading to improved financial outcomes. This aligns with our finding that digital technology adoption mediates the relationship between IT infrastructure and financial performance, highlighting the importance of IT infrastructure in facilitating technological advancements that drive financial gains. Huang et al. (2012) discuss the role of IT in achieving operational agility, using Haier, China as a case study. They demonstrate that IT infrastructure enables firms to adopt new technologies and respond quickly to market changes, thereby improving overall performance. Our findings resonate with this perspective, as the mediating role of digital technology adoption emphasizes how IT infrastructure supports the adoption of technologies that enhance agility and, consequently, financial performance.
- Finally, the lack of a significant mediating effect of digitalization overall degree (DIGO) on the relationship between IT infrastructure and financial performance suggests that the broader scope of digitalization may not directly influence financial outcomes as effectively as specific technology adoption. This may be because overall digitalization encompasses a wide range of activities and processes, not all of which have immediate financial implications. Čater and Čater (2009) discuss how intangible resources, such as IT capabilities, contribute to competitive advantage and performance. They suggest that the impact of such resources may be more indirect and mediated by other factors, such as innovation and process improvements. This supports our finding that the broader scope of DIGO does not significantly mediate the relationship between IT infrastructure and

financial performance, as the benefits of digitalization are likely realized through more specific and targeted DIGT.

2. On the relationship between Digital skills and financial performance

   The research results indicate that while SKI exhibit insignificant direct impacts on FINP, there is a notable mediating effect of DIGT on the association between digital skills and financial performance. In contrast, no significant mediating effect of the DIGO on this relationship was found.

- Firstly, the finding that digital skills do not have a direct significant impact on financial performance aligns with previous research suggesting that skills alone may not directly translate into financial outcomes. Cantoni & Mangia (2018) emphasize the role of human resource management in digitalization, arguing that while digital skills are crucial, their impact is often indirect, mediated through various organizational processes and technological adoptions that leverage these skills. This perspective is consistent with our finding that digital skills alone do not directly enhance financial performance but do so through the adoption of digital technologies. Ciarli et al. (2021) also discuss the importance of digital skills in fostering innovation and enabling the effective use of digital technologies. They suggest that digital skills are foundational but need to be complemented by other organizational resources and processes to realize financial benefits. This supports the thesis finding that digital skills impact financial performance primarily through their role in facilitating digital technology adoption.

- Secondly, the significant mediating effect of digitalization technology adoption (DIGT) on the relationship between digital skills and financial performance highlights the critical role of technological implementation. This finding resonates with Cirillo et al. (2023), who examine the adoption of digital technologies and emphasize that the effective use of these technologies depends heavily on the presence of digital skills within the workforce. Their research shows that digital skills enhance the ability to adopt and utilize digital technologies, which in turn drives financial performance. This supports the research conclusion that digital skills indirectly influence financial performance through their impact on technology adoption. Kotler et al. (2021) in "Marketing 5.0" also emphasize the importance of digital skills in leveraging new technologies for improved business performance. They argue that digital skills enable organizations to better implement and utilize digital tools, leading to enhanced customer engagement and operational efficiency,

which ultimately contribute to financial performance. This aligns with the study's finding that digital technology adoption mediates the relationship between digital skills and financial outcomes.

- Finally, the absence of a significant mediating effect of the DIGO suggests that a broad scope of digitalization efforts may not directly translate into financial performance enhancements. This may be because overall digitalization encompasses various activities and processes, not all of which have immediate financial implications. Sidhu (2015) discusses the digital revolution and the transformative potential of connected digital innovations. While he acknowledges the broad impacts of digitalization, his work suggests that specific, targeted digital initiatives often have more immediate and measurable financial impacts compared to broad, overall digitalization efforts. This supports the research finding that the specific DIGT has a more pronounced mediating effect on financial performance than the broader DIGO. Trenerry et al. (2021), in their integrative review on preparing workplaces for digital transformation, highlight the multi-level factors involved in digitalization, including organizational readiness and specific digital skills. They argue that while broad digital transformation efforts are important, the direct financial impacts are more likely to be realized through specific, well-implemented digital technology initiatives. This perspective aligns with the thesis finding that the broader scope of DIGO does not significantly mediate the relationship between digital skills and financial performance.

3. On the relationship between Leadership and financial performance

   The research findings indicate that LED does not have a direct significant impact on FINP but has a notable mediating effect through DIGT.

- Firstly, the insignificant direct impact of leadership on financial performance aligns with the findings of Ismail et al. (2023), who examined the role of leadership in digital transformation in Indonesia. They found that while leadership is crucial for initiating and guiding digital transformation efforts, its direct impact on financial performance is often mediated by other factors such as technological adoption and organizational changes. This supports our result that leadership alone does not directly enhance financial performance but does so through its influence on digital technology adoption. Similarly, Srivastava et al. (2013) argue that leadership contributes to building a sustainable competitive advantage, which indirectly impacts financial performance. They highlight that leadership's value is

often realized through strategic initiatives and organizational capabilities, which aligns with our finding that the effect of leadership on financial performance is mediated by digital technology adoption.

- Secondly, the study's identification of a significant mediating effect of DIGT on the relationship between leadership and financial performance underscores the importance of technology implementation in translating leadership into financial outcomes. Ruel et al. (2021) emphasize the role of leadership in fostering organizational learning and digital business strategizing, which enhances the adoption and effective use of digital technologies. Their research supports the notion that leadership facilitates digital technology adoption, which in turn drives financial performance. Meanwhile, Senadjki et al. (2024) further elaborate on the impact of digital leadership on firm performance through digital transformation. They argue that leaders play a pivotal role in creating a vision for digital transformation, securing necessary resources, and driving the adoption of digital technologies. This aligns with our finding that leadership influences financial performance primarily through its effect on digital technology adoption rather than through direct mechanisms.

- Finally, the absence of a significant mediating effect of the DIGO suggests that broad digitalization efforts, while important, do not directly translate into financial performance improvements. Škare and Soriano (2021) discuss how digitalization contributes to a firm's agility and overall strategic capabilities but highlight that specific technological implementations often have more immediate and measurable financial impacts. This perspective supports our finding that the broad scope of digitalization does not significantly mediate the relationship between leadership and financial performance. Moreover, Ulrich and Ulrich (2015) in their work on the leadership capital index also suggest that the impact of leadership on firm performance is multifaceted and often realized through specific initiatives and organizational practices. This aligns with our result, indicating that the specific DIGT is a more effective mediator between leadership and financial performance than the DIGO.

6.3.3 The impact of digitalization on financial performance

1. Digitalization overall degree

   The research indicated that the DIGO has an insignificant direct impact on FINP. Digitalization in organizations encompasses a wide range of elements, including digital artifacts, platforms, infrastructures, business models, and management practices (Briel et al., 2018; Giones & Brem, 2017; Nambisan, 2017; Nambisan et al., 2019; Srinivasan & Venkatraman, 2018; Yi et al., 2019). Despite this broad scope, the research confirms that DIGO does not significantly enhance financial performance directly. This aligns with several studies indicating that the financial benefits of digitalization are often mediated by specific practices and technologies rather than by the degree of digitalization itself.

   Niemand et al. (2021) argue that the impact of digitalization in the financial industry is contingent on entrepreneurial orientation and strategic vision. They suggest that digitalization must be coupled with a clear strategic direction and entrepreneurial drive to translate into financial gains. This supports the finding that DIGO alone does not significantly impact financial performance without the integration of strategic and entrepreneurial elements. Eller et al. (2020) also highlight that SMEs face numerous challenges in digitalization, such as resource constraints and technological integration issues, which can mitigate the direct impact of digitalization on financial performance. Their research underscores the importance of addressing these challenges to realize the financial benefits of digitalization, aligning with the current finding that DIGO's impact is not straightforwardly positive. Cherkasova and Slepushenko (2021) explore the digitalization of Russian companies and find mixed results regarding its impact on financial performance. They conclude that digitalization can lead to financial benefits only when supported by complementary organizational changes and strategic alignment. This parallels the current research, emphasizing that the degree of digitalization must be effectively managed and integrated into the broader business strategy to yield financial improvements. Studies by Ekinci (2021) and Zeng et al. (2022) provide sector-specific insights, particularly in the financial and manufacturing sectors, where digitalization can significantly enhance operational efficiency and customer engagement. However, they also note that these benefits are contingent upon the effective implementation of digital technologies and the alignment of digital initiatives with organizational goals. This aligns

with the current research, suggesting that while DIGO provides a framework, the financial impact is realized through targeted digital technology adoption.

The results from the semi-structured interviews reinforce these findings, highlighting several motivations for digitalization, including enhancing operational efficiency, improving customer experiences, gaining competitive advantage, and fostering innovation. However, experts also identified challenges such as resistance to change, integration issues, and data privacy concerns, which must be mitigated through effective project management, robust cross-functional collaboration, and continuous monitoring. These insights underscore that the financial impact of digitalization is not simply a function of the degree of digital adoption but rather depends on how well organizations plan, execute, and align their digital strategies with broader business objectives.

Additionally, the interviews suggest that the success of digitalization initiatives is assessed through KPIs such as operational efficiency gains, customer satisfaction, revenue growth, cost savings, and overall profitability improvements. These metrics provide a nuanced understanding of how digitalization impacts financial performance. Organizations leveraging digital strategies reported notable enhancements in revenue generation, cost efficiencies, and profitability, driven by improved operational processes and enriched customer interactions. However, these benefits were realized not merely by achieving a high degree of digitalization but by strategically aligning digital initiatives with specific business goals.

2. Digitalization technology adoption

   The findings from empirical research and the semi-structured interviews underscore the significant positive impact of DIGT on FINP. Digital technology adoption involves the integration of various advanced technologies, such as Social media, Mobile platforms, Big data analytics, Cloud computing, the IoT, Platform development, and AI-related technologies, which are crucial for enhancing organizational capabilities, operational efficiency, and innovation (Sebastian et al., 2017; Sturgeon, 2021; Vial, 2019). These improvements, in turn, translate into enhanced financial outcomes.

   The relationship between digital technology adoption and financial performance is closely linked to strategic alignment and effective implementation. As Eller et al. (2020) suggest, while digitalization offers potential benefits such as operational efficiencies and new business opportunities, its direct impact on financial performance depends significantly on

how well these technologies are integrated into the organization's overall strategy. The current study supports this perspective, indicating that the positive effects of DIGT on FINP are contingent upon aligning digital initiatives with broader organizational goals.

The findings also align with the study by Cherkasova & Slepushenko (2021), which demonstrates that the effective adoption and integration of digital technologies can enhance productivity and market competitiveness. The experts interviewed in this research emphasize that digitalization is driven by motivations such as enhancing operational efficiency, improving customer experiences, gaining a competitive advantage, and fostering innovation. These motivations suggest that the adoption of digital technologies not only improves internal processes but also positions companies more favorably in the marketplace, thereby contributing to better financial performance.

The role of digital technologies in service innovation is also highlighted in the literature. Abou-Foul et al. (2021) find that firms leveraging digital technologies for service innovation achieve higher profitability and growth rates. This finding is reinforced by the current study's observation that companies adopting digitalization strategies report notable improvements in revenue generation, cost efficiencies, and profitability. For instance, Company B focuses on data analytics, social media integration, and programmatic advertising, all of which are enabled by digital technologies, resulting in enhanced audience engagement, advertising performance, and overall financial performance (Table 16).

Sector-specific insights provided by Fernández-Portillo et al. (2022) and Luu et al. (2023) further illustrate how digitalization influences financial performance across various industries, including SMEs. These studies highlight the importance of innovation and strategic adaptation in leveraging digital technologies for financial gains. For example, Company C prioritizes advanced CRM systems and cloud technologies, resulting in improved operational efficiency, customer satisfaction, and market share growth (Table 16). This reflects the relevance of digital technology adoption in driving financial performance improvements across different contexts.

The study’s findings also resonate with those of Autio et al. (2021) and Blichfeldt & Faullant (2021), who emphasize the transformative effects of digital technology adoption on business models and innovation. Digital technologies such as AI, IoT, cloud computing, and blockchain are central to enhancing organizational efficiency, facilitating informed decision-making, and augmenting customer engagement strategies. These technologies

play a critical role in transforming traditional business models into more agile and innovative ones, thereby contributing to improved financial and sustainability performance. The success of digitalization initiatives is frequently assessed using KPIs such as operational efficiency gains, customer satisfaction levels, revenue growth rates, cost savings, and overall profitability improvements. These metrics provide valuable insights into the tangible impacts of digitalization on financial performance. The study's findings confirm that organizations leveraging digitalization strategies report significant enhancements in financial outcomes, driven by improved operational processes and enriched customer interactions. This reflects the direct and measurable impact of digital technology adoption on financial performance.

3. Impact of Field on the relationship between digitalization and Financial performance

   The findings of the research indicated that the sector (Field variable) has an insignificant influence on the relationships between digitalization (DIGO and DIGT) and FINP.

   The study's observation of sectoral differences in how digitalization influence financial achievements aligns with various scholarly perspectives. For instance, Favoretto et al. (2022) highlight the transformative effects of digitalization on companies' transition towards services, emphasizing how these changes can vary across sectors. Similarly, Holmlund et al. (2017) discuss how digitalization challenges institutional logics, which can manifest differently in service-oriented sectors compared to traditional manufacturing or financial services sectors.

   Conversely, studies like those by Cherkasova & Slepushenko (2021) and Zeng et al. (2022) delve into sector-specific impacts of digitalization on financial performance. Cherkasova & Slepushenko (2021) explore this within Russian companies, while Zeng et al. (2022) provide evidence from Chinese firms, illustrating varying degrees of digitalization's financial effects across different economic contexts. Moreover, the research contributes to the ongoing discourse on the intersection of digitalization and financial performance, echoing findings from Abou-Foul et al. (2021) and Ribeiro-Navarrete et al. (2021), who empirically analyze how digitalization and servitization influence financial outcomes. These studies underscore the nuanced nature of digital transformation's financial impacts, which can be contingent on sectoral dynamics and organizational strategies.

   In light of these comparisons, the negligible path coefficients (-0.0293 and 0.0264) observed in the present study suggest that while digitalization initiatives like digital

operations and digital technologies may have intrinsic value across sectors, their direct influence on financial performance might be moderated by sector-specific factors such as regulatory environments, market structures, and customer behaviors. Furthermore, the findings resonate with the theoretical frameworks discussed by Kohtamäki et al. (2020) and Autio et al. (2021), emphasizing the role of servitization and business model innovation in capturing the financial benefits of digitalization. These frameworks provide a lens through which to interpret how sectoral nuances can shape the outcomes of digital initiatives on financial metrics.

7. CONCLUSIONS AND NOVEL FINDINGS

7.1 Main conclusions

This dissertation provides a comprehensive examination of the antecedents and impacts of digitalization capabilities within enterprises, offering several key conclusions:

1. The role of enterprise resources in enhancing digitalization capabilities

   The research demonstrates that key enterprise resources, namely, IT infrastructure, digital skills, and leadership are critical in significantly enhancing an organization's digitalization capabilities. These resources collectively influence both the overall degree of digitalization and the specific adoption of digital technologies within organizations. The empirical analysis shows that IT infrastructure, digital skills, and leadership constitute foundational elements that bolster digitalization capabilities. For instance, IT infrastructure not only forms the technological backbone required for digital transformation but also directly affects the extent to which digital technologies are adopted. Similarly, digital skills ensure the workforce is proficient in using digital tools, while leadership provides the strategic vision and support needed for successful digitalization. The significance of these findings is further underscored through semi-structured interviews with experts from four diverse companies in Vietnam, which reveal how these resources are effectively mobilized to support digital initiatives.

2. Indirect impact on Financial performance

   The study finds that these key enterprise resources do not have a significant direct impact on financial performance. This is an important finding, as it suggests that simply possessing a robust IT infrastructure, a skilled workforce, and strong leadership does not inherently lead to improved financial outcomes. Rather, the research highlights the critical mediating role of digital technology adoption in this relationship. Mediation analysis reveals that the adoption of specific digital technologies acts as a crucial intermediary that enhances financial performance. This implies that the effectiveness of digital resources is realized through their strategic application and integration into business processes rather than through their mere presence. Thus, it is the targeted use of digital technologies, rather than a broad accumulation of digital capabilities, that drives financial success.

3. Differentiated impacts of digitalization on Financial performance

   The research further distinguishes between the overall degree of digitalization and the adoption of digital technologies in terms of their impact on financial performance.

- The findings suggest that the overall degree of digitalization does not have a significant direct impact on financial outcomes. This observation aligns with existing literature, which indicates that while digitalization encompasses various components such as digital artifacts, platforms, and management practices, its direct financial benefits are often mediated by specific practices and technologies rather than the extent of digitalization itself. The study emphasizes that financial benefits are contingent upon strategic direction and effective implementation, rather than simply the extent or breadth of digitalization.
- Conversely, the study finds that the adoption of digital technologies has a significant positive impact on financial performance. The integration of advanced technologies such as AI, the IoT, cloud computing, and Big data analytics plays a crucial role in enhancing organizational capabilities, operational efficiency, and innovation. This finding aligns with expert opinions, which assert that financial benefits are realized when these technologies are strategically aligned with organizational goals. Effective digital technology adoption leads to increased productivity, greater market competitiveness, and higher profitability, demonstrating the importance of targeted technological investments.

4. Sector insensitivity of digitalization's financial impact

   The study also reveals that the sector (referred to as the Field variable) does not significantly moderate the relationship between digitalization and financial performance. This suggests that while digitalization initiatives have intrinsic value, their direct financial impact may be moderated by sector-specific factors such as regulatory environments and market structures. This finding underscores the importance of business model innovation and servitization offering services based on products as critical strategies for capturing the financial benefits of digitalization.

Overall, the research provides a nuanced understanding of the interplay between digital resources and organizational outcomes. It offers practical insights for enterprises on how to strategically leverage IT infrastructure, enhance digital skills among employees, and foster leadership that supports digital transformation. These findings contribute to the broader discourse on digitalization

by emphasizing the importance of strategic digital technology adoption in achieving financial success and driving organizational growth in the digital era.

7.2 Novel findings for Vietnam enterprises

1. Mediation effect of Digitalization technology adoption

   The adoption of digital technologies is pivotal for the financial performance of Vietnamese enterprises, particularly in the context of the country's rapid digitalization efforts. The research highlights that IT infrastructure, digital skills, and leadership alone may not directly influence financial outcomes. However, their integration into targeted digital technology adoption significantly impacts financial performance. For Vietnamese enterprises, which are navigating challenges such as uneven digital infrastructure and varying levels of digital literacy, this underscores the importance of strategic investments in digital technologies tailored to operational needs. Enterprises that align their resources with specific digital tools, such as E-commerce platforms or digital payment systems, can optimize their financial results and remain competitive in Vietnam's fast-evolving digital economy.

2. Limited impact of Digitalization overall degree

   The study challenges the prevailing assumption that increasing the overall degree of digitalization within an enterprise will invariably lead to enhanced financial performance. The study's finding that a general increase in digitalization does not inherently improve financial performance is particularly relevant for Vietnamese enterprises. Many businesses, especially SMEs, have pursued broad digitalization strategies, as evidenced by increasing internet penetration and E-commerce adoption rates. However, this research suggests that such efforts must be strategically focused. For Vietnamese enterprises, prioritizing digitalization in high-impact areas like logistics, customer engagement, or production efficiency could yield better financial results. This targeted approach aligns with Vietnam's unique challenges, such as regional disparities in digital infrastructure and the nascent adoption of advanced Industry 4.0 technologies.

3. Sector insensitivity of digitalization benefits

   Another novel finding of this research is the observation that the field or sector of an enterprise does not significantly moderate the impact of digitalization capabilities on

financial performance. The universality of digitalization's impact across sectors holds significant implications for Vietnam's diverse industries. Whether in manufacturing, real easte, retail, E-commerce, or fintech, digital transformation strategies are shown to benefit enterprises irrespective of their sector. This finding supports Vietnam's broad-based digitalization efforts and provides policymakers with a clear mandate to advocate for sector-agnostic strategies. For Vietnamese enterprises, this insight simplifies digital transformation planning, enabling them to adopt best practices from other industries and leverage government-supported initiatives to achieve comparable financial benefits.

These findings collectively emphasize the need for Vietnamese enterprises to adopt a more nuanced approach to digital transformation. Rather than pursuing widespread digitalization indiscriminately, businesses should focus on areas that directly align with their strategic goals. The evidence also underscores the importance of leadership and workforce development in ensuring successful digital technology adoption. Policymakers must continue to address challenges such as digital infrastructure gaps and talent shortages to facilitate effective enterprise digitalization. With such strategic focus and support, Vietnamese enterprises can better navigate their digital transformation journey and unlock their potential for sustained growth and competitiveness in the global economy.

7.3 Suggestions for Enterprises and recommendations for Government

1. Suggestions for Vietnamese enterprises

- Strategic investment in digital technologies: Enterprises should prioritize strategic investments in specific digital technologies that are directly aligned with their operational efficiency and financial performance goals. Instead of pursuing a broad approach to digitalization, which may dilute resources and focus, companies should concentrate on adopting digital technologies that offer the most significant potential for improving their core business processes and outcomes. For instance, investing in advanced data analytics tools can provide insights that drive better decision-making and operational efficiencies, while automation technologies can streamline routine tasks and reduce costs. By focusing on targeted digital technology adoption, enterprises can achieve more substantial and measurable improvements in their financial performance.
- Comprehensive Digital skills training: Organizations must implement extensive and ongoing digital skills training programs to ensure that their workforce is capable of

effectively utilizing new and emerging digital technologies. This training should cover a broad spectrum of digital competencies, from basic IT skills to advanced technical expertise required for operating complex digital systems. By fostering a culture of continuous learning and skill development, enterprises can enhance their overall digital capability, making their employees more adaptable and proficient in leveraging digital tools. This not only drives digital transformation but also positions the organization to better respond to the dynamic demands of the digital economy.

- Fostering Digital leadership: Leadership plays a crucial role in the successful implementation of digital transformation initiatives. Enterprise leaders should actively support and champion digital innovation, creating a culture that embraces change and encourages the adoption of new technologies. Leaders should be well-versed in digital trends and possess the vision to integrate digital strategies with the organization's overall objectives. By fostering digital leadership, companies can navigate the complexities of digital transformation more effectively and ensure that digital initiatives are aligned with strategic goals. This involves not only top-level executives but also empowering middle management and other key personnel to take on digital leadership roles, thus embedding a digital-first mindset throughout the organization.

2. Recommendations for Government

- Support for Digital infrastructure development: Governments should take an active role in developing robust digital infrastructure, particularly in underdeveloped and rural areas. Investment in high-speed internet, reliable connectivity, and other foundational technologies is essential to enable enterprises to fully leverage digital tools and platforms. By creating a strong digital infrastructure, governments can facilitate the widespread adoption of digital technologies, fostering an environment conducive to digital transformation and economic growth. This infrastructure development is critical for bridging the digital divide and ensuring that all regions can participate in and benefit from the digital economy.
- Incentives for Digital skills training: Policymakers should provide incentives for enterprises to invest in digital skills training for their workforce. These incentives could include tax breaks, grants, or subsidies for companies that offer comprehensive digital education and training programs. By encouraging enterprises to develop the digital competencies of their employees, governments can help build a more digitally proficient workforce, which is

crucial for the success of national digital transformation efforts. This approach ensures that the workforce is adequately prepared to handle the demands of digital technologies, enhancing overall productivity and competitiveness.

- Promotion of Digital leadership programs: Government initiatives should aim to develop and promote digital leadership capabilities across industries. This could involve creating specialized training programs, leadership development workshops, and certification courses focused on digital leadership. By fostering digital leadership, policymakers can ensure that industry leaders are well-equipped to guide their organizations through the complexities of digital transformation. Strong digital leadership is essential for driving innovation, improving operational efficiencies, and enhancing the competitiveness of the national economy. By promoting digital leadership, governments can facilitate smoother transitions to digitalized operations and help businesses achieve sustainable growth in the digital age.

7.4 Research limitations and future orientations

1. Research limitations

   This study, while providing significant insights into the antecedents and impacts of digitalization capabilities, has several limitations that should be addressed in future research. Firstly, the cross-sectional design of the study limits the ability to infer causality and observe long-term impacts. Longitudinal studies would be beneficial in understanding the evolution and sustainability of digital transformation benefits over time. Secondly, the study focuses on a limited number of mediators (IT infrastructure, digital skills, and leadership) without considering other potential factors such as organizational culture, innovation capacity, and employee engagement, which could also influence the relationship between digitalization and financial performance. Thirdly, the generalizability of the findings across different sectors and cultural contexts is not fully established, as the study does not account for sector-specific or cultural variations in digitalization strategies and outcomes. Future research should address these limitations by adopting longitudinal designs, exploring additional mediators, and conducting sector-specific and cross-cultural analyses to provide a more comprehensive understanding of digital transformation processes and their impacts.

2. Research future orientations

- Longitudinal studies on digitalization impact: Future research should prioritize conducting longitudinal studies to capture the long-term effects of digital technology adoption on financial performance across diverse industries. While the current study provides valuable insights into the immediate benefits of digital technology adoption, a longitudinal approach would enable researchers to observe the sustainability and evolution of these benefits over time. Such studies can identify trends, patterns, and potential pitfalls in the digital transformation journey, offering a more comprehensive understanding of how digitalization influences financial outcomes in the long run. This approach will also help distinguish between short-term gains and enduring improvements, thereby providing deeper insights into the strategic value of digital investments.
- Exploration of additional mediators: Further studies should explore additional mediators that might influence the relationship between digitalization and financial performance. Potential mediators such as organizational culture, innovation capacity, and employee engagement could play significant roles in determining the success of digital transformation initiatives. By identifying and analyzing these mediators, researchers can uncover more nuanced factors that contribute to the effectiveness of digitalization efforts. This expanded focus can provide a more holistic view of the digital transformation process, highlighting the importance of fostering a supportive organizational environment, encouraging innovative practices, and enhancing employee engagement to maximize the benefits of digitalization.
- Sector-specific digitalization strategies: Given the varying needs and challenges across different industries, future research should investigate sector-specific digitalization strategies. Understanding whether certain industries derive more benefits from specific digital technologies or approaches can help formulate tailored digital transformation strategies. This sector-specific analysis can identify best practices, key success factors, and potential obstacles unique to each industry, enabling more effective and targeted digital initiatives. By customizing digital strategies to fit the specific requirements of different sectors, enterprises can optimize their digital investments and achieve better outcomes.
- Impact of emerging technologies: Future research should also focus on the impact of emerging technologies, such as AI, blockchain, and the IoT, on digitalization capabilities and financial performance. These advanced technologies represent the next frontier of

digital transformation and have the potential to revolutionize business operations and competitive dynamics. Exploring the implications of these technologies can provide valuable insights into their potential benefits, challenges, and strategic applications. By understanding how emerging technologies can enhance digital capabilities, enterprises can better prepare for future digital transformations and stay ahead in an increasingly technology-driven marketplace.

- Cross-cultural analysis of digitalization: Investigating the impact of cultural differences on digitalization strategies and outcomes can provide valuable insights for multinational enterprises. Cultural contexts can significantly influence the adoption, implementation, and success of digital transformation initiatives. Future research should examine how different cultural environments affect digitalization efforts, identifying best practices and strategies for navigating cultural variations. A cross-cultural analysis can help multinational companies develop more effective global digital strategies that are sensitive to cultural nuances, thereby enhancing the likelihood of success in diverse markets.

SUMMARY

This dissertation examines the key drivers of digitalization within enterprises, such as IT infrastructure, digital skills, and leadership, and their impact on organizational financial performance. It explores how these factors influence digital degree and technology adoption, ultimately affecting financial outcomes and competitiveness. The study provides a nuanced understanding of how digitalization contributes to firm success.

In this study, there are three main objectives including:

1. To examine relevant theories related to enterprise performance in the context of digitalization.
2. To investigate which factors affect the digitalization capabilities of the enterprise.
3. To examine the relationship between digitalization and the financial performance of enterprises in Vietnam.

Two methods are used:

1. PLS-SEM using primary data from survey questionnaires to effectively address the complexities associated with digital transformation and its impact on organizational performance.
2. Semi-structured interviews with experts to understand how digitalization affects financial performance, capturing stakeholder views on technology adoption, organizational change, and process innovation and its outcome.

Four main conclusions are drawn from the results of this study, as follows:

1. Role of resources: IT infrastructure, digital skills, and leadership are crucial for improving digitalization capabilities, as also supported by expert interviews.
2. Indirect financial impact: Key resources alone do not directly boost financial performance; their effect is mediated through the adoption of digital technologies, which enhances financial results.
3. Differentiated impacts: The overall level of digitalization does not directly affect financial performance; however, adopting specific digital technologies significantly improves financial outcomes by increasing efficiency and competitiveness.

4. Sector insensitivity: The financial impact of digitalization is consistent across sectors, indicating that while sector-specific factors may influence outcomes, the fundamental principles of digital transformation are broadly applicable.

Three novel findings for Vietnam enterprises are explored from the research results include:

1. Mediation effect: Digital technology adoption significantly boosts financial performance when IT infrastructure, skills, and leadership are strategically integrated. Targeted tools help Vietnamese enterprises overcome challenges and stay competitive.
2. Limited impact: Broad digitalization efforts don't guarantee financial gains; focused strategies in key areas yield better results. Aligns with Vietnam's unique challenges, including uneven infrastructure and early Industry 4.0 adoption.
3. Sector insensitivity: Digitalization benefits all sectors equally, simplifying strategies for Vietnamese enterprises. Encourages broad, sector-agnostic policies and adoption of best practices for comparable success.

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LIST OF ABBREVIATIONS

Artificial Intelligence:	AI
Average Variance Extracted	AVE
Composite Reliability	CR
Confidence Intervals	CIs
Covariance-Based Structural Equation Modeling	CB-SEM
Customer Relationship Management:	CRM
Digital Density Index	DDI
Digital Economy and Society Index	DESI
Digitalization Overall Degree:	DIGO
Digitalization Technology Adoption	DIGT
Dynamic Capabilities	DC
Enterprise Resource Planning	ERP
Goodness-of-Fit	GoF
Heterotrait-Monotrait	HTMT
Industry Digitalization Index	IDI
Information and Communication Technology(s)	ICT(s)
Internet of Things	IoT
Key Performance Indicators	KPIs
Partial Least Squares Structural Equation Modeling	PLS-SEM
Resource-Based View	RBV
Small and Medium-sized Enterprises	SMEs
Technology-Organization-Environment	TOE
Variance Inflation Factor:	VIF

APPENDICES

Appendix A: Survey questionnaire

Introductory section

Dear Sir/Madam,

I extend my gratitude to you for expressing your interest in my research project.
I am Tran Lam Quynh Tran, and I am conducting this research project as part of the requirements for my Doctor of Philosophy degree at the University of Debrecen, under the esteemed guidance of Professor Emeritus, Dr. Herdon Miklos.
Benefits:
Your participation in this survey offers the opportunity to contribute your valuable knowledge and expertise in the realm of implementing digitalization and utilizing digital technology within your organization. By sharing your insights, you will facilitate our project's comprehensive analysis of the impact of digitalization on organizational performance in Vietnam. This analysis aims to provide a robust assessment of the viability of digitalization, affording managers a clearer understanding of the opportunities and challenges inherent in the process of its implementation.
Risks:
We anticipate no inherent risks associated with your participation in this study. However, should you encounter any uncertainties or concerns during your participation, please do not hesitate to contact us via email at lam.tran@econ.unideb.hu. We are committed to addressing any issues or questions promptly and effectively, ensuring your participation is a safe and productive experience.
Thank you for your consideration, and I look forward to your valuable contributions to our research.
Sincerely,
Tran Lam Quynh Tran

Demographic section

Information of the respondents
1. Your age:
☐ 23-35 years old ☐ 36-50 years old ☐ Over 50 years old
2. Years of work experience at the company:
☐ less than 3 years ☐ 3-5 years ☐ 6-10 years ☐ more than 10 years
3. Which term is the best to describe your role in your organization?
☐ Top manager (Chief executive officer (CEO), Chief financial officer (CFO), Chief operating officer (COO), etc.)
☐ Head of department
☐ Senior staff
☐ Staff
Information of organization
4. The organization size (number of employees)?
☐ Micro-enterprise (Less than 10 employees)
☐ Small enterprise (Between 10 to 50 employees)
☐ Medium enterprise (Between 51 to 200 employees)
☐ Large enterprise (More than 200 employees)
5. The organization age?
☐ Less than 3 years
☐ 3 to 5 years
☐ 6 to 10 years

☐ More than 10 years

6. The scope of organization's activities?

☐ Real estate and construction ☐ Banking and finance

☐ Transportation and storage ☐ Retail and distribution

☐ Other services ☐ Agriculture, Forestry, Fishery and Mining

☐ Manufacturing ☐ IT and communication

☐ Tourism and hospitality ☐ Food and beverage

Main section

1. Questions about your organization resources for digitalization.

Please indicate your level of agreement with the following statement

*(1 represents **strongly disagree**, 5 represents **strongly agree)***

Indicator	Question	1	2	3	4	5
IT infrastructure	The IT infrastructure within our organization is sufficient for digitalization					
	When implementing digitalization, the organization will have sufficient supporting staff					
	When implementing digitalization, the organization will have sufficient support in training					
Digital skills	Our organization promotes continuous learning of the unique properties of digital technologies					
	In our organization, the balance between overall digital skills & specialized digital roles is adequate.					
	In organization, staffs can assemble teams with the right combination of skills for each digital project.					
	My organization provides the employees with the resources or opportunities to obtain the right skills to take advantage of digital trends					
Leadership management	Our top management promotes the digitalization in the organization.					
	Our top management creates support for digitalization initiatives within the organization.					
	Our top management promotes digitalization as a strategic priority within the organization.					

2. Questions about Digitalization capabilities of your organization

Please indicate your level of agreement with the following statement

What is your firm's overall degree of digitalization?

*(1 represents **strongly disagree**, 5 represents **strongly agree)***

Question	1	2	3	4	5
We fully adopt digital artifacts (products or services)					
We fully adopt digital platforms that support digital products and services					
We fully adopt digital infrastructures, such as technology tools and systems					
We fully adopt digital business models					
We fully adopt digital management models					

What is your firm's degree in digital technology adoption?
*(1 represents **very low**, 5 represents **very high**)*

Question	1	2	3	4	5
Big data technology (such as big database, data analysis technology)					
AI technology (such as machine learning)					
Mobile technology (such as mobile Internet, wireless communications)					
Cloud computing technology (such as cloud computing)					
IoT technology (such as network distribution technology)					
Social technology (such as online commerce, instant messaging)					
Platform development technology (such as network platforms)					

3. What is the financial performance ratio of your organization after applying digitalization?
*(1 represents **strongly disagree**, 5 represents **strongly agree**)*

Question	1	2	3	4	5
The profit margin of main business increases					
The rate of return on equity increases					
The rate of return on asset increases					
The cost decreases					
The market share increases					

Appendix B: Semi-structured interview questions

1. Introduction and background

Can you provide information about your organization: Field, sector; Size (micro, small, medium or large); Age?

Can you provide an overview of your role and your involvement in digitalization in your organization?

How would you describe the current state of digitalization within your organization?

2. Digitalization strategy

What were the primary motivations behind initiating digitalization efforts within your organization?

Could you outline the key components of your digitalization strategy?

How has your digitalization strategy evolved over time?

3. Implementation process

Can you outline the process of implementing digitalization initiatives within your organization?

What were the major challenges or obstacles encountered during the implementation phase?

How were these challenges addressed or mitigated?

4. Technological infrastructure

What technologies have been adopted as part of your digitalization efforts? (Big data, IoT, AI, Cloud computing, Social platforms…)

How have these technologies impacted day-to-day operations within the organization?

5. Organizational change and culture

How has the digitalization process influenced the organizational culture within your organization?

What steps have been taken to ensure that employees are adequately prepared for and engaged in the digitalization journey?

6. Performance measurement and metrics

How do you assess the success of your digitalization initiatives?

What key performance indicators (KPIs) do you use to evaluate relationship between digitalization and financial success?

7. Financial impact

Can you discuss any observable effects of digitalization on the financial performance of your organization?

Have you seen any improvements in revenue, cost savings, or other financial metrics as a result of digitalization efforts?

How do you attribute these changes to the digitalization process?

8. Lessons learned and future outlook

What lessons have you learned from the digitalization journey so far?

How do you envision the future of digitalization within your organization?

Are there any upcoming digitalization initiatives or areas of focus?

9. External factors and industry trends

How do you perceive the role of external factors and industry trends in shaping your digitalization strategy?

Have you observed any notable trends or developments within your industry that are influencing your approach to digitalization?

10. Recommendations and advice

Based on your experiences, what advice would you offer to other organizations embarking on a similar digitalization journey?

Are there any specific strategies or best practices that you would recommend for maximizing the financial benefits of digitalization?

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As I reflect on my journey through my PhD studies at the University of Debrecen, I am filled with a deep sense of pride and accomplishment. Having transitioned from the finance industry to the academic realm, I find this achievement particularly meaningful. Balancing research with the responsibilities of caring for my two young daughters, Khanh Nhien and Khanh Dan, has been a challenging yet rewarding experience. I hope they will look back on this accomplishment with pride in their mother.

My heartfelt gratitude goes to my parents, whose unconditional love and unwavering support have been the bedrock of my endeavors. Their belief in me has been a driving force in my journey.

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Thank you all for being part of this significant chapter in my life.

Best regards,

Tran Lam Quynh Trang