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NATIONAL ECONOMICS UNIVERSITY



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RESEARCH ON FACTORS AFFECTING THE
EFFECTIVENESS OF E-INVOICING SYSTEM
USAGE IN VIETNAMESE ENTERPRISES
WITHIN THE DIGITAL ECONOMY

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INTRODUCTION

1. Rationale for the research

Invoices are a critical type of document that play an essential role for all stakeholders involved in business activities, including enterprises, customers, and government authorities. In practice, the use of traditional paper-based invoices has revealed numerous limitations, particularly in tax administration. According to Koch (2017), in Europe, tax losses resulting from invoice management errors and fraudulent activities amount to approximately EUR 150–200 billion annually. Globally, this figure is even higher, accounting for 20% to 30% of total value added Tax (VAT) revenues, thereby significantly affecting national budgets.

In response to this situation, reforming invoice management methods has become an inevitable requirement. This involves the adoption of electronic invoicing (EI) to fully replace traditional paper based invoices.

According to statistics reported by Penttinen and Hyytiäinen (2008), the cost of generating and processing a paper invoice ranges from €30 to €50 per invoice. When replaced by EI, this cost can be reduced by up to 80%. In addition to cost reduction, EI eliminates spatial and temporal constraints in the transmission and receipt of invoices and provides numerous benefits to all stakeholders involved in the transaction process, including individual users, enterprises, tax authorities, and society at large. Specifically:

From the user perspective, EI significantly reduces errors associated with manual data entry, thereby enhancing accuracy in information processing. As a result, users spend less time on verification, correction, and reconciliation tasks. Moreover, EI streamlines workflows by minimizing manual operations, ultimately improving individual and organizational productivity. The transition to EI not only optimizes work processes but also enhances user satisfaction and overall experience (Pintarič et al., 2010).

From the enterprise perspective, EI plays a critical role in optimizing operational costs by substantially reducing expenses related to printing, storage, and invoice delivery. It also mitigates the risk of invoice loss and facilitates more systematic and efficient document management. Furthermore, EI contributes to the establishment of a transparent and fair business environment by reducing payment delays and minimizing risks in commercial transactions (Cohen & Eimicke, 2001; European Commission, 2010; Sandberg et al., 2009).

From the tax authority perspective, EI serves as an essential tool for enhancing transparency and effectiveness in tax administration (Haag et al., 2013).

From a broader societal perspective, the implementation of e-invoicing reduces the consumption of paper, ink, and related resources, thereby

mitigating environmental pollution and contributing to the development of a green and sustainable economy (Lagzian & Naderi, 2015).

In addition, EI fosters a transparent business environment, promotes fair competition among enterprises, and accelerates the growth of e-commerce and digital transactions within the digital economy (Hesami et al., 2024).

Given these substantial benefits, EI has emerged as a prominent innovation of the digital era and has been widely adopted across countries. While only 65 countries had adopted EI as of 2013 (TrustWeaver AB, 2013), by 2024, more than 80 countries have mandated its use, and approximately 50 others are in the process of developing implementation roadmaps.

The rapid diffusion of EI reflects the broader trend of digital transformation in accounting and financial management, enabling enterprises, regulatory authorities, and society to move toward more intelligent, integrated, and transparent transaction systems.

However, EI itself merely represents a set of electronic data messages related to sales and service provision, which are created, transmitted, received, stored, and managed through digital means. Therefore, the effective implementation of e-invoicing requires a supporting information system namely the E-Invoicing system (EIS).

Recognizing the importance of EIS, a growing body of literature has examined various aspects of EIS in academic journals. A review of prior studies indicates four main research streams: (i) the extent of EIS usage; (ii) frameworks and processes for EIS implementation; (iii) user acceptance of EIS; and (iv) the effectiveness of EIS usage.

Among these streams, research on the effectiveness of EIS usage has attracted the greatest scholarly attention. However, within this stream, studies focusing on the determinants of the effectiveness of EIS usage remain relatively limited, both globally and in the Vietnamese context. In practice, most studies in Vietnam have primarily focused on general theoretical issues, such as identifying barriers, advantages, and disadvantages of EI, with the aim of improving its implementation outcomes.

This gap highlights the need for more in-depth research on the factors influencing the effectiveness usage of EIS. This need is particularly critical in the context of Vietnam's transition toward a digital economy, where EIS play a pivotal role in advancing automation, integration, and transparency in financial transactions, business relationships, and regulatory management.

Motivated by these considerations, this study investigates topic: ***“Research on factors affecting the effectiveness of EIS usage in Vietnamese enterprises within the digital economy”***.

2. Research Objectives, Tasks, and Questions

2.1. Research Objectives

- Assessing the current state of measuring information systems (IS) effectiveness usage in general and EIS in particular within enterprises in the current context;

- Identifying the key factors affecting the effectiveness of EIS usage in Vietnamese enterprises within the digital economy;

- Developing a research model of factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy;

- Examining the magnitude and direction of the impact of each factor on the effectiveness of EIS usage within the digital economy;

- Proposing practical solutions and policy recommendations to enhance the effectiveness of EIS usage in Vietnamese enterprises within the digital economy.

2.2. Research Questions

- What constitutes effectiveness of EIS usage in the context of Vietnamese enterprises? How do enterprises perceive and evaluate the effectiveness of EIS usage?

- What factors influence the effectiveness of EIS usage in Vietnamese enterprises within the digital economy? What are the relationships among these factors?

- To what extent does each factor affect the effectiveness of EIS usage?

- What solutions and recommendations can be proposed for relevant stakeholders to enhance the effectiveness of EIS usage in Vietnamese enterprises?

2.3. Research Tasks

To achieve the research objectives, the study undertakes the following tasks:

- Conducting a comprehensive literature review of domestic and international studies on EIS and the factors affecting the effectiveness of EIS usage, thereby establishing a theoretical framework, developing a research model, and formulating research hypotheses;

- Empirically test the proposed model and hypotheses, and to measure the direction and magnitude of the relationships among the identified factors;

- Analyzing and discussing the empirical findings, and based on these results, to propose recommendations and practical solutions to support Vietnamese enterprises in improving the effectiveness of EIS usage within the digital economy.

3. Research scope and context

3.1. Research Subject

- The subject of this research is the set of factors influencing the effectiveness of EIS usage.

- The research context focuses on small and medium-sized enterprises in Vietnam.

3.2. Research Scope

- Scope of content: This study focuses on identifying and analyzing the effects of 08 factors: System Quality, Information Quality, Service Quality, Technological Infrastructure Quality, Top Management Support, Digital Skills, Readiness, and Legal framework on the effectiveness of EIS usage in Vietnamese enterprises within the digital economy.

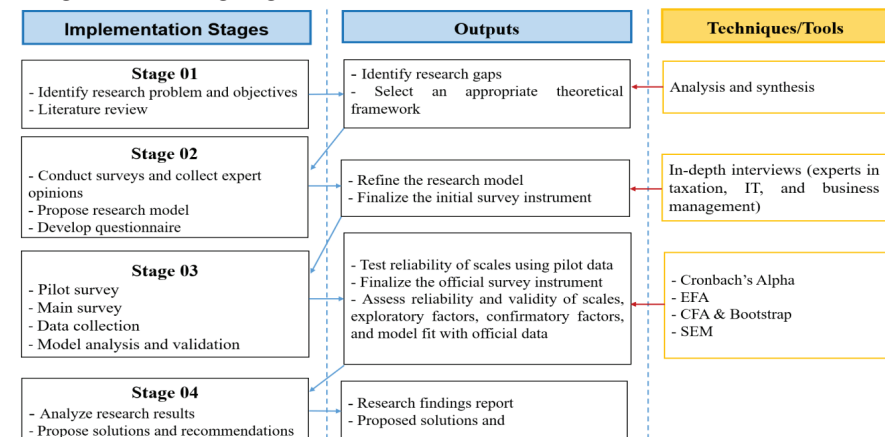
- Geographical scope: The empirical study is conducted among SMEs located in 04 northern provinces and municipalities of Vietnam, including Hanoi, Bac Ninh, Phu Tho, and Quang Ninh.

- Time scope: Secondary data were collected for the period from 2018 to 2021, while primary data were gathered from July 1, 2022 to the end of 2023.

4. Research Methodology

4.1. Research Procedure

The research procedure of this study is designed and implemented through the following stages:



4.2. Research Methods

This study employs a mixed-methods approach, combining both qualitative and quantitative research methods to examine the factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy.

5. Contributions of the research

In line with the research objectives and questions, this study makes several key theoretical and practical contributions as follows:

5.1. Theoretical Contributions

- This study proposes a comprehensive research model comprising 08 factors: System Quality, Information Quality, Service Quality, Technological Infrastructure Quality, Top Management Support, Digital Skills, Readiness, and Legal framework that directly influence User Satisfaction. In addition, these factors exert both direct and indirect effects on the effectiveness of EIS usage through the mediating role of user satisfaction within the context of the digital economy. The proposed model provides a robust theoretical foundation for understanding and enhancing the effective use of EIS in enterprises.

- The study extends and refines the updated D&M by incorporating 05 additional constructs, namely Technological Infrastructure Quality, Top Management Support, Digital Skills, Readiness, and Legal Framework. Furthermore, the construct “Use” is excluded, as it represents a behavioral outcome more suitable for process-oriented research rather than causal modeling. The study also removes the reverse relationship from the effectiveness of EIS usage to User Satisfaction to better align the model with the specific characteristics of EIS and the research context of the digital economy.

5.2. Practical Contributions

- Based on the proposed model, this study develops and refines measurement scales and empirically validates the relationships among the identified factors. The results indicate that all factors have positive and significant direct effects on both the effectiveness of EIS usage and User Satisfaction. Moreover, the findings reveal that the indirect effects of these factors on the effectiveness of EIS usage mediated through user satisfaction are stronger than their direct effects. This highlights the critical role of human factors in enhancing the performance and effective utilization of EIS in Vietnamese enterprises.

- Based on the relationships among the identified factors and the magnitude of their effects, this study proposes several solutions and recommendations to assist relevant stakeholders in enhancing the effectiveness of EIS usage.

6. Structure of the Study

In addition to the Introduction and Conclusion, this study is organized into four chapters:

- **Chapter 1:** Literature review on the effectiveness of EIS usage in the digital economy;

- **Chapter 2:** Development of a research model of factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy;

- **Chapter 3:** Empirical testing of the proposed research model;

- **Chapter 4:** Analysis of research findings and recommendations.

CHAPTER 1: LITERATURE REVIEW ON THE EFFECTIVENESS OF EIS USAGE IN THE DIGITAL ECONOMY

1.1. Key Concepts Related to E-Invoicing System Effectiveness

1.1.1. Invoice

An invoice is a document issued by a seller to record information related to the sale of goods or the provision of services in accordance with legal regulations (Ministry of Finance, 2014).

1.1.2. Electronic Invoice

Electronic invoicing (EI) has been increasingly promoted alongside the development of information technology (IT) and e-commerce. Due to its relatively recent development, there is currently no universally agreed-upon definition of e-invoicing. However, several definitions have been proposed to describe its characteristics and attributes.

According to the European Commission (2009), an electronic invoice is an invoice that is issued, transmitted, processed, and stored entirely in electronic form. Similarly, Shunren (2009) defines an electronic invoice as a document issued by a business through an information system and transmitted via the Internet. In Vietnam, an electronic invoice is defined as an invoice, with or without a tax authority code, presented in the form of electronic data and created by organizations or individuals selling goods or providing services using electronic means to record transaction information in accordance with accounting and tax regulations (Government, 2020a). This definition is adopted in this study.

1.1.3. E-Invoicing System

Electronic invoices are created, processed, and managed using electronic means, which in this context refers to an information system (IS) that supports the creation, issuance, processing, transmission, receipt, storage, and management of electronic invoices (National Assembly, 2023). Such a system is referred to as an E-Invoicing System (EIS).

In the financial domain, EIS is one of the most widely implemented financial information systems in enterprises worldwide, aiming to enhance convenience and optimize invoicing processes (Amalina & Suryani, 2022). Furthermore, EIS is increasingly developed following a service-oriented architecture, particularly Software-as-a-Service (SaaS) on web-based platforms, to facilitate the issuance, distribution, transmission, and receipt of invoices online among enterprises, service providers, and tax authorities (DeMello et al., 2009).

1.1.4. Effectiveness of E-Invoicing System Usage

According to DeLone and McLean (2003), an information system is considered effective when it generates benefits for the organization using it. Building upon this perspective, within the scope of this study, the effectiveness of EIS usage is conceptualized as the set of benefits that organizations obtain from using EIS.

These benefits include cost savings in invoicing-related processes, reduced storage requirements and environmental impact, time savings, error

reduction, enhanced transparency, improved data aggregation capabilities, and increased ability to detect fraudulent activities.

Overall, the effectiveness of EIS usage is approached from an output-oriented and causal perspective, focusing on evaluating the extent to which the system creates value for organizations in real-world application contexts.

1.1.5. Digital Economy

The digital economy is currently recognized as a key driver of economic growth and plays a significant role in modern society. Rather than being an entirely new economic system, it represents a transformation from the traditional economy to one in which all activities are closely integrated with information technology to create new platforms and business models.

Various definitions of the digital economy have been proposed by scholars and organizations. For example: (i) Tapscott (1996) defines the digital economy as the integration of intelligence, knowledge, and creativity to generate breakthroughs in economic prosperity and social development; (ii) Margherio et al. (1998) emphasize key aspects such as the Internet, e-commerce, digital delivery of goods and services, and the retail of tangible goods; (iii) Barefoot et al. (2018) define it as an economy primarily based on the Internet, information, and communication networks; (iv) Wang et al. (2022) describe it as an economy characterized by the use of digitized information and knowledge as key production factors, modern information networks as operational space, and information and communication technologies (ICT) as drivers of productivity and structural optimization; (v) Irkinovich (2022) defines the digital economy as an economy that operates primarily based on digital technologies, particularly electronic transactions conducted via the Internet.

Among these definitions, the conceptualization by Irkinovich (2022) is considered the most comprehensive and is therefore adopted in this study.

1.2. Literature Review on the Effectiveness of E-Invoicing System Usage

In the context of promoting the development of the digital economy, EIS has emerged as a critical tool supporting tax administration and is widely adopted across many countries, including Vietnam. To provide a comprehensive understanding of EIS development and its effective utilization, it is essential to examine the current state of EIS implementation in selected countries as well as prior research on the effectiveness of EIS usage.

1.2.1. Current Status of E-Invoicing System implementation globally and in Vietnam

Amid rapid technological advancement driving the digital economy, EIS has become an inevitable trend in many countries worldwide, including Chile, Mexico, Brazil, Finland, Denmark, Austria, Italy, Norway, Slovenia, Spain, Switzerland, France, Singapore, South Korea, China, Taiwan, and Vietnam. However, each country has followed its own roadmap and approach in developing, implementing, and utilizing to enhance the effectiveness of EIS usage.

In line with global trends, Vietnam has drawn on the experiences of countries such as South Korea and Taiwan in designing and implementing its EIS.

In 2019, e-invoicing was initially deployed in major cities under Resolution No. 01/NQ-CP. As of July 1, 2022, all entities regulated under the 2019 Law on Tax Administration are required to adopt e-invoicing. Vietnam has established an integrated EIS architecture consisting of 03 main subsystems: (i) the enterprise's internal management system; (ii) the systems of service providers, including e-invoicing systems and data transmission systems; and (iii) the tax authority's systems (including e-invoice authentication and data exploitation systems).

1.2.2. Effectiveness of EIS Usage

The global landscape of EIS adoption reflects strong efforts by governments to accelerate implementation and realize benefits for stakeholders.

A review of both domestic and international studies on EIS reveals 04 primary research streams: (i) the level of EIS usage; (ii) frameworks and processes for EIS implementation; (iii) user acceptance of EIS; (iv) the effectiveness of EIS usage.

Among these streams, research on the effectiveness of EIS usage has received the greatest attention (17/40 reviewed studies). However, within this stream, only 03 studies focus on identifying the determinants of the effectiveness of EIS usage. The remaining studies primarily address technical solutions (05 studies) or analyze benefits and barriers affecting the effectiveness of EIS usage (09 studies), often with the aim of proposing strategies to enhance the effectiveness of EIS usage. These findings indicate that research on the factors influencing the effectiveness of EIS usage remains limited both globally and in Vietnam, despite the growing interest in this topic (Joung et al., 2014).

In the context of Vietnam's digital transformation, driven by the adoption of information technology and government mandates, enterprises are required to implement e-invoicing to enhance transparency, reduce tax fraud, and promote the development of the digital economy (Government, 2020b). To perform key e-invoicing functions: invoice creation, updating, transmission, receipt—enterprises must rely on a fully functional EIS.

Based on the above analysis, investigating the factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy is necessary.

1.3. Evaluation of the effectiveness of E-Invoicing System usage

1.3.1. Approaches to evaluating the effectiveness Information System usage

Aggelidis and Chatzoglou (2008) suggest that single-dimensional approaches to evaluating the effectiveness of IS usage typically focus on 03 key aspects: (i) economic performance, (ii) system usage, and (iii) user satisfaction.

Weill and Olson (1989), Grover et al. (1996), and DeLone and McLean (2003) argue that IS effectiveness should be assessed using a multidimensional approach. Similarly, Doll and Torkzadeh (1988) demonstrate that multidimensional evaluation provides more accurate and comprehensive results than single-dimensional approaches. From this perspective, evaluating the effectiveness of IS usage solely based on economic performance, system usage or user satisfaction may fail to fully capture the overall value generated by the system.

In addition to single and multi-dimensional approaches, the evaluation of IS usability has also attracted significant attention. In 1998, the International Organization for Standardization (ISO) introduced ISO 9241-11 as part of the ISO 9241 standards to provide a framework for evaluating usability from 03 main perspectives: (i) effectiveness, (ii) efficiency, and (iii) user satisfaction within a specific context of system use (ISO, 1998). In this framework, effectiveness refers to the extent to which users achieve their intended goals and obtain benefits from using the system; efficiency refers to the resources required to accomplish tasks; and satisfaction reflects users' comfort and positive responses. After two decades, ISO 9241-11 was updated in 2018, retaining its core concepts while expanding its scope to encompass overall user experience with the system and its supporting services, rather than focusing solely on interface design.

In summary, among the 03 usability dimensions proposed by ISO 9241-11—effectiveness, efficiency, and user satisfaction—this study adopts an effectiveness-oriented perspective which is most appropriate given its objective of examining the factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy.

1.3.2. Models for evaluating the effectiveness of IS and EIS usage

Based on the review by Mukti and Rawani (2016), several prominent models have been developed to evaluate the effectiveness of IS usage, including: (i) the Technology Acceptance Model (1985); (ii) the DeLone and McLean (D&M) IS Success Model (1992); (iii) the IS Function Performance Evaluation Model by Saunders and Jones (1992); (iv) the Comprehensive IS Function Quality and Productivity Model by Myers et al. (1997); (v) the IS Success Model by Seddon (1997); (vi) the updated D&M IS Success Model (2003); (vii) the Enterprise IS Success Model by Gable et al. (2003); (viii) the revised Enterprise IS Success Model (2003); (ix) the Project Success Model by Van der Westhuizen and Fitzgerald (2005); (x) the Project Management IS Success Model by Kaiser and Ahlemann (2010).

Among these models, the updated DeLone and McLean (2003) model remains the most widely adopted framework for evaluating the effectiveness of IS usage.

Given the objective of this study to examine the factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy, the updated D&M model is selected as the foundational framework for developing the proposed research model.

CHAPTER 2: DEVELOPMENT OF A RESEARCH MODEL OF FACTORS INFLUENCING THE EFFECTIVENESS OF EIS USAGE IN VIETNAM ENTERPRISE WITHIN DIGITAL ECONOMY

2.1. Specific factors influencing the effectiveness of EIS usage in Vietnam

The objective of this study is to identify the factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy, as well as to examine the magnitude of their effects and the relationships among these factors.

Based on a synthesis of prior studies on EI and EIS in Vietnam, combined with expert insights, the updated D&M model is adapted to the Vietnamese context, initially comprising 18 factors: (i) System Quality; (ii) Information Quality; (iii) Service Quality; (iv) User Satisfaction; (v) EIS Effectiveness; (vi) User Habit; (vii) IT Competence of Top Management; (viii) IT Competence of Employees; (ix) Technological Infrastructure; (x) Initial Investment Cost; (xi) Reluctance toward Transparency; (xii) Communication and Awareness of E-Invoicing Benefits; (xiii) Resistance to Change; (xiv) Regulatory Specificity; (xv) Organizational Responsibility Awareness; (xvi) Penalty and Enforcement Mechanisms; (xvii) Security and Privacy; (xviii) Training and User Guidance.

2.2. Research model of factors influencing the effectiveness of E-Invoicing system usage in Vietnamese enterprises within the digital economy

2.2.1. Qualitative Study

To gain deeper insights into the effectiveness of EIS usage, explore influencing factors, refine measurement scales, and develop the survey instrument, this study employs a qualitative approach through in-depth interviews with 28 experts who have practical experience in developing and implementing EIS.

The qualitative study is conducted with four main objectives: (i) to explore factors influencing EIS effectiveness in Vietnamese enterprises; (ii) to identify relationships between independent and dependent variables; (iii) to refine and contextualize measurement scales; (iv) to finalize the survey questionnaire.

Based on the findings from the literature review and qualitative analysis, the study proposes a refined model consisting of 10 constructs: (i) System

Quality; (ii) Information Quality; (iii) Service Quality; (iv) Technological Infrastructure Quality; (v) Top Management Support; (vi) Digital Skills; (vii) Readiness; (viii) Legal Framework; (ix) User Satisfaction; and (x) EIS usage effectiveness.

2.2.2. Proposed research model of factors influencing the effectiveness of E-Invoicing system usage in Vietnamese enterprises within the digital economy

Based on the above findings, the proposed research model illustrates the relationships among the identified factors influencing the effectiveness of EIS usage in Vietnamese enterprises within the digital economy. The model is presented in Figure 2.3 and the corresponding research hypotheses are detailed in Table 2.7.

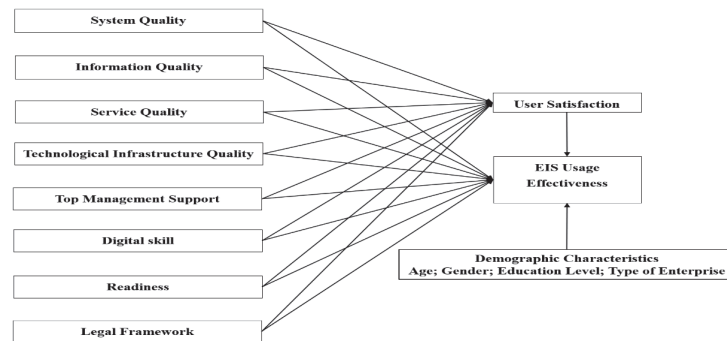


Figure 2.3: Model of factors affecting the effectiveness of EIS usage in Vietnamese enterprises within the digital economy

Source: Proposed by the author based on the research findings

Table 2.7. Proposed Hypotheses

Hypothesis	Description
H1	System Quality positively affects User Satisfaction with EIS in Vietnamese enterprises within the digital economy
H2	System Quality positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H3	Information Quality positively affects User Satisfaction with EIS in Vietnamese enterprises within the digital economy.
H4	Information Quality positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H5	Service Quality positively affects User Satisfaction with EIS in Vietnamese enterprises within the digital economy
H6	Service Quality positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H7	Technological Infrastructure Quality positively affects User Satisfaction

Hypothesis	Description
	with EIS in Vietnamese enterprises within the digital economy
H8	Technological Infrastructure Quality positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H9	Top Management Support positively affects User Satisfaction with EIS in Vietnamese enterprises within the digital economy
H10	Top Management Support positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H11	Digital Skills positively affect User Satisfaction with EIS in Vietnamese enterprises within the digital economy
H12	Digital Skills positively affect EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H13	User Readiness positively affects User Satisfaction with EIS in Vietnamese enterprises within the digital economy
H14	User Readiness positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H15	Legal Framework positively affects User Satisfaction with EIS in Vietnamese enterprises within the digital economy
H16	Legal Framework positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy
H17	User Satisfaction positively affects EIS Usage Effectiveness in Vietnamese enterprises within the digital economy

Source: Proposed by the author based on the literature review

CHAPTER 3: EMPIRICAL TESTING ON THE RESEARCH MODEL OF FACTORS INFLUENCING EIS EFFECTIVENESS IN VIETNAM ENTERPRISES WITHIN THE DIGITAL ECONOMY

3.1. Quantitative Study

This study employs a two-stage quantitative approach, consisting of a pilot study and a main survey.

- **Stage 1:** The pilot study is conducted to assess the conceptual validity of the constructs and the reliability of the measurement scales. It aims to eliminate inappropriate observed variables and refine the scales prior to the main data collection. The pilot sample shares similar characteristics with the main sample but is smaller in size.

- **Stage 2:** Main Survey. Based on the pilot results, the measurement scales are refined to develop the final questionnaire. Data collected from the main survey are used to assess reliability (Cronbach's Alpha), conduct Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and test the research hypotheses using Structural Equation Modeling (SEM).

3.1.1. Pilot Study Results

A total of 120 valid responses were collected from accounting staff using EIS in 120 Vietnamese enterprises in Hanoi. After data cleaning, reliability analysis was conducted using Cronbach's Alpha (see Table 3.1)

Table 3.1. Reliability Results of Measurement Scales (Pilot Data)

No.	Factor	Cronbach's Alpha
1	System Quality (SQ)	0,874
2	Information Quality (IQ)	0,930
3	Service Quality (SERV)	0,923
4	Technological Infrastructure Quality (INFQ)	0,928
5	Top Management Support (SL)	0,897
6	Digital Skills (DL)	0,924
7	Readiness (R)	0,925
8	Legal Framework (INS)	0,919
9	User Satisfaction (US)	0,872
10	EIS Usage Effectiveness (EOC)	0,932

Source: Author's analysis

The results indicate that all 10 factors have Cronbach's Alpha values ranging from 0.8 to 0.932, exceeding the acceptable threshold. All item-total correlations are above 0.5, and thus all observed variables are retained for the main survey.

3.1.2. Main Survey Results

- **Descriptive Statistics:** The sample is described in terms of gender, age, education level, and type of enterprise.

- **Reliability Analysis (Cronbach's Alpha):** A threshold of 0.8 is applied for scale reliability. Out of 61 initial items, 4 items are removed after reliability analysis, resulting in 57 retained items that meet the required criteria. These items are used for further EFA.

- **Exploratory Factor Analysis (EFA):** All factor loadings exceed 0.5. The KMO value is 0.935 ($0.5 < \text{KMO} < 1$), indicating sampling adequacy. Bartlett's Test of Sphericity is significant ($p = 0.000 < 0.05$), confirming the suitability of factor analysis. The total variance explained is 70.019%, exceeding the 50% threshold. The 57 observed variables are extracted into 10 factors, which are retained for CFA.

- **Confirmatory Factor Analysis (CFA):** CFA is conducted using AMOS. Model fit indices (see Table 3.2) indicate a good fit. Although GFI = 0.838 is below 0.9, it exceeds the acceptable threshold of 0.8 (Baumgartner & Homburg, 1996). The results indicate that the model demonstrates a good fit to the data and is therefore retained for subsequent SEM analysis.

Table 3.2. Model Fit Indices

Criteria	CFA Result	Evaluation
$\text{Cmin/df} \leq 2$	1,999	Satisfactory
$\text{TLI} \geq 0,9$	0,932	Satisfactory
$\text{CFI} \geq 0,9$	0,936	Satisfactory
$\text{GFI} \geq 0,8$	0,838	Acceptable
$\text{RMSEA} \leq 0,05$	0,042	Excellent

Source: Author's analysis

The CFA results confirm that the measurement model fits the data well and is suitable for SEM analysis.

3.2. Structural Model and Hypothesis Testing

Based on the CFA results, SEM is conducted to test the proposed hypotheses. The SEM model fit assessment and hypothesis testing results, presented in Figure 3.3 and Table 3.30, indicate that the model demonstrates a good fit to the data and that all 17 hypotheses are supported.

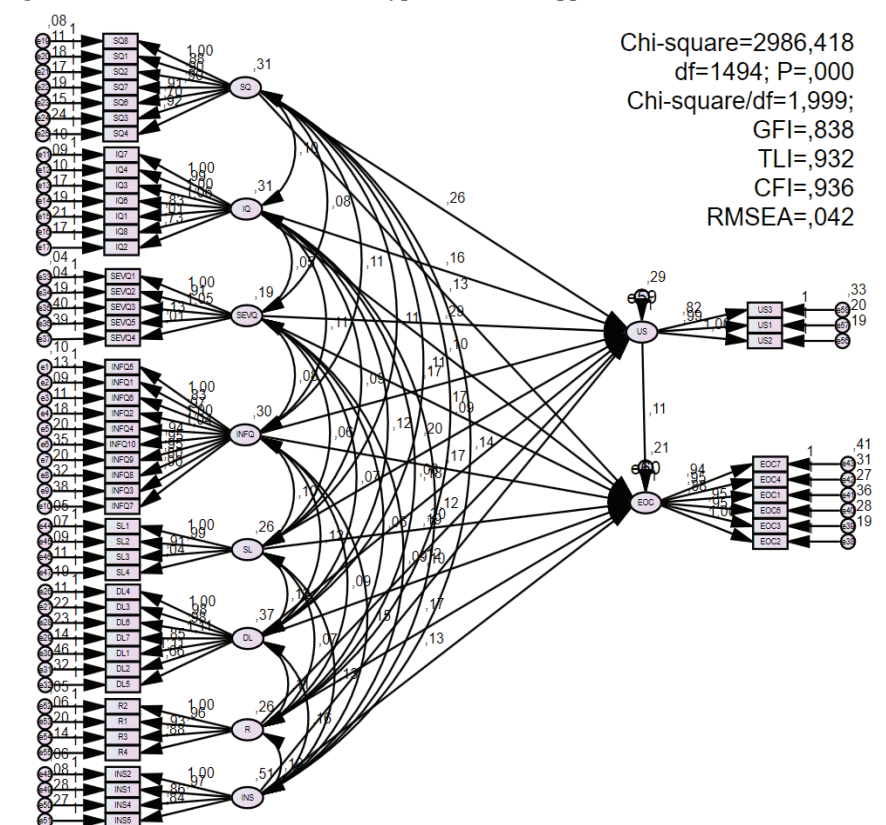


Figure 3.1. Results of the Structural Equation Modeling (SEM) analysis

Source: Author's analysis

Table 3.3. Results of Direct Effects Hypothesis Testing

Hypothesis	Relationship between variables			Standardized regression coefficient	P. value	Conclusion
H1	US	<---	SQ	0,190	***	Accepted
H3	US	<---	IQ	0,113	0,005	Accepted
H5	US	<---	SEVQ	0,168	***	Accepted
H7	US	<---	INFQ	0,122	0,004	Accepted
H9	US	<---	SL	0,137	***	Accepted
H11	US	<---	DL	0,141	***	Accepted
H13	US	<---	R	0,127	0,002	Accepted
H15	US	<---	INS	0,111	0,007	Accepted
H2	EOC	<---	SQ	0,107	0,012	Accepted
H4	EOC	<---	IQ	0,088	0,028	Accepted
H6	EOC	<---	SEVQ	0,115	0,004	Accepted
H8	EOC	<---	INFQ	0,138	***	Accepted
H10	EOC	<---	SL	0,153	***	Accepted
H12	EOC	<---	DL	0,097	0,021	Accepted
H14	EOC	<---	R	0,131	0,001	Accepted
H16	EOC	<---	INS	0,139	***	Accepted
H17	EOC	<---	US	0,128	0,017	Accepted

Source: Author's analysis

Table 3.4. Coefficient of Determination

Dependent Variable	R ²
US	0,502
EOC	0,512

Source: Author's analysis

With the R² value of “User Satisfaction” in Table 3.31 being 0.502, it indicates that the independent variables, namely: (i) “System Quality”; (ii) “Information Quality”; (iii) “Service Quality”; (iv) “Technological Infrastructure Quality”; (v) “Leadership Support”; (vi) “Digital Skills”; (vii) “Readiness”; and (viii) “Legal Framework”, explain 50.2% of the variance in “User Satisfaction”. Similarly, with the R² value of “Effectiveness of E-invoice System Usage” being 0.512, the result demonstrates that the independent variables, including: (i) “System Quality”; (ii) “Information Quality”; (iii) “Service Quality”; (iv) “Technological Infrastructure Quality”; (v) “Leadership Support”; (vi) “Digital Skills”; (vii) “Readiness”; and (viii) “Legal Framework”, account for 51.2% of the variance in “Effectiveness of E-invoice System Usage”.

CHAPTER 4: ANALYSIS OF RESEARCH RESULTS AND RECOMMENDATIONS

4.1. Analysis of Results

The research results of the dissertation, from the theoretical review to qualitative and quantitative research, have addressed the stated research objectives and questions. After analyzing the data collected from 579 accounting staff using the E-invoice system in Vietnamese enterprises, the research model satisfied the testing criteria and was validated, as shown in Figure 4.1.

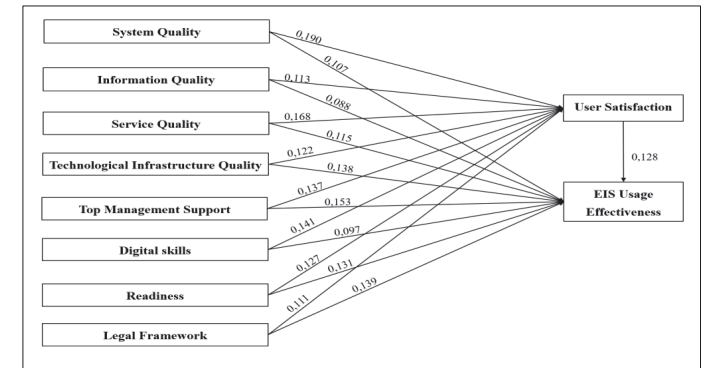


Figure 4.1. Research Model Results

Source: Author's analysis

The results in Figure 4.1 show that:

- 08 factors have a direct and positive effect on “User Satisfaction with the E-invoice System” in Vietnamese enterprises within the digital economy, ranked as follows: (i) “System Quality”; (ii) “Service Quality”; (iii) “Digital Skills”; (iv) “Leadership Support”; (v) “Readiness”; (vi) “Technological Infrastructure Quality”; (vii) “Information Quality”; (viii) “Legal Framework”.

- 08 factors also have a direct and positive effect on “Effectiveness of E-invoice System Usage”, ranked as follows: (i) “Leadership Support”; (ii) “Legal Framework”; (iii) “Technological Infrastructure Quality”; (iv) “Readiness”; (v) “Service Quality”; (vi) “System Quality”; (vii) “Digital Skills”; (viii) “Information Quality”.

The results indicate that the indirect effects of the 08 factors on “Effectiveness of E-invoice System Usage” through the mediating role of “User Satisfaction” are stronger than their direct effects. The detailed results are presented in Table 4.1

Table 4.1. Results of indirect effects of factors on the effectiveness of EIS usage in Vietnamese enterprises within the digital economy through User Satisfaction

Factor	Standardized regression coefficients				
	Direct effect of 8 factors on “Effectiveness of E-invoice System Usage”	Direct effect of 8 factors on “User Satisfaction”	Effect of “User Satisfaction” on “Effectiveness of E-invoice System Usage”	Indirect effect of 8 factors on “Effectiveness of E-invoice System Usage” via “User Satisfaction”	Total
	β_1	β_2	β_3	$\beta_2 * \beta_3$	$\beta_1 + \beta_2 * \beta_3$
SQ	0,107	0,190	0,128	0,024	0,131
IQ	0,088	0,113		0,014	0,102
SEVQ	0,115	0,168		0,021	0,136
INFQ	0,138	0,122		0,015	0,153
SL	0,153	0,137		0,017	0,170
DL	0,097	0,141		0,018	0,115
R	0,131	0,127		0,016	0,147
INS	0,139	0,111		0,014	0,153

Source: Author's analysis

In summary, the data analysis results presented in Figure 4.1 show that the research model is valid and all hypotheses are accepted.

4.2. Solutions and Recommendations

4.2.1. Solutions for Vietnamese Enterprises (VNEs)

The researcher proposes several solutions to enhance the effectiveness of EIS usage in Vietnamese enterprises within the digital economy. Enterprise-related factors affecting the effectiveness of EIS usage are presented from three perspectives: management, organizational, and technological.

a. Management perspective

The research results indicate that “Top Management Support” has the strongest impact on the effectiveness of E-invoice system usage in Vietnamese enterprises ($\beta = 0.153$), confirming that leadership commitment, consensus, determination, and strategic direction play a central role in promoting the implementation of the EIS.

As the head of the organization responsible for all business activities, to strengthen and sustain leadership support during the implementation of the E-invoice system, leaders should: (i) Actively accompany and set an example in using information systems to support work activities; (ii) Define clear vision and objectives when implementing mandatory E-invoice usage in enterprises; (iii) Foster a culture of acceptance of change from traditional working models to digital working environments; (iv) Actively participate in seminars,

workshops, and experience-sharing sessions on E-invoice system implementation organized by experts; (v) Regularly attend short-term training courses on the use of modern electronic tools for work, as well as training sessions on new features of the E-invoice system, delivered both in-person and online.

b. Organizational perspective

i) Employee readiness in Vietnamese enterprises

The research results show that “Readiness” of employees is the fourth most influential factor affecting the effectiveness of EIS usage in Vietnamese enterprises ($\beta = 0.131$). To enhance employees’ readiness and adaptability when using the E-invoice system, enterprises should: (i) Strengthen communication about the benefits of EI usage and the risks of not adopting it; (ii) Promote innovative thinking by building a corporate culture that encourages innovation; (iii) Establish incentive mechanisms to motivate employees to actively engage in the digital working environment; (iv) Develop supportive digital transformation mechanisms that accompany employees, helping them feel organizational support and be ready to adapt to new system functions; (v) Encourage self-learning and self-development through IT training courses (both online and offline), supported by allocated time and financial resources.

ii) Digital skills of employees in Vietnamese enterprises

According to the research results, “Digital Skills” have a relatively lower direct impact on the effectiveness of E-invoice system usage in Vietnamese enterprises ($\beta = 0.097$). However, digital skills are considered an essential competency enabling employees to effectively use information systems in general and E-invoice systems in particular (Stofkova et al., 2022).

From the enterprise perspective, to improve employees’ digital skills in using EIS as well as other information systems, Vietnamese enterprises should: (i) Focus on providing IT knowledge and digital competencies; (ii) Require employees to fully participate in training programs and capacity-building courses on IT application and EIS usage; (iii) Collaborate with service providers to design specialized digital skills training programs in both online and offline formats; (iv) Increase exposure to digital transformation content via social media platforms and television programs to enhance awareness; (v) Implement periodic assessments of employees’ digital skills every three months.

c. Technological perspective

The research results show that “Technological Infrastructure Quality” ($\beta = 0.138$) is the third most influential factor among the eight factors affecting the effectiveness of EIS usage in Vietnamese enterprises.

To improve technological infrastructure quality, Vietnamese enterprises should consider implementing infrastructure development solutions based on a

service model. This approach helps reduce initial investment costs and also minimizes operational, maintenance, and periodic replacement costs of equipment.

4.2.2. Recommendations for Service Providers and Tax Authorities

Based on the proposed solutions to enhance the effectiveness of E-invoice system usage in Vietnamese enterprises and the current implementation context in Vietnam, the researcher provides several recommendations as follows:

For E-invoice Service Providers

Based on the research findings, the researcher proposes recommendations from 03 perspectives (management, organizational, and technological) to help service providers address existing limitations and thereby improve the effectiveness of EIS usage among Vietnamese enterprises in the digital economy. The relevant factors are presented as follows: Management perspective (Top Management Support); Organizational perspective (Readiness, Digital Skills); Technological perspective (Technological Infrastructure Quality, System Quality, Information Quality, Service Quality)

a. Management perspective

To enable enterprises to effectively implement and utilize the EIS, the leadership role within service provider organizations is a decisive factor in strategic orientation, policy development, and resource allocation to ensure service quality. Service provider leadership should develop a long-term strategy for EIS service development, clearly defining objectives for improving service quality, enhancing system integration capability, and ensuring compliance with legal requirements for data and electronic transactions.

In addition, leadership should issue investment and infrastructure upgrade policies to ensure stable system operation, the ability to process large volumes of data, and continuous connectivity with both enterprise systems and tax authority systems.

b. Organizational perspective

i) Employee “Readiness”: E-invoice service providers should establish reward, recognition, and incentive mechanisms for employees who demonstrate readiness in adapting to and learning new tools and system functionalities developed within the EIS.

ii) Employee “Digital Skills”: To enhance digital skills for employees directly involved in developing and operating the E-invoice system, organizations should mandate participation in professional training programs, including new knowledge updates or retraining courses delivered by domestic and international IT experts. Through these training programs, employees can access new applications and technologies that help improve and optimize the EIS’s functionality.

c. Technological perspective

i) Technological Infrastructure Quality: Technological infrastructure quality is a key factor ensuring stable system operation. Therefore, organizations should ensure the following aspects: (i) Server and data center infrastructure quality; (ii) Information security infrastructure quality; (iii) Cloud infrastructure quality ensuring stable Internet connectivity and transmission quality, thereby reducing processing time for E-invoice-related tasks and ensuring smooth data exchange with tax authorities and stakeholders.

ii) System Quality: To improve system quality and better support enterprises in digital transformation, service providers should: (i) Regularly update system functions according to tax authority regulations; (ii) Ensure 24/7 system availability; (iii) Design user-friendly interfaces and allow system customization according to enterprise needs; (iv) Add features such as automatic tax code-based data filling, fast search functionality, and AI chatbot support for user assistance.

iii) Information Quality: Information generated by the EIS must be accurate and comply with tax authority regulations to serve as reliable input data for reporting and analysis functions. Service providers must comply with the Law on Network Information Security and the Law on Cybersecurity to ensure data protection and information security for enterprises.

iv) Service Quality: To improve service quality, service providers should: (i) Offer appropriate E-invoice service packages; (ii) Apply AI-based 24/7 support systems to handle common issues without time limitations; (iii) Assign technical staff to directly support enterprises; (iv) Organize online training sessions on E-invoice system usage via social media platforms; (v) Establish clear reward and penalty mechanisms to enhance employee responsibility in service delivery.

For Tax Authorities

The tax authority plays a central role in operating and supervising the national EIS. The factors affecting EIS effectiveness are grouped into three perspectives: **Management** (Top Management Support, Legal Framework); **Organizational** (Readiness, Digital Skills); **Technological** (Technological Infrastructure Quality, System Quality, Information Quality)

a. Management perspective

i) Top Management Support: In the development and implementation of the EIS, leadership within tax authorities plays a critical role in strategic orientation, resource allocation, and governance mechanisms. Tax authority leadership should: (i) Develop a long-term E-invoice system strategy aligned with digital transformation in tax administration; (ii) Issue supportive policies and mechanisms for SMEs in implementing E-invoices; (iii) Invest in technological infrastructure and data platforms to ensure stable, secure, and

efficient processing of large transaction volumes; (iv) Strengthen communication, training, and guidance for enterprises; (v) Establish coordination mechanisms with service providers and related government agencies to ensure system interoperability; (vi) Promote the application of emerging technologies such as AI, big data analytics, and automation; (vii) Implement continuous evaluation and improvement mechanisms based on feedback from enterprises and stakeholders.

ii) Legal framework: The legal framework is the most influential factor among the eight determinants ($\beta = 0.139$). Therefore, tax authorities should: (i) Timely update clear and detailed regulations and enforce strict penalties for E-invoice fraud; (ii) Establish transparent policies on data security, storage, and access; (iii) Develop mechanisms for international interoperability of E-invoice systems; (iv) Strengthen dissemination of updated information through mass media; (v) Create multiple feedback channels (chatbots, social networks, etc.) to gather enterprise feedback; (vi) Allow pilot testing of new technologies such as blockchain and AI in E-invoice control; (vii) Learn from international best practices in E-invoice implementation.

b. Organizational perspective

i) Digital skills of tax officers: Tax authorities should implement periodic and structured training programs for officers directly involved in operating and managing the EIS.

ii) Readiness for technological change: Readiness refers to the extent to which tax officers are willing and able to adapt to technological changes. To enhance readiness, tax authorities should: (i) Improve professional competence and digital skills; (ii) Promote a digital organizational culture that encourages innovation; (iii) Establish reward mechanisms for initiatives and contributions; (iv) Provide supportive and collaborative digital transformation environments; (v) Encourage self-learning through both online and offline IT training programs with institutional support in time and funding.

c. Technological perspective

i) Technological infrastructure quality: Tax authorities have invested significantly in technological infrastructure, including: (i) Develop an electronic portal providing E-invoice services and E-invoice system applications for the tax authority, including 25 functions, and designed with an overall architecture based on Industry 4.0 technology; (ii) Deployment of 557 servers, 52 network devices, 8 security devices, and a backup data system; (iii) Implementation of Level 5 cybersecurity protection with 24/7 monitoring.

In addition, tax authorities should (i) Maintain and regularly upgrade infrastructure to ensure 24/7 system stability; (ii) Ensure stable internet connectivity; (iii) Use penetration testing tools to identify security

vulnerabilities; (iv) Enhance AI and machine learning applications for big data analysis.

ii) System quality: The E-invoice system of the tax authority is not only a technical tool supporting tasks related to e-invoices, but also performs certain functions in state tax management. To ensure system quality, tax authorities should: (i) Optimize user interfaces for tax officers; (ii) Improve access control and authorization functions; (iii) Add a “risk warning” feature; (iv) Develop quantitative monitoring and evaluation systems; (v) Apply advanced encryption standards (AES-256) to secure E-invoice data and information security.

iii) Information quality: Information quality of the E-invoice system is a key factor contributing to improving its usage effectiveness in Vietnamese enterprises; at the same time, it enhances tax administration efficiency and supports decision-making processes of state management agencies.

To ensure the quality of information generated from the E-invoice system, the tax authority should: (i) Standardize data structures, data entry procedures, and automated validation criteria to prevent input errors; (ii) Implement mechanisms for periodic data verification, reconciliation, and cleansing; (iii) Apply artificial intelligence to detect anomalies, identify fraud, and enhance data reliability.

CONCLUSION

Recognizing the importance of EIS usage in the digital transformation process in Vietnam, as well as the difficulties and challenges faced by Vietnamese enterprises in using the system, and based on 04 main research directions on EIS published in academic journals: (i) the level of EIS usage; (ii) frameworks and processes for E-invoice system implementation; (iii) factors influencing the acceptance of EIS usage; (iv) factors affecting the effectiveness of EIS usage, the researcher has selected the fourth research direction that focusing on usage effectiveness with the topic: ***“Research on factors affecting the effectiveness of E-invoice System Usage in Vietnamese Enterprises within the Digital Economy”***

Based on the results of the literature review, the researcher conducted qualitative research through in-depth interviews with 28 experts, thereby proposing a research model consisting of 10 factors: (i) “System Quality”; (ii) “Information Quality”; (iii) “Service Quality”; (iv) “Top Management Support”; (v) “Digital Skills”; (vi) “Readiness”; (vii) “Technological Infrastructure Quality”; (viii) “Legal Framework”; (ix) “User Satisfaction”; and (x) “Effectiveness of E-invoice System Usage,” along with 17 hypotheses regarding the relationships among these factors.

After proposing the research model, the researcher conducted model validation and hypothesis testing using a quantitative research method with data

collected from 579 accounting staff using the E-invoice system from 579 Vietnamese enterprises. This dataset was cleaned from an initial sample of 588 accounting staff from 588 enterprises across four northern provinces of Vietnam (Hanoi, Bac Ninh, Phu Tho, and Quang Ninh).

The testing results indicate that all research hypotheses are accepted, confirming that the research model is appropriate.

Based on these findings, the researcher proposed several solutions and recommendations to enhance the effectiveness of EIS usage in Vietnamese enterprises within the digital economy.

With the achieved results, the dissertation has fulfilled its research objectives and contributed several new insights, enriching the body of literature on factors affecting the effectiveness of IS usage in general and EIS in particular, as follows:

▪ **Theoretical Contributions**

i) This study proposes a comprehensive research model comprising 08 factors: System Quality, Information Quality, Service Quality, Technological Infrastructure Quality, Top Management Support, Digital Skills, Readiness, and Legal framework that directly influence User Satisfaction. In addition, these factors exert both direct and indirect effects on the effectiveness of EIS usage through the mediating role of user satisfaction within the context of the digital economy. The proposed model provides a robust theoretical foundation for understanding and enhancing the effective use of EIS in enterprises.

ii) The study extends and refines the updated D&M by incorporating 05 additional constructs, namely Technological Infrastructure Quality, Top Management Support, Digital Skills, Readiness, and Legal Framework. Furthermore, the construct “Use” is excluded, as it represents a behavioral outcome more suitable for process-oriented research rather than causal modeling. The study also removes the reverse relationship from the effectiveness of EIS usage to User Satisfaction to better align the model with the specific characteristics of EIS and the research context of the digital economy.

▪ **Practical Contributions**

i) Based on the proposed model, this study develops and refines measurement scales and empirically validates the relationships among the identified factors. The results indicate that all factors have positive and significant direct effects on both the effectiveness of EIS usage and User Satisfaction. Moreover, the findings reveal that the indirect effects of these factors on the effectiveness of EIS usage mediated through user satisfaction are stronger than their direct effects. This highlights the critical role of human factors in enhancing the performance and effective utilization of EIS in Vietnamese enterprises.

ii) Based on the relationships among the identified factors and the magnitude of their effects, this study proposes several solutions and recommendations to assist relevant stakeholders in enhancing the effectiveness of EIS usage.

In summary, although the novel contributions of the dissertation have enriched the literature on factors affecting the effectiveness of information systems in general and E-invoice systems in particular, the study still has certain limitations in terms of: (i) data collection subjects; (ii) data sources; (iii) research scope.

These limitations suggest the need for further in-depth studies on: factors influencing the effectiveness of EIS usage; expanding the range of respondents to include representatives from enterprises and tax authorities; broadening the geographical scope of data collection; and extending the research scope to enterprises of different sizes.

Therefore, future research aiming to develop a more comprehensive model of factors affecting the effectiveness of EIS usage should expand the respondent pool to include business leaders, employees directly involved in EISs within enterprises, and staff involved in EISs within tax authorities. In addition, future studies should extend data collection to central and southern regions of Vietnam and include enterprises of larger scale and those with foreign investment.

Furthermore, it is necessary to propose a model of factors affecting the effectiveness of EIS usage within Vietnamese tax authorities in the digital economy. Finally, researchers may consider using larger samples with more diverse demographic groups, along with longer survey and research periods.

LIST OF PUBLISHED SCIENTIFIC WORKS

1. Pham Huyen Trang (2020), “E-invoices: Promoting the Operation of the Digital Economy,” *State Tax Journal*, No. 34 (809), August 20, 2020.
2. Pham Huyen Trang (2021), “E-invoices: Some Perspectives on Evaluating Usage Effectiveness,” *Proceedings of the National Scientific Conference on Information Systems in Business and Management*, University of Economics Ho Chi Minh City.
3. Pham Huyen Trang (2021), “Proposing a Model of Factors Affecting the Effectiveness of E-invoice System Usage in Vietnamese SMEs in the Digital Economy,” *Journal of Economics and Forecasting*, No. 27/2021.
4. Pham Huyen Trang (2022), “E-invoices – A Tool to Promote Modern and Efficient National Governance,” *State Management Journal*, No. 317, June 2022.
5. Pham Huyen Trang (2023), “E-invoices – Promoting Transparency, Modernization, and Public Disclosure at the State Bank of Vietnam in the Context of the Fourth Industrial Revolution,” *Proceedings of the National Scientific Conference: Administrative Procedure Reform at the State Bank of Vietnam in the Context of the Fourth Industrial Revolution – Current Situation and Solutions*, Banking Academy, State Bank of Vietnam.
6. Pham Huyen Trang (2023), “E-invoices – Promoting Fully Online Public Services in the Development of E-Government,” *State Management Journal*, No. 333, October 2023.