In the context of the industrial revolution 4.0, information technology (IT) plays an essential role in the supply chain operation. Adopting IT helps companies stay competitive globally. Many researchers have highlighted the influence of IT on supply chain management and performance. It facilitates the linkages between components in the supply chain, minimizes operating costs, and enhances supply chain performance. Furthermore, IT helps increase the speed and quality of information exchange between partners in the supply chain, increasing competitiveness. To develop tourism, the application of information is a prerequisite for success. Currently, most tourism organizations in Vietnam have applied IT in operating their activities. However, new technologies' application and updated processes have not been synchronized. In Vietnam, literature reviews have indicated that there was no research demonstrating the role of IT in the supply chain performance of the tourism industry. This study was conducted to demonstrate the influence of IT on tourism supply chain performance in Vietnam. The level of impact is presented through the intermediary of "information sharing" and "electronic data interchange". Research data was collected from 154 domestic and international travel agencies. The study has applied structural equation modeling (SEM) to prove the positive impact of IT on information sharing and electronic information exchange, thereby improving the efficiency of the supply chain. Research results have confirmed the significant role of IT in tourism supply chain performance in Vietnam. It concludes that tourism managers need to pay special attention and adequately invest in IT to improve the performance of the tourism supply chain continuously

Keywords: information technology, information sharing, electronic data interchange, tourism supply chain performance

UDC 658
DOI: 10.15587/1729-4061.2022.267281

ESTIMATES OF THE IMPACT OF INFORMATION TECHNOLOGY ON THE TOURISM SUPPLY CHAIN PERFORMANCE IN VIETNAM

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Received date 05.09.2022
Accepted date 14.11.2022
Published date 30.12.2022

How to Cite: *Nguyen, Q. N., Hoang, T. H. L. (2022). Estimates of the impact of information technology on the tourism supply chain performance in Vietnam. Eastern-European Journal of Enterprise Technologies, 6 (13 (120)), 96–106. doi: https://doi.org/10.15587/1729-4061.2022.267281*

1. Introduction

In the 21st century, advanced science and technology benefit work and life [1–3]. The development of information technology has changed doing business and managing supply chains [4]. It facilitates the linkages between components in the supply chain, minimizes operating costs [5–7], and enhances supply chain performance [8, 9]. Furthermore, information technology helps increase the speed and quality of information exchange between partners in the supply chain, thus increasing competitiveness [10]. Besides, IT facilitates real-time information sharing and strengthens information visibility [11–15]. Several studies have demonstrated that information technology plays a vital role in the supply chain [16, 17]. Investing in information technology to manage the supply chain is an effective solution to gaining competitive advantages in the market [18, 19]. Therefore, it is necessary to determine the role and importance of information technology in supply chain performance. Tourism is a smokeless industry that is one of the essential elements of Vietnam's economy. The application of information technology is a prerequisite for success in the tourism development, especially in the Covid-19 pandemic. This is because information technology could be employed to mitigate the negative impact of the pandemic. The information technology sector proved its usefulness during the recent two years of the Covid-19 pandemic when the majority of enterprises in tourism witnessed a significant decrease in revenue due to travel restrictions and safety regulations. To some extent, improving information and communication technologies can help those enterprises (such as travel agents, hotels, restaurants, and recreation sites) optimize supply chain performance and brand awareness and reduce risks. Although most tourism organizations in Vietnam have applied information technology in operating their activities, new technologies' application and updated processes have not been synchronized. A review of the literature shows that there is no research demonstrating the role of information technology in the supply chain performance of the tourism industry in a developing country, like Vietnam. Despite the importance of information technology-related activities in tourism in the Covid-19 crisis, scholars have not paid much attention to it. Therefore, research on the influence of information technology on the tourism supply chain performance needs to be considered carefully. This can help tourist managers have insights and understand the critical role of smart tourism (relating to digital technology, big data, artificial intelligence, robotics revolutions, etc.), thus increasing the level of application of information technology in operation.

2. Literature review and problem statement

The concepts of "information technology" and "supply chain" are one of the most concerning terms in modern scientific literature. Thus, this part of the article aims to review the linkage between information technology and supply chain performance that has been examined by previous researchers. Furthermore, the literature analysis also identifies the gaps in the literature, thus showing the importance of this study. Additionally, this part also reviews the nexus between information technology and supply chain performance through two intermediary variables: "information sharing" and "electronic data interchange".

According to [20], information technology is a term that includes software, internet, and computer system used for the distribution and processing of data, exchange, storage, and use of information. Information technology promotes more accessible and more effective information sharing. Similarly, in [21, 22], researchers claimed that if information is appropriately shared and regularly updated, it enhances the organization's competitiveness and achieves sustainability in business operations. Many researchers, such as [23–26], have highlighted the influence of information technology on supply chain management and performance. For instance, according to [23], the hospitality industry service supply chain is found to be directly influenced by "Knowledge management" and "Information technology competency". The model proposed in [23] shows that "Knowledge management" works as an intermediary variable in the causal relationship between supply chain efficiency and the organization's ability on information technology. However, [23] did not mention other potential latent variables, and it only focuses on the hotel sector, making it difficult to generalize the results to other service industries. In addition, in [24], the authors proved that the application helps accelerate the exchange of planning and operation data, contracts, real-time progress reports, and delivery. Similarly, in [25], the authors have demonstrated that IT plays an important role in many industries and can help manufacturers meet customers' requirements today. IT enables firms to add more secondary functions to attract customers, e. g. anticipated problem-solving features and unanticipated problem-solving features of a product. For example, the value of a car is not considered solely by its primary function but also by the convenience and enhancements that IT and relevant software can provide. A modern smart car system can connect vehicles to a data center, providing access to unlimited information to aid in driving for safety. However, those authors did not present any convincing evidence to demonstrate the influence of IT on the performance of firms in the supply chain of a specific product in the globalization context. In addition, according to [26], IT is one of five independent variables that influence firms' performance and reduction in transaction costs. The research results denoted the growing influence of IT in partnership governance structures. Yet, the research was conducted in firms in the US, where the IT industry has developed well for many years. Therefore, the spillover of IT enhancements to other industries can be recognized. Meanwhile, the level of development of the IT sector in developing countries (like Vietnam) has not been researched thoroughly.

According to [27], supply chain performance is broadly defined as the performance of processes and functions. It includes all closely linked activities, which is the ability to produce and deliver products/services to meet customer needs, delivering superior efficiency to members [28, 29]. The research study by [30] also found that firms with a strategic orientation emphasizing cooperation among supply-chain partners are more likely to gain more significant economic benefits than firms that apply the traditional notion of competition. Researchers have applied different criteria to measure supply chain performance. For instance, [31] assumed that customer satisfaction could be used to measure the performance of the supply chain, while [32] believed inventory costs, on-time deliveries, product availability, and response time were performance indicators. [33, 34] found differences suggesting that flexibility is a key response to business performance. Meanwhile, [35] indicated that enterprise logistics is an important tool for coordinating supply chain operations that are geographically dispersed worldwide. It appears that there is no consensus among scholars on the measurement of supply chain performance. The reason for this may be objective difficulties associated with the unique features of various industries.

Information technology facilitates real-time information sharing by reducing the system's variability and uncertainty [12, 14, 15]. Real-time data sharing is increasingly becoming vital in many sectors. For example, [15] found that real-time data can successfully inform rapid adaptive management in international development programmes. Similarly, [12] shows that integrating Geographical Information Systems (GIS), remote sensing, and communication platforms (e. g., web-based information and instant messaging – SMS/MMS) can alert smallholder farmers about incoming floods in near real-time. In addition, information technology supports processing software to provide high-quality information among stakeholders in the Indian auto components industry [36]. Information technology combines information sources and positively affects the information-sharing process between the government and citizens, which leads to a democratic society [13]. According to [37], information technology enables to lift quality standards and ensure process standards through data accuracy, information sharing and timely communication. Also, it promotes collaboration and data sharing to identify changes in the market, thereby taking appropriate actions [38]. These studies reveal that information technology-based platforms can help improve supply chain performance through the mediating role of information sharing. However, there were unresolved issues related to estimating the causal relationship between three factors (information technology, information sharing and supply chain performance). The reason is probably associated with the research method used by previous scholars. Several researchers have employed qualitative research methods with small sample sizes; thus, the research cannot meet the requirements of quantitative analysis models.

Information technology promotes the electronic exchange of information between partners in the supply chain [24, 39, 40]. According to [39], integrating multiple organizations in the supply chain (e. g., customers, providers, stakeholders) possibly becomes a complicated process that takes time to manage. To support this process, information technology can provide several tools to facilitate and increase the reliability of communications as well as the exchange of information between organizations. Information technology increases the speed and depth of information exchange between members [24], contributing to an organization's competitiveness [10]. Information technology enhances information exchange in the buyer-supplier relationship through data processes [41, 42]. Information tech-

nology enables business partners to increase the volume and complexity of exchanged data [11]. However, [40] indicated that most of interviewed logistics firms in Vietnam mainly shared operational information (e. g., ordering information) instead of strategic information through traditional communication channels such as emails and telephones. The authors also claimed that the main factors influencing sharing practices include technical capability, security risks, organization rules and policies, and mutual trust.

Information technology is one of the critical factors in supply chain management, playing an essential role in improving its performance [26]. Information technology effectively monitors supply chain activities [42, 43]. It can quickly respond to customer needs and improve organizational performance [44]. Applying and managing information technology increases the quality of the supply chain [45, 46]. The above finding is consistent with the study by [47]. The authors examined the impact of IT on developing supply chain competitive advantage in 76 manufacturing firms in Greece. As a result, the authors confirmed the crucial role of IT practices (e. g., e-procurement, e-commerce, e-invoice, and data exchange) in establishing a sustainable competitive advantage based on Supply Chain Management. Information technology enables organizations to integrate internally, with suppliers, and with customers to maximize operational efficiency [48, 49].

Information sharing is critical to improving an organization's operations. Also, it utilizes resources and equipment, reduces costs, and effectively manages supply chain events [50, 51]. Information sharing helps businesses quickly identify emerging problems, optimizing supply chain processes and performance [52]. Information sharing is a critical component of supply chain performance management [53]. Information sharing builds better partnerships and fosters the connection between suppliers and manufacturers in the supply chain, which leads to operational efficiency [54–56]. [54] undertook a study with data from 3951 small or medium-sized enterprises in four target industries: import/export, manufacturing, retail, and wholesale. They concluded that the willingness to share template-based information increases when partnerships become closer. This can be explained by the fact that important information (such as financial and strategic information) cannot be shared arbitrarily with partners who may later be competitors. Furthermore, [55] claimed that information sharing results in better annual profit with a drop in buyer's price. Several types of information are shared between buyers and vendors, including possible yield losses, output uncertainty, capacity shortages, equipment problems, quality issues, and insufficient stocks. A research finding by [56] also pointed out that information sharing can prompt knowledge sharing and improve the buyer-supplier relationship and supplier performance in the electronics industry. In addition, according to [57], data from 125 North American manufacturing firms denoted that both effective information sharing and effective supply chain practice are significant in achieving good supply chain performance. Therefore, information sharing positively affects supply chain performance [58, 59].

Electronic communication enables real-time exchange of information between partners, members, suppliers-retailers and improves supply chain speed [60, 61]. According to [62], using EDI for information transmission allows companies to save considerable amounts of time and money (e. g. inventory costs, orders placed, cumulative cost, amplification and excess net stock) in the supply chain. Electronic data interchange positively affects supply chain performance, benefits information transmission, and supplier-retailer relationships [63, 64]. Electronic information exchange enables rapid information sharing, reduces uncertainty, enhances supplier transportation efficiency, and enhances supply chain system performance [65]. EDI allows rapid exchange of information [66], reduces risks, enhances transportation productivity, and increases supply chain performance [67]. A research finding by [68] also points out that EDI applications positively influence customer service as well as cost reduction because it greatly reduces time and effort to complete purchasing transactions by eliminating the paper chain of requisitions, approvals, receiving and payment reconciliation. However, the research only approached a small sample size (34 respondents). This results in being challenging to conduct quantitative research methods (e. g. multiple regression analysis).

Although the complex linkage between variables (information technology, supply chain performance, information sharing, and electronic data interchange) has been examined theoretically, there is a lack of empirical evidence from the tourism industry in the Covid-19 period. This is probably due to the difficulties of data collection when the coronavirus has spread out in Asian countries, and many travel agencies have gone bankrupt. Besides, several prominent research works have not fully studied the impact of latent variables such as "information sharing" and "electronic data interchange" on supply chain performance. Based on this, the problem of quantitative examination of the causal relationship between information technology and supply chain performance in tourism remains unresolved. That is why there is a need to conduct a study using a large sample size and alternative intermediary variables to fill the literature gap.

3. The aim and objectives of the study

The aim of the study is to demonstrate the influence of information technology on tourism supply chain performance in Vietnam. This will make it possible to increase the level of information technology-based activity of the business.

To achieve this aim, the following objectives are accomplished:

– to identify the scale of factors;

– to form the research framework and hypotheses;

– to employ quantitative research methods to test the hypotheses.

4. Materials and methods

Based on the literature review and the proposed hypotheses, the present research proposes five hypotheses as follows:

– H1: information technology positively impacts information sharing in the tourism supply chain;

– H2: information technology positively influences electronic data interchange in the tourism supply chain;

– H3: information technology positively influences tourism supply chain performance;

– H4: supply chain information sharing (SCIS) positively affects tourism supply chain performance;

– H5: electronic data interchange (EDI) has a positive impact on tourism supply chain performance.

The study has applied focus group discussion, which is frequently used as a qualitative approach to gain an in-depth understanding of social issues. The group discussion was conducted with the participation of nine experts (six travel agency managers, two university lecturers, and one independent expert) and was under the authors' supervision. The results of the group discussion help identify the appropriate scales for the factors of the research model. Additionally, the authors proposed a research framework in line with the previous studies and current characteristics of travel agencies in the Covid-19 pandemic. The research framework is shown in Fig. 1.

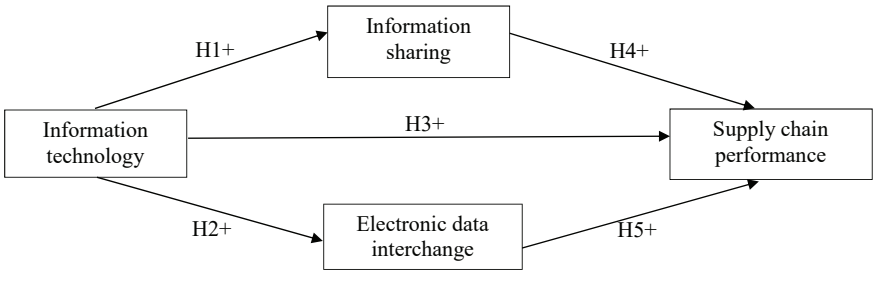

Fig. 1. Proposed research framework

The authors use qualitative and quantitative research methods to achieve the goals. First, expert consultation is applied to identify the appropriate scales for factors in the research model. In addition, quantitative analyses include testing the reliability of the scale by Cronbach's Alpha, exploratory factor analysis (EFA) to evaluate the convergent and discriminant validity of scales, confirmatory factor analysis (CFA) to test the suitability of the research data. Finally, structural equation modeling (SEM) is employed to test the research hypotheses.

The study uses quota sampling to collect data. The grouping criteria include enterprise scale and operating area. The study surveyed from February 2021 to April 2021 by e-mail interview. The survey respondents are the Board of Directors of domestic and international travel agencies. To ensure the reliability of the SEM model, a large sample size is required because it is based on the theory of sample distribution [69]. The appropriate sample size is determined based on the number of factors [70]; the minimum sample size should be 150 when the number of factors is 7 or less. Each factor must have more than 3 observations, and communality values in EFA reach 0.5 or above [70]. Based on the proposed research model, the sample size is at least 150 observations. The sample size achieved is 154 travel agencies (112 international and 42 domestic travel agencies). Headquarters are located in the main cities in Vietnam, such as Ho Chi Minh, Ha Noi, Da Nang, and Can Tho city. The sample size meets the requirements, ensuring the reliability test.

5. Results of studying the impact of information technology on the supply chain performance in the tourism industry

5. 1. Formulation of the scale of factors

In this study, there are four main factors that are mentioned above, including "Information technology (IT)", "Supply chain information sharing (SCIS)", "Electronic data interchange (EDI)", and "Supply chain performance (SCP)". Therefore, this part of the research explains how to formulate the scale of those factors.

A group discussion has been undertaken with the participation of nine experts from universities (department of tourism, and department of IT), the Mekong Delta Tourism Association, and enterprises in tourism. In parallel, the authors have examined a wide range of periodic scientific publications to identify the observable variables that could be used to measure the factors. This would ensure the factors in the research are appropriate for a transition economy context like Vietnam.

As a result, each factor (that could be considered as a concept) can be measured by various dimensions. For instance, the concept of "Supply chain performance" was constituted by four observed variables as follows:

– SCP1: effectiveness of the organization's supply chain management;

– SCP2: influence of relationship management on performance;

– SCP3: level of risk management in the supply chain;

– SCP4: responsiveness to market changes.

These variables were transferred into a questionnaire that used a Likert-type scale (from 1 to 5). In which, "1" refers to "totally disagree", and "5" refers to "totally agree" on a specific statement. Table 1 presents the various dimensions of each factor that then is utilized in Exploratory factor analysis (EFA).

Table 1

Interpretation of observed variables in the research model

Factor	Observed variables	Scale	Reference sources
Information technology (IT)	IT1: Level of information technology usage in the supply chain	Likert 1-5	[10, 42, 47, 71–75]
	IT2: Alignment of applications (applying technologies in the supply chain)	Likert 1-5	
	IT3: Information technology improves operational risk resistance	Likert 1-5	
	IT4: Using information technology in relationship quality management	Likert 1-5	
Supply chain information sharing (SCIS)	SCIS1: Quality of information shared	Likert 1-5	[59, 62, 75–79]
	SCIS2: Extent to which internal information is shared	Likert 1-5	
	SCIS3: Level of information sharing between members and suppliers	Likert 1-5	
	SCIS4: Reliability of information sharing in the supply chain	Likert 1-5	
Electronic data interchange (EDI)	EDI1: Level of integration of shared information	Likert 1-5	[10, 80–86]
	EDI2: Extent to which information is exchanged with suppliers by technology	Likert 1-5	
	EDI3: Level of technology application in information exchange	Likert 1-5	
	EDI4: Data analysis capability of information flows	Likert 1-5	
Supply chain performance (SCP)	SCP1: Effectiveness of the organization's supply chain management	Likert 1-5	[87–93]
	SCP2: Influence of relationship management on performance	Likert 1-5	
	SCP3: Level of risk management in the supply chain	Likert 1-5	
	SCP4: Responsiveness to market changes	Likert 1-5	

As can be seen from Table 1, there are four observed variables measured for each factor. These variables are crucial in explaining various aspects of each concept (factor). Therefore, they would be tested for reliability before undertaking quantitative analysis such as EFA, CFA and SEM.

5. 2. Testing the reliability of scales

The study tests the scale reliability by Cronbach's Alpha coefficient. Based on the test results, all scales have Cronbach's Alpha values from 0.794 to 0.899. Also, all observed variables have the corrected item-total correlation values greater than 0.3 [94]. Hence, all research scales have met the reliability requirement [95–97] and can be used for the following exploratory factor analysis (EFA). Table 2 presents the test results of scale reliability including key indices such as Standard deviation, Factor loading, and Cronbach's Alpha.

Table 2

Scale reliability test results

Observed variables	Mean	Standard deviation	Factor loading	Cronbach's Alpha
Information technology (IT)				
IT1	3.34	1.084	0.703	0.840
IT2	3.40	0.880	0.872	
IT3	3.23	0.972	0.633	
IT4	3.19	0.912	0.757	
Supply chain information sharing (SCIS)				
SCIS1	3.72	0.931	0.621	0.847
SCIS2	3.48	0.885	0.895	
SCIS3	3.52	0.949	0.822	
SCIS4	3.57	0.845	0.616	
Electronic data interchange (EDI)				
EDI1	3.75	0.803	0.593	0.794
EDI2	3.65	0.812	0.565	
EDI3	3.72	0.734	0.895	
EDI4	3.65	0.680	0.596	
Supply chain performance (SCP)				
SCP1	3.39	1.137	0.863	0.899
SCP2	3.48	0.963	0.787	
SCP3	3.37	0.981	0.761	
SCP4	3.32	0.911	0.919	

The statistical values are guaranteed: Bartlett's test of the variable correlation reaches Sig.=0.000 [98]. The model's suitability test is accepted with KMO=0.879 [98]. The reliability of the observed variables is satisfactory, with the Factor loading value higher than 0.5 [98]. The cumulative variance test reaches 70.54 % (>50 %) [99]. This shows that the observed variables included in the model have a high explanatory capacity. Based on the final test results, 4 factors are created from 16 observed variables, ensuring convergent and discriminant validity.

Table 3 indicates that statistical indicators are guaranteed: Chi-square/df=1.740<2 with P=0.000≤0.05. The TLI and CFI values reach 0.931 and 0.943, all greater than 0.9. RMSEA=0.069<0.08 [99, 100]. This proves that the research data is consistent with the market data.

Scale testing is necessary in quantitative research. The test helps to evaluate several important indices such as Composite Reliability, and Average Variance Extracted. Table 4 presents the results of the scale testing analysis.

Table 3

CFA and SEM analysis results

Evaluation criteria	CFA	SEM	Comparative value	Reference resources
2 –	170.5 27	172. 347	–	[99, 100]
DF	98	99	–	
2/*df*	1.7 40	1.741	2	
P-value	0.000	0.000	<0.05	
TLI	0.9 31	0.9 31	0.9	
CFI	0.943	0.943	0.9	
RMSEA	0.0 69	0.0 69	0.08	

Table 4

Scale testing analytical results

Factor	Number of observed variables	Composite Reliability (P_c)	Average Variance Extracted (P_{vc})	Reference resources
Information technology (IT)	4	0.84	0.57	[101]
Information sharing (SCIS)	4	0.84	0.58	
Electronic data interchange (EDI)	4	0.80	0.50	
Supply chain performance (SCP)	4	0.90	0.70	

According to Table 4, the values of composite reliability (P_c) and average variance extracted (P_{vc}) meet the statistical requirement (the minimum P_c value reaches 0.80 and P_{vc} is 0.50), according to [101]. All factors are satisfactory in value and reliability, so all scales are suitable for the subsequent SEM analysis.

5. 3. Research Hypothesis Test

Structural equation modeling (SEM) is used to test the research hypotheses. The results of the analysis are shown in Table 5.

Table 5

Research hypothesis test results

Relationship	Unstandardized			Standardized Estimated Value	Significance	Hypothesis
	Estimated value	Standard error S.E	Critical ratio C.R			
SCIS<--IT	0.634	0.117	5.406	0.570	***	H1: accepted
EDI <--IT	0.552	0.101	5.459	0.588	***	H2: accepted
SCP<--IT	0.439	0.168	2.618	0.294	***	H3: accepted
SCP<--SCIS	0.460	0.124	3,708	0.343	***	H4: accepted
SCP<--EDI	0.478	0.154	3.105	0.300	***	H5: accepted

Based on Table 5, hypotheses H1, H2, H3, H4, and H5 are accepted at a 99 % significance level. The relationship between the factors is discussed in detail in the next section.

6. Discussion of the results of studying the impact of IT on the supply chain performance

The specified indicators (Tables 4, 5) indicate that *Information Technology* positively impacts *Information Sharing* in the tourism supply chain. Based on the estimation results presented in Table 5, *Information technology* is positively correlated with *Information sharing*. The standardized estimated value reaches 0.570, and the statistical significance P=0.000. This points out that if travel agencies invest in information technology, it promotes information sharing among members and improves the quality and intensity of information shared. The research result is consistent with the studies proposed by [26, 43–47, 102, 103].

Information technology also positively affects *Electronic data interchange* in the tourism supply chain. This hypothesis is accepted with the standardized estimated value of 0.588 and the statistical significance of P=0.000. This proves the beneficial relationship between information technology and electronic information exchange in the tourism supply chain. This finding confirms the assumption of previous scholars that information technology promotes electronic data exchange between members and partners in the supply chain [24, 39, 40]. In addition to this, it increases the speed and depth of information exchange among partners [11, 24]. In fact, the majority of enterprises in the tourism industry in Vietnam are small and medium-sized enterprises (SMEs). Typically, these enterprises are not able to spend much money on advertising and customer relationship management. Therefore, electronic information/data exchange is a feasible solution to save cost and time, thus enhancing business operation effectiveness.

Testing the impact of *Information technology* on tourism *Supply chain performance* was conducted rigorously. There is a positive relationship between information technology and tourism supply chain performance, with the standardized estimation coefficient of 0.294 and the statistical significance level P=0.000. The result emphasizes the vital role of information technology in improving supply chain performance. Furthermore, investing in information technology enhances the ability to quickly respond to customer needs and supply chain performance. The research result is consistent with the studies proposed by [26, 45–47].

In addition, Table 5 shows the standardized estimated coefficient reaching 0.343 and statistical significance P=0.000. This means that *Information sharing* positively affects tourism *Supply chain performance*. Information sharing is essential in improving the performance of each element participating in the supply chain. It also enhances human resource usage, minimizes costs, and effectively manages advertising campaigns. Furthermore, sharing information in the tourism supply chain helps quickly identify issues, thereby optimizing supply processes. The research finding is consistent with the literature [50–52, 54–59].

The fifth hypothesis states that *Electronic data interchange* positively affects tourism *Supply chain performance*. This hypothesis is accepted with the standardized estimated value of 0.300 and statistical significance of P=0.000. The result demonstrates a positive relationship between electronic information exchange and tourism supply chain performance. EDI facilitates the real-time exchange of information between supply chain actors and improves supply chain speed and efficiency. Besides, EDI allows to exchange information quickly and enhance the supplier's transportation efficiency as well as the performance of the whole supply system. This finding is consistent with the studies proposed by [60–65, 67, 68].

The disadvantages of the study are that the data collection is limited during the Covid-19 pandemic. Furthermore, the limitation of data used in the model may result in the lack of generalization for different types of enterprises (large enterprises, small and medium-sized enterprises – SMEs) in the service sector. Therefore, adopting information technology in small and medium-sized enterprises' daily operations under the conditions of dynamism and uncertainty of the market can be a potentially interesting object of further research.

According to the Vietnam National Administration of Tourism [104], only hotels (especially large-scale hotels and international hotels) successfully apply IT in their business operation. Other actors in the tourism supply chain, such as travel agencies, tourist destinations, and transport companies, have limitations in applying IT, digitalization, and network security. For instance, many tourism-related enterprises have had their database stolen or lost website domains (.com). Several large enterprises lost domains, such as Sai Gon Tourist (lost domain of Saigontourist.com), Ha Noi Tourist (lost domain of Hanoitourist.com), Vitour (lost domain of Vitours.com). This might have negative influences on their business performance as well as their prestige.

Compared to Thailand's tourism, Vietnam's tourism has fewer competitive advantages. This might result from a shallow collaboration between different actors in Vietnam's tourism supply chain in terms of vertical and horizontal collaboration, thus decreasing productivity and performance. In addition, recovering after the Covid-19 pandemic is a significant challenge for tourism in both Vietnam and Thailand. However, the Thailand government enacted policies supporting their supply chain very soon (e.g., spending 2.88 million USD to recover the tourism industry, boosting collaboration between travel agencies and Thai Airways or charter flights, and developing virtual tours) [105], while Vietnam authorities seem to be late in reaction to changes in the global tourism market. Therefore, it is necessary to strengthen the stakeholder relationship (including enterprises and government agencies), in which information sharing and strategic collaboration should be considered to adapt to a changing world.

7. Conclusions

1. The research framework and five hypotheses are formulated in the present study. Accordingly, two factors of "information sharing" and "electronic data interchange" play an intermediary role in explaining the nexus between "Information technology" and "Supply chain performance". In addition, "Information technology" directly influences "Supply chain performance" in the tourism industry in an emerging country like Vietnam.

2. The scale of factors mentioned in the research framework is constructed. Sixteen observed variables in total reflect various dimensions of factors. It is proved that these variables are appropriate to the current context of the tourism industry in Vietnam.

3. The quantitative indicators of research results indicate that all hypotheses are accepted. This means that "Information technology" has a positive impact on "Information sharing", "Electronic data interchange", and "Supply chain performance". Furthermore, "Information sharing"

and "Electronic data interchange" also positively influence "Supply chain performance". This result can be interpreted so that the considerable improvement in information technology and communication system in travel agencies contributes to ameliorating the performance of the whole chain. Applying information technology advances enables enterprises to increase the excellent experience of customers (tourists) as well as reduce operational costs, time of purchase and paper works. Therefore, this study suggests several main feasible solutions for travel agencies to boost their information technology capability. These measures are recommended based on the current weakness of most of the travel agencies in Vietnam. Firstly, the enterprise should accelerate digitalization in the internal systems. Secondly, it is necessary to enhance the competencies of IT department staff. Last but not least, the enterprise should be aware of protecting the website's domain.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

Financing

The study was performed without financial support.

Data availability

Data cannot be made available for reasons disclosed in the data availability statement.

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