Journal of Business and Management Sciences, 2025, Vol. 13, No. 1, 1-7
Available online at http://pubs.sciepub.com/jbms/13/1/1
Published by Science and Education Publishing
DOI:10.12691/jbms-13-1-1

Research on Digital Transformation Readiness Levels of Petroleum Small and Medium Enterprises in Thanh Hoa, Vietnam

Nguyen Thi Loan[1], Lai Duc Loc[2], Do Thi Man[3,*]

[1]Assoc. Prof. Dr, Hong Duc University, Vietnam
[2]MBA, The State Bank of VietNam - Thanh Hoa Provincial Branch, Vietnam
[3]DBA, Hong Duc University, Vietnam
*Corresponding author: dothiman@hdu.edu.vn

Received November 25, 2024; Revised December 27, 2024; Accepted January 02, 2025

Abstract The economic reform has comprehensively changed the production and business activities of enterprises, increased efficiency, shortened time and streamlined management. That success must be attributed to the digital transformation efforts with many positive results of enterprises in many fields and types. The article mentions the readiness levels of the digital transformation of Petroleum enterprises in Thanh Hoa Vietnam based on six aspects of digital transformation, such as strategy, infrastructure and technology, digital customer experience, operation, corporate culture and data and information assets. Through the assessment of Digital Business Indicators (DBI). It can be seen that petroleum companies are mainly at Level 2 - Beginning in the digital transformation roadmap. Some indicators exceed Level 3 - Forming. Based on the current status, the author proposes a number of solutions to further promote efficiency in digital transformation at enterprises.

Keywords: *Digital transformation, readiness levels, solutions, petroleum enterprises*

Cite This Article: Nguyen Thi Loan, Lai Duc Loc, and Do Thi Man, "Research on Digital Transformation Readiness Levels of Petroleum Small and Medium Enterprises in Thanh Hoa, Vietnam." *Journal of Business and Management Sciences*, vol. 13, no. 1 (2025): 1-7. doi: 10.12691/jbms-13-1-1.

1. Introduction

In today's rapidly evolving digital age, digital transformation has become a critical factor in the success of modern businesses. It refers to the process of using digital technologies to change business models, create new opportunities, and enhance value [1]. It is no surprise that research on digital transformation has raised vast interest among academics in recent decades. Countries, cities, industries, companies, and people all face the same challenge of adapting to a digital world [2]. When firms use digital technologies to create new or modify existing business models and processes or to support the transformation of organizational structures, resources, or relationships with internal and external actors, scholars refer to this as digital transformation [3]. According to Cichosz [4], digital transformation enables businesses to change how they operate and deliver services, while also creating new business models that increase revenue and optimize operational efficiency. Verhoef et al. [5] identified three stages of digital transformation: digitization, digitalization, and digital transformation. They identified and delineated growth strategies for digital firms as well as the assets and capabilities required in order to successfully transform digitally. Digital transformation not only brings competitive advantages but also helps businesses improve internal processes and management systems through technology [6]. In the context of an economy operating according to a market mechanism, the sustainable and stable development of businesses is always an important measure [7]. However, despite its potential, implementing digital transformation poses significant challenges. Businesses often face high upfront investment costs with no clear guarantee of returns on these investments [8].

Understanding this, petroleum companies in Thanh Hoa province have constantly made efforts to adjust their strategy, focusing on the application of information technology in business operations. For many years, the companies have determined that the digital transformation process plays an essential role in improving operational efficiency. However, the companies still need to overcome certain limitations in the application and digital transformation process to ensure optimal performance. Therefore, this study comprehensively assesses the current status of digital transformation at petroleum companies, focus on small and medium enterprises, which account for 98% of all enterprises and plays important motivation role in evonomic development. From there, the study will deeply analyze existing problems and propose practical solutions to promote the digital transformation process in the coming period, thereby improving the competitiveness

and sustainable development of the companies.

2. Literature Review and Research Framework

There have been many studies on methods to assess the readiness of digital transformation for businesses. Scientists have developed an empirical scale of qualitative and quantitative parameters for assessing an organization's readiness to implement digital technologies. A comprehensive system of criteria for evaluating readiness has been developed, for example, customer, operation, culture, innovation, performance, and resources [9,10]. Organizations have quite varied maturity criteria. An innovative approach to evaluating an organization's preparedness for implementing information technology. From the degree of preparedness of an outsider to that of an expert and the top performer, it was founded on 18 points of complexity criteria that were defined by quality levels of passion and professionalism in the process of implementing digital transformation [11]. This approach is beneficial for the organization's self-assessment to understand the current state of readiness for digital transformation**.** By researching global smart manufacturing models, including the Acatech, Deloitte, Openroad, and Taiwan's iBench models, a strong basis for evaluating businesses' readiness for digital transformation may be established [9,10,11,12]. Applying those models—which work well for standardized and well-founded businesses—takes many crucial steps toward implementing digital transformation successfully. However, there is still a significant gap to applying the entire approach as described above for Vietnamese businesses, particularly SMEs. Vietnamese SMEs have many unique factors [13]. The awareness of business leaders about the necessity of digital, smart production, application of basic management tools in production such as Manufacturing JIT, Lean, Total productivity management still have many limitations, and the machinery systems are still not synchronized [14,15].

In Vietnam, according to Ministry of Information and Communications [16], the DBI (Digital Business Indicators) is the full name of the Enterprise Digital Transformation Index. This is the basis for evaluating digital transformation for businesses nationwide to help each unit determine the most accurate transformation stage. Pursuant to Decision No. 1970/QD-BTTTT, from December 13, 2021, the Ministry of Information and Communications officially approved the Scheme on Determining Indicators to assess the level of digital transformation of enterprises and support the promotion of digital transformation enterprises, including the DBI Index and its objectives, wide communication direction [17]. On November 7, 2023, the Ministry of Information and Communications issued Decision No. 2158/QD-BTTTT approving the Scheme to determine the Index to assess the level of digital transformation of enterprises and support the promotion of digital transformation enterprises [18]. Accordingly, the DBI index consists of 6 main pillars common to all business sizes. including strategy, infrastructure and technology, digital customer experience, operation, corporate culture and data and information assets. This study uses the DBI index to assess the readiness of Thanh Hoa petroleum enterprises to digitally transform according to the 6 main pillars listed above.

3. Research Method

Based on the theoretical basis and results of related studies, as well as consulting with 10 experts in the field of digital transformation, the authors designed a preliminary questionnaire based on the DBI scale. The questionnaire was then tested with 20 managers in the enterprises to ensure its completion, and then it will be used to investigate the companies with a total sample size of 256 employees. The time frame for collecting survey and investigation data is from December 2023 to February 2024. The authors then analyzed the collected data and concluded as a basis for evaluating the effectiveness of digital transformation at petroleum companies in Thanh Hoa province.

To assess the current status of digital transformation in the companies and the level of digital transformation response, the authors conducted a comprehensive survey of the staffs in the companies. The results of 265 questionnaires were distributed, 235 were collected, and those with incomplete information were eliminated, leaving 210 valid questionnaires for further analysis. The survey included questions that were evaluated according to the level of agreement with the current status at the following levels: 1: Do nothing, 2: Beginning, 3: Forming, 4: Developing, 5: Best-performing. From there, the scales of the digital transformation level was deduced as follows:

Table 1. Scale of employee satisfaction

Rating Points	Interval scale	Understand as/digital transformation level
1	1.00-1.80	Do nothing/ Level 1
2	1.81-2.60	Beginning /Level 2
3	2.61-3.40	Forming/ Level 3
4	3.41-4.20	Developing / Level 4
5	4.21-5.00	Best-performing/ Level 5

(Source: Ministry of Information and Communications, 2023 [13])

4. Research results

Based on the DBI index with 6 main pillars: Digital Transformation Strategy, Digital Transformation in Infrastructure and Technology, Digital customer experience, Digital transformation operations (digital transformation personnel), Digital transformation of corporate culture, and Data and digital information assets. The results of the assessment of the readiness of digital transformation of Thanh Hoa Petroleum SMEs are indicated below:

Digital Transformation Strategy

Grasping the rapid development of science and technology, the companies's Board of Directors has proactively developed strategic plans to meet the digital transformation needs of the enterprise, thereby bringing companies firmly into the digital age. The companies have approved the digital transformation strategy until 2025, with a long-term orientation until 2030. One of the main

focuses of this strategy is to build a digital culture. The survey results on digital transformation strategy according to the DBI index set are as follows:

Table 2. Readiness levels of Digital Transformation Strategy in Petroleum SMEs

Criteria	Average score	Level of digital transformation
Enterprises have built a digital transformation strategy.	2.81	3
The digital transformation strategy has been implemented.	2.34	2
The enterprise's digital transformation strategy is consistent with the overall strategy.	2.21	2

(Source: SME survey results)

Evaluating the criteria related to the digital transformation strategy of the enterprise shows a low score ranging from 2.21 to 2.8. This result also reflects the current state of digital transformation in the enterprise. In general, the enterprise has determined, taken solid steps, and has a vision toward the goal of digital transformation in the future.

The enterprise has endeavored to develop and execute a digital transformation strategy for every individual within the organization. However, numerous aspects remain unsuitable or unimplementable, resulting in the implementation of the target level and a low suitability of the strategy at 2.34. To solve this problem, it is necessary to introduce policies and measures to encourage enterprises to apply digital transformation. These measures will help raise awareness, support capacity building, and promote innovation.

Digital Transformation in Infrastructure and Technology

Digital transformation infrastructure and technology are essential factors that play an important role in the digital transformation process of businesses and organizations. They provide the necessary platforms and tools to digitize and automate business processes, improve operational efficiency, and improve the customer experience. Grasping the trend of the times, companies have constantly tried to transform digitally to adapt to the constant changes in science and technology.

The survey results on digital transformation infrastructure and technology according to the DBI index are as follows:

Table 3. Readiness levels of Digital Transformation in Infrastructure and Technology

Criteria	Average score	Level of digital transformation
The business has a connection to broadband Internet.	3.57	4
The business has a wireless internet connection.	3.45	4
ICT security policy is guaranteed	2.34	2
Data protection policy guaranteed	2.33	2
Quality assurance policy is guaranteed	2.52	2
Number of specialized IT departments of the enterprise meeting the requirements of digital transformation.	2.41	2

(Source: SME survey results)

In the context of the rapid development of digital technology, broadband or wireless network connection has become indispensable for every business. The survey results show that the Internet connection infrastructure of businesses has been invested and upgraded. This is also inevitable because the Internet is now popular to everyone, agencies, organizations, businesses, or families all install systems to connect to the network. Although reaching a fairly good level with an average score of 3.5, there are still some employees who cannot use companies's Internet because many connecting devices are still limited. The difference in the level of network connection between businesses reflects differentiation in the digital transformation process. Businesses that seize the opportunity to digitize will have a competitive advantage, while slower businesses will easily fall behind in the technology era.

Digital customer experience

In today's digital age, a business's success or failure is heavily influenced by the digital experience of its customers.

To improve services and support customers in using and storing invoices, companies used an electronic invoice instead of a paper invoice. This helps to overcome errors in lost, burned, and damaged invoices, and reduces risks and fraud when using invoices.

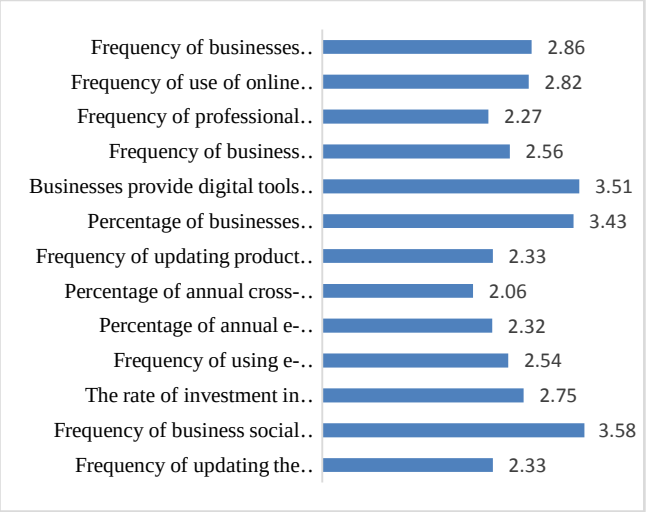

Figure 1. Readiness levels of Digital customer experience in petroleum SMEs *(Source: SME survey results)*

Always striving to become a digital enterprises, companies have had ideas to bring its products and services to e-commerce platforms and social networks to reach more customers. The companies have also built its website and has pages on Facebook to communicate, receive, process information, and interact with people more easily. Although has website, the frequency of access and attracting viewers to interact on the website is not as expected. Conversely, the rate of interaction on social networks like Facebook is quite high, surpassing the expected level. This is also understandable because the number of Facebook users in Vietnam is currently close to 80 million. Vietnam is in the top 7 countries with the most Facebook social networking platform users in the world. Businesses are using e-commerce to sell products, but the revenue conversion rate of these platforms is very low, almost negligible. This indicates that businesses have not

fully leveraged the available resources of e-commerce platforms to enhance their business activities. Due to the business characteristics of petroleum products, lubricants, and chemicals, reaching customers on e-commerce platforms remains challenging. Businesses primarily launch their products on social networks like Facebook due to the stable interactions they foster there. The online activities section reveals that the frequency of connections in digital environments is low. Even the companies conduct their transactions directly with banks, rather than through online platforms.

Digital transformation operations (digital transformation personnel)

Every year, petroleum companies organize training courses for employees and store managers on gas station management. Conferences and training sessions are opportunities for employees to meet, share, and exchange valuable experiences accumulated through working at companies. From there, companies aim to be a united collective, ready to exchange and help each other improve their work.

Table 4. Readiness levels of digital transformation operations in petroleum SMEs

Criteria	Average score	Level of digital transformation
The rate of enterprise employees graduating from ICT courses is High.	2.52	2
The percentage of employees in business specialist roles working remotely is High.	2.72	2
Businesses create conditions for employees to participate in online training classes.	3.13	3
The company has built up a repository of knowledge and expertise.	2.35	2

(Source: SME survey results)

According to the published survey results, the rate of employees of enterprises who have graduated from ICT courses is rated low, only 2.52 points. This figure reflects the fact that enterprises are not interested in training human resources in information and communication technology (ICT). The primary cause of this situation could be the absence of a dedicated technology sector within enterprises, leading to the manual execution of key tasks. Therefore, the demand for ICT human resources is still not considered important. In addition, enterprises have not encouraged employees to participate in online courses or build internal knowledge bases. This shows that they are not aware of the importance of updating their knowledge and technology skills to keep up with the modern digital transformation trend. Although they have not invested much in ICT training, the rate of sales staff in enterprises working remotely is rated higher. However, the reason behind this assessment is not because the business has implemented effective remote work support measures, but mainly comes of the perception of the survey participants. They think that remote work can be done via phone or laptop, an incomplete understanding of the requirements of modern remote work.

The rate of businesses facilitating employees to participate in online courses may be quite high, but the rate of building knowledge and expertise is low. This may be largely due to the human factor, as the average age of the company's workforce is high. This means that many individuals are not prepared to learn and accept new technologies, which makes training challenging.

Digital transformation of corporate culture

Petroleum companies is also one of the pioneers in implementing the conversion to a digital office model. from 2018, companies deployed E-office software. E-office is a system built on a web platform, digitizing the document management process from the company to the company's officers and employees; meeting the requirements of synchronization, searching and processing documents anytime, anywhere on Internet-accessible terminals. Results of evaluating the digital transformation index of corporate culture.

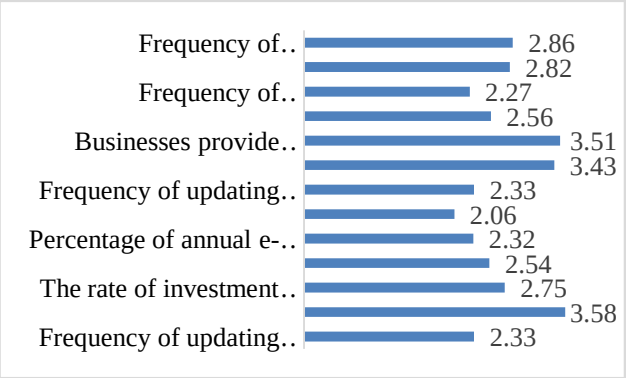

Figure 2. Readiness levels of digital culture response in petroleum SMEs *(Source: SME survey results)*

The R&D infrastructure of enterprises is still not well developed. With a modest score of 2.33, investment in R&D is still a dark area, hindering the emergence of breakthrough inventions. Patents and exclusive brands are extremely rare, which can make it difficult for enterprises to position themselves in the global market.

Enterprises have recognized the importance of innovation, but the gap between vision and action is still significant. Although there have been assessments of innovation capacity with an average score of 3.02, there is still a lack of effective activities. This is clearly shown in the frequency of cooperation between enterprises to create pioneering products and services with an average score of 2.21, as well as the rate of enterprises owning their own databases with an average score of 2.86. This represents a disconnect between thinking and actual doing, which hinders businesses' ability to innovate and improve.

Data and digital information assets

In the context of strong digital transformation, data, and digital information assets have become extremely valuable resources for businesses. Recognizing this importance, businesses have actively deployed comprehensive information security classes and training courses for all employees. These training programs not only help employees understand the power and pitfalls of information technology in the business context but also equip them with essential knowledge to ensure the safety of digital life in the 4.0 era. Results of the assessment of the unit's data and digital information assets index.

The survey results show that in this index, enterprises are rated at a low average level with scores ranging from 2.53 to 2.91. This shows that enterprises need to pay more attention to building and managing this important asset pillar. Specifically, the indicator of enterprises collecting

and using big data of enterprises is only rated at 2.53 points, showing that enterprises do not have the habit of collecting data. Enterprises often only collect small data about the market situation and competitors but cannot collect and process big data. Although there is internal software, most of the collected data is usually stored on computers or documents, without using specialized software for management. This makes it difficult to retrieve, analyze, and use data. Businesses have not yet taken advantage of data collection methods through digital channels. Businesses mainly use manual data collection methods such as phone calls, face-to-face meetings, or observations on social networks. There are not many popular digital tools or channels used to collect data. Businesses need to increase the systematic collection, storage, and management of data. In this way, businesses can exploit insights from data to make better decisions and improve operational performance.

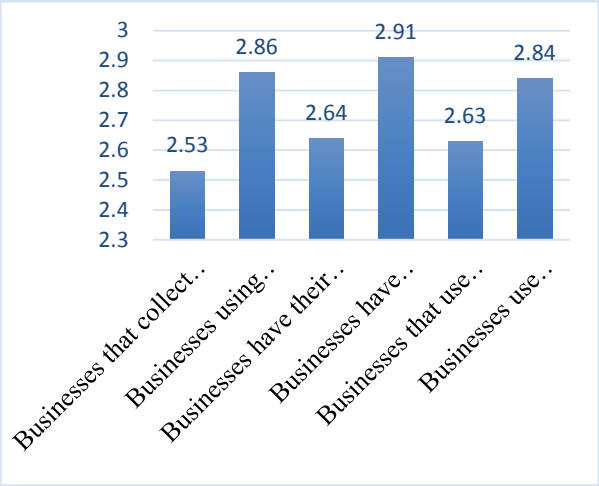

Figure 3. Readiness levels of digital information asset data in petroleum SMEs *(Source: SME survey results)*

Results of Digital Transformation Assessment

Indicators The survey results show that most indicators of the level of digital transformation assessment in enterprises have an average score of below 3. This alarmingly low number in most indicators signals the fact that the level of digital transformation of the company has only reached the level of start-complete. Although businesses are aware of the importance of digital transformation, they lack a clear strategy to put this ship into operation. Management, operations, and business activities are still following the old path, without any signs of digital innovation. Businesses face a significant challenge in the digital age, as those who fail to adapt risk falling behind. Not embracing digital transformation not only puts companies at a disadvantage, but it also gives competitors who are more adept at technology an advantage. Businesses need to wake up to this reality and make urgent changes. A comprehensive digital transformation strategy is key, providing a clear roadmap for applying technology to every aspect of business operations. It is time for businesses to take action and embrace the power of digital transformation. By doing so, businesses can not only improve operational efficiency, and enhance competitiveness, but also access long-term success in an increasingly digital world.

Table 5. Readiness levels of digital transformation in Petrolium SMEs

Criteria	Average score	Level of digital transformation
Digital transformation strategy	2.42	2
Digital transformation infrastructure and technology	2.75	3
Customer Experience in Digital Transformation	2.65	3
Digital Transformation Operations	2.68	3
Digital transformation of corporate culture	2.55	2
Data and digital information assets	2.70	3

(Source: SME survey results)

In general, the indexes range from 2.4 to 2.75, showing the company's significant progress in all key aspects of digital transformation. The company has been in the process of digital transformation, but through the above indexes, it can be seen that companies do not have a vision and long-term strategies for the digital transformation process. Most of the strategies are short-term strategies, without many positive results. However, the Infrastructure and Technology section, with a score of 2.75, shows that the company has begun to invest in advanced systems and technologies to support its digital transformation process. The digital transformation operation section shows that companies have increased operational efficiency in digital processes and activities. The processes have been streamlined and effectively adapted to optimize work productivity. In addition, there are 2 items that the company also needs to improve: Customer experience in digital transformation and digital transformation of corporate culture. The company needs to focus on improving customer engagement and delivering seamless digital experiences. However, the adoption of digital values and practices remains an area that needs improvement. The company can consider driving cultural change, encouraging digitally conscious behaviors, and creating a culture where innovation and adaptation are top priorities.

Through the assessment of digital transformation indicators, it can be seen that petroleum companies are mainly at Level 2 - Beginning. Some indicators have surpassed Level 3 - Formation. This shows that the company is in an active digital transformation phase, with some areas having made significant progress in the transition to digital models and technologies

5. Some Solutions for the Digital Transformation Process At Petroleum Companies

As previously discussed, the current state of digital transformation in petroleum companies is hindered by numerous limitations, which adversely affect the outcomes of these activities. Based on the above limitations, the author has some proposed solutions at 3 levels to help improve the digital transformation process at petroleum companies as follows:

Level 1, Basic digital transformation helps to operate effectively and optimize resources.

Upgrade the cashless payment system: Cashless payment allows customers to make payments through solutions such as cards, transfers, e-wallets, or QR Codes. Cashless payments offer numerous advantages to customers, including the reduction of time spent managing cash or bank transactions, enhancing payment convenience, and freeing up cashiers to engage in various other roles that enhance customer value.

Putting products on e-commerce: Putting products on e-commerce platforms can make items more accessible to customers, thereby increasing the number of new customers. Customers can buy products online and receive them right at home. Customers ordering and paying in advance helps companies manage and optimize costs for premises and warehouses. Replacing or upgrading hardware related to measurement automation is crucial for companies. Despite having an automation system, the system's age and numerous errors make its use inconvenient.

Management through automation can help the company save human resources, forecast supply needs, and control unnecessary losses. Automate the management of schedules and routes: Currently, companies manually mobilize imports and exports, requiring the warehouse keeper to dispatch vehicles to import and export goods based on each customer's request. This takes a lot of time and sometimes some errors cause the import and export of goods not to meet expectations. The automated system's management and monitoring will display the actual export and inventory quantity. Based on the customer's request, the system will automatically calculate and provide imports and exports in accordance with the actual needs. Management according to the automated system will save maximum manpower and operational capacity will be optimized.

Main results to be achieved at level 1: Start to bring automation into the company's operations, so customers can serve their own needs, manage measurement connections to save manpower, and be more efficient in work.

Level 2, Advanced Digital Transformation puts automation as the main goal to help improve productivity and development.

Loyalty management: Loyalty is a customer loyalty program, this is a promotion for customers through the process of purchasing and using services at the company. Previously, companies had implemented the program and received significant support from customers. However, the new operational process encountered numerous errors, leading the company to temporarily halt operations. Allowing customers to accumulate points and offer promotions will help retain existing customers and attract new ones.

Building a store on a phone application: The phone is an indispensable tool for everyone, building a store management system on an e-commerce platform or being able to apply a separate store on the phone helps customers easily choose and shop, thereby speeding up the transaction speed.

Self-checkout counters: While self-checkout counters have gained popularity in many other industries, they are not as prevalent in specific industries like gasoline. Deploying a self-checkout counter system helps customers increase their experience, attract new customers, and optimize staff costs.

Main results to be achieved at level 2: Finding new markets, innovating new business models such as phone business, smart after-sales service, and proactively searching for customers using artificial intelligence applications.

Level 3, Comprehensive digital transformation brings new product and business service innovations.

Integrate multi-channel platforms: Integrate sales across multiple channels to maximize customer interaction to create a consistent customer experience, thereby making products more accessible to customers more effectively and easily through multiple channels.

Authenticate product origin: Allow customers to view the origin, production date, expiry date, and product licenses to protect the brand from counterfeiting and make customers more confident when buying products.

Advertising cooperation: Use digital platforms to take advantage of businesses with similar customer files and product types, thereby sharing resources to develop brands or sell products together. Cooperation helps reduce advertising costs, increase the effectiveness of brand and product communication, and increase sales.

Key results to be achieved at level 3: Use data to analyze business forecasts, discover new markets, develop new products and services In addition to the above solutions, the human factor plays a significant part in the company's digital transformation process. More than 70% of digital transformation companies fail due to a lack of proper training in technology skills for their employees. To avoid making the same mistakes as previous businesses, companies need to focus on the training and development of their staff. The companies need to periodically organize training courses to help employees understand and proficiently use non-cash payment methods and process online transactions. The aim of the course is to equip all employees with fundamental knowledge and understanding of technology. Technology personnel must ensure that the maintenance and upkeep of equipment and materials serving the digital transformation process is free of problems and interruptions.

6. Conclusion

The 4.0 industrial revolution with its outstanding technical advances in the application of technology brings businesses great opportunities and prospects to improve not only in Vietnam but also in the world. The study has assessed the current status of digital transformation at petroleum companies. The research results indicate that the company has made significant progress in digital transformation, but still faces numerous challenges. The author has thoroughly analyzed the factors that led to this situation. On that basis, the study proposes specific solutions for petroleum companies as well as recommendations to promote the digital transformation process more effectively.

Funding

This article is a research result of the Ministary Level of Scientific Project under code number **B2023-HDT-02** funded by Hong Duc University .

ACKNOWLEDGMENT

The authors would like to thank Petroleum Companies in Thanh Hoa, Hong Duc University, MBA student helped us collect research data.

References

[1] Teng, X., Wu, Z., & Yang, F. (2022). Impact of the Digital Transformation of Small‐and Medium‐Sized Listed Companies on Performance: Based on a Cost‐Benefit Analysis Framework. *Journal of Mathematics*, *2022*(1), 1504499.

[2] Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International journal of information management*, *63*, 102466.

[3] Plekhanov, D., Franke, H., & Netland, T. H. (2023). Digital transformation: A review and research agenda. *European Management Journal*, *41*(6), 821-844.

[4] Cichosz, M. (2018). Digitalization and Competitiveness in the Logistics Service Industry. E-Mentor, 77(5), 73–82.

[5] Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of business research*, *122*, 889-901.

[6] Chen, C. L., Lin, Y. C., Chen, W. H., Chao, C. F., & Pandia, H. (2021). Role of government to enhance digital transformation in small service business. *Sustainability*, *13*(3), 1028.

[7] OECD. (2017). *OECD Reviews of Innovation Policy: Kazakhstan 2017*, Paris: OECD Publishing.

[8] Sundaram, R., Sharma, D. R., & Shakya, D. A. (2020). Digital transformation of business models: A systematic review of impact on revenue and supply chain. *International Journal of Management*, *11*(5). 9–21.

[9] Jung, K., Kulvatunyou, B., Choi, S., & Brundage, M. P. (2016). An overview of a smart manufacturing system readiness assessment. In *Advances in Production Management Systems. Initiatives for a Sustainable World: IFIP WG 5.7 International Conference, APMS 2016, Iguassu Falls, Brazil, September 3-7, 2016, Revised Selected Papers* (pp. 705-712). Springer International Publishing.

[10] Schuh, G., Anderl, R., Dumitrescu, R., Krüger, A., & ten Hompel, M. (2020). Industrie 4.0 maturity index. Managing the digital transformation of companies – update 2020. Munich: National Academy of Science and Engineering. https:// en.acatech.de/ publication/industr ie-4-0-maturity-index-update-2020/.

[11] Lichtblau, K., Stich, V., Bertenrath, R., Blum, M., Bleider, M., Millack, A., Schmitt, K., Schmitz, E., & Schröter, M. (2015). Impuls - Industrie 4.0 readiness. Aachen, Cologne. https:// industrie40.vdma.org/ documents /4214230/ 26342484/ Industrie_ 40_Readi ness_Study_1529498007918.pdf/0b5fd5 21-9ee2-2de0-f377-93bdd01ed1c8.

[12] Axmann, B., & Harmoko, H. (2020). Industry 4.0 readiness assessment: comparison of tools and introduction of new tool for SME. Technical Journal, 14, 212-217.

[13] Ministry of Planning and Investment & USAID (2021), Digital Transformation Handbook for Enterprises in Vietnam.

[14] Ministry of Planning and Investment & USAID (2022), Annual Report on Digital Transformation of Enterprises 2022: Level of readiness for digital transformation of Vietnamese enterprises.

[15] Ministry of Planning and Investment & USAID & Agrotrade Vietnam (2022), Digital Transformation Handbook for Small and Medium Enterprises: Program to support enterprises in digital transformation for the period 2021-2025.

[16] Ministry of Information and Communications (2023), Decision No. 2158/QD-BTTTT, approving the Scheme on determining indicators to assess the level of digital transformation of enterprises and supporting the promotion of digital transformation enterprises. Decision 2158/QD-BTTTT 2023 determines the Index for assessing the level of digital transformation of enterprises.

[17] Ministry of Information and Communications (2021), Decision No. 1970/QD-BTTTT, approving the project to determine the index to assess the level of digital transformation of enterprises and support to promote enterprises in digital transformation.

[18] Ministry of Information and Communications (2023), Decision No. 2158/QD-BTTTT, approving the Scheme to determine the Index to assess the level of digital transformation of enterprises and support the promotion of digital transformation enterprises.