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Original Article

Digital Transformation Readiness of Electrical Equipment Manufacturing Enterprises in Hanoi

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Abstract: The study of digital transformation that leads to the implementation of the digital economy is a matter of special concern for businesses around the world. This study systematizes the theoretical basis of digital transformation in manufacturing enterprises and on that basis analyzes the current status and readiness for the digital transformation of electrical equipment manufacturers in Hanoi. The analysis results show that electrical equipment manufacturing enterprises in Hanoi are at the beginning of the digital transformation. Overall, companies show the highest levels of digital readiness in forward and backward linkages. The study also provides recommendations for businesses in the process of implementing digital transformation and recommendations on the state's macro policies in creating favorable conditions for businesses to successfully implement digital transformation in the future.

Keywords: Digital transformation, enterprises, manufacturing, electrical equipment.

1. Introduction

Digital transformation is currently a matter of concern for everyone, including the C-suit, governments, policymakers, and academia [1]. Digital transformation is ongoing and holds great promise to drive innovation, create efficiency and improve services, and drive productivity gains. However, those benefits come with new challenges as digital transformation changes the nature and structure of organizations, markets, and communities, and raises employment and technical concerns, privacy, and security, as well as the concept of equity and integration. A big problem is that we are often not ready to accept changes imposed by old thinking and habits [2]. Researching the awareness and readiness of businesses for digital transformation is an urgent issue because digital

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transformation is not simply an effort to invest in information technology applications but a comprehensive and profound reform in order to fully exploit the power of the times and technological advances to improve efficiency, competitiveness and create a basic foundation for a long-term development journey.

Meanwhile, the manufacturing industry is an important industry and is the driving force for Vietnam's economic growth in the period 2011-2020 [3]. This is also a highly profitable industry from Industry 4.0. However, labor productivity in Vietnam's manufacturing sector is very low compared to other East Asian countries [4]. The study of the digital transformation situation of equipment manufacturing enterprises is of theoretical and practical significance for research enterprises and other manufacturing enterprises and is necessary for the successful implementation of the transition to the digital economy in the future. This may require new organizational forms and new ways of working to build the capacity to perceive, shape, and seize opportunities [7, 9]. If manufacturing enterprises do not take full control of their digitization efforts in terms of developing and transforming their methods, strategies, and organizations, they risk losing opportunities to create profits and are left behind by others [10-11]. The study of digital transformation to lead to the implementation of the digital economy is a matter of special concern for businesses around the world.

2. Theoretical foundations of digital transformation of manufacturing enterprises

2.1. Concepts

Digital transformation is the general trend of the 4.0 era.

In his book *Digital Transformation*, Siebel [1] posits that the confluence of four technologies - elastic cloud computing, big data, artificial intelligence, and the Internet of things, is fundamentally changing how business and government will operate in the 21st century.

According to many studies, digital transformation is the ability of an organization to "adapt, respond, and position itself for success in the face of the rapid technology evolution" [14], which is changing the way businesses operate around the world [16]. However, the essence of digital transformation is the creation of a new production method based on technology and digital data and gradually converting to that method. And for successful digital transformation, besides the application of new digital technologies and data, businesses need to build a comprehensive and appropriate digital transformation process.

2.2. The importance of digital transformation

Many studies suggest that digital transformation is associated with high expectations (new quality of services, increasing competitiveness and productivity, unique experiences, etc.) and concerns (new professions, job losses, threats to information security, high-cost risks) [17]. According to the statistics of the Ministry of Science and Technology, the reasons why manufacturing enterprises should transform digitally are environmental benefits, risk management, improving the efficiency of equipment use, management efficiency, etc., value, saving input, and increasing output. According to Microsoft's 2018 research, the five biggest benefits when businesses adopt digital technology are improvement in profit margins, improvement in productivity, cost reduction, increased revenue from new products and services, and improved customer advocacy and loyalty [18]. Digital transformation is a chance for Vietnam to increase labor productivity, promote innovation and improve national competitiveness.

2.3. Conditions and difficulties in digital transformation of manufacturing enterprises

Four important elements of digital transformation [19] are:

Vision and strategy: Vision is expressed through strategy. Businesses need to think

beyond what they think is possible - especially in a time when speed and agility are essential to survival.

Culture: Culture supports strategy and vision, and activates and empowers employees. Digital transformation organizations succeed when all employees unite and work on the values and vision they share.

Distinctive potential: Businesses that discover the distinctive potential of the organization will respond and adapt to circumstances more easily. Every organization has potential, but it's important to find a specific point of difference - a key point - that can set your business apart in a whole new way.

Competence: This means a combination of human capacity and technological competence. Businesses need human resources equipped with the right skills to make the transformation. They also need appropriate and secure technology platforms with the ability to empower employees to remotely access and grow the business under any circumstances.

In the context of Vietnam, the fourth industrial revolution - Industry 4.0 - is a huge chance for Vietnam to make a breakthrough. To succeed, however, there are five barriers that need to be overcome. These are leadership and political will, Vietnam's legal regulations, human resources, and an ecosystem for innovation and start-up businesses and digital infrastructure [20].

According to another study by Microsoft, the top three challenges that organizations in Asia-Pacific have faced in their digital transformation are a lack of skill and resources, a siloed and resistant culture, and a lack of thought leadership in driving digital transformation [18]. Whereas the biggest challenges in the digital transformation of manufacturing enterprises in Vietnam are: lack of information, finance Shortage, technology identification and incompatible and not useful equipment. In the next part of the study, the authors will analyse these challenges for electrical equipment manufacturers in Hanoi.

3. Situation and readiness for the digital transformation of electrical equipment manufacturers in Hanoi

3.1. Research methods

Previous studies have shown that for companies that are just starting this transformation, key questions are: how to start and what barriers are hindering the digital transformation that relates to the company's readiness for digital transformation [21, 22]. Ismail, Khater, Zaki [22] divided the barriers companies face in the transformation into two groups: leadership and institutional. Among the problems of leadership is the absence or uncertainty of a digital strategy, which turns out to be the most significant barrier, especially in the early stages of transformation [23]. Institutional barriers include insufficient organizational structure, lack of technical skills and investments, regulatory restrictions, the cultural gap between managers and employees, and even psychological aspects, such as indifference to the need for transformation and fear of change [24, 25]. These problems are not only in the scale of the novelty of digitalization but rather in the company's inability to function outside of the familiar operating environment [25]. All these restrictions require the company to deeply analyze its internal relations and operations to understand the company's readiness for digital transformation [21]. The results of numerous studies show that only a synergy of business and digital management strategies can lead to success [26-28]. In this study, the authors examine the concept of corporate readiness and internal barriers to digital transformation according to the research of Stoianova [21]. Studies on the readiness of businesses for digital transformation [21, 29, 30] have analyzed and given evaluation criteria such as:

- Organizational culture: full, long-term digital transformation requires redefining organizational mindsets, processes, and talent and capabilities for the digital world.

- Business model: Organizations need to evaluate their business model and the maturity of the company's architecture before any digitalization and witness its revolutionary consequences. Specifically, companies should analyze the efficiency of IT, its correspondence between strategies, and to what extent it is involved in the business.

- Business process: Some businesses are dependent on their unique business processes, and as they can be easily mimicked or even improved, continuous digitization is crucial for the readiness and success of organizations. Moreover, organizations need to assess the automation, and standardization and how their processes are integrated within the company or consumers, which will show how prepared a company is for change.

- Systematic management: The significance of leadership is more than common knowledge in any circumstance, and that includes organizations, but more specifically significant is leadership competence in decision-making in accordance with any digital change. Management needs to be reviewed in terms of the company's consistency of objectives, quality of change management, and feedback. Evaluating the speed and completeness of management when implementing change within organizations in general, not necessarily in the context of digital technology, can portray the effectiveness and therefore the value of readiness. Additionally, the quality of feedback in the management system within the company and between contractors also indicates preparedness for digital transformation.

Critical parameters for choosing a digital transformation strategy result from assessments of the current state of the company, or rather an assessment of the company's readiness for digital transformation [21]. In addition, many studies also use the Digital Adoption Index (DAI) to assess the status and readiness for the digital transformation of enterprises [31] through 6 pillars (human resources, finance, strategy and organization, smart production, infrastructure, and forward and backward linkages). The DAI helps businesses identify where they are in their digital transformation journey, as well as analyze their capacity, potential, and barriers to advancement. Most of the current research focuses on multinational, transnational, or leading domestic companies, or large-scale companies in the fields of banking, information technology, and telecommunications. There have not been many studies on the readiness for digital transformation in small businesses, especially in Vietnam. From the synthesis and analysis of previous research results, combined with the actual situation of Vietnamese enterprises, the authors find that the use of the DAI is appropriate for the research enterprise.

Two surveys evaluated the level of digital awareness and readiness of electrical equipment manufacturing enterprises in Hanoi. The research focuses on two modules:

Survey module 1 assessed awareness of digital transformation in electrical equipment manufacturing enterprises in Hanoi. This survey aims to answer questions such as: (i) What are the reasons for adopting digital technologies, emerging technology trends and vision and strategy in selected electrical equipment manufacturing enterprises? (ii) What are the main barriers to organizations' further adoption of digital technologies associated with Industry 4.0?

Survey module 2 estimated the level of readiness for digital transformation in electrical equipment manufacturing enterprises in Hanoi. This survey aims to answer: What is the level of digitalization in representative companies in selected businesses?

To assess the level of readiness for digital transformation in electrical equipment manufacturing enterprises in Hanoi, the author used the digital acceptance index (DAI) [31] to evaluate. The DAI was then computed by weighting each of these areas to build a prepared readiness indicator for the entire enterprise [32]. The assessment of acceptability through the enterprise sub-indicators was carried out using a standardized questionnaire consisting of a closed-ended question for each item. Each question required an answer that gives a Likert

value from 1 "not implemented/not important" to 5 "widely deployed/very important". The overall DAI score was calculated from the weighted average of all pillar values.

According to the value of DAI, businesses were classified into three levels of digital adoption:

• Businesses with a DAI value of 1 to 2: have done nothing or little to deal with digital adoption or those who point to Industry 4.0 or are unknown or irrelevant

• Enterprises with a DAI value of 3: have taken the first steps in digitization

• Experienced / top performers (with a DAI value of 4 to 5) are well on their way to the digitization and thus are far ahead of most companies in the sector.

The data in this study were collected in 23 small and medium-sized electrical equipment manufacturing enterprises operating in Hanoi. The objects of the survey are the middle or senior managers of these enterprises. The survey was conducted from August to October 2021.

3.2. Research results

3.2.1. The awareness of digital transformation in electrical equipment manufacturing enterprises in Hanoi

The reasons for adopting digital technologies

The most common reasons for enterprises to invest in digital technology are reducing input costs (74%), increasing productivity (83%), and increasing business management (70%). The results of the assessment of the reasons for the digital transformation of the enterprises are shown in Figure 1.

Figure 1 shows that enterprises are not really interested in digital transformation to create environmental benefits, manage risks and improve equipment efficiency.

Emerging technology trends

In the field of electrical equipment manufacturing, because most businesses assemble and process such products, technologies directly related to production are most appreciated. Among technology fields such as Big data, Simulation, 3D printing, Robotics and automation, Process monitoring and control, these enterprises tend to be interested in the processes of monitoring and control (48%), robotics (39%), and automation technology (30%). Technologies related to research and development, analytics, and marketing receive much less attention. Only nearly 5% of manufacturing enterprises appreciate the role of simulation technology and big data technology. The results of this assessment are shown in Figure 2.

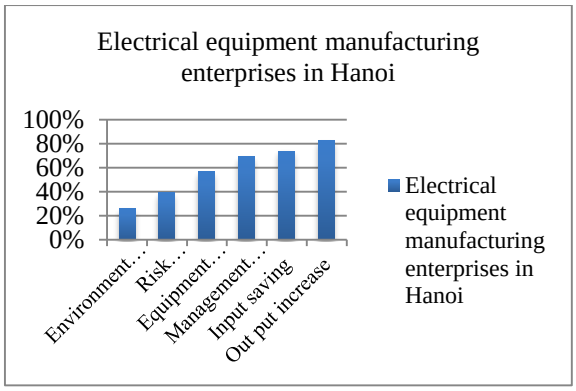

Figure 1: Reasons given as to why enterprises should adopt digital technologies
Source: Authors' survey results.

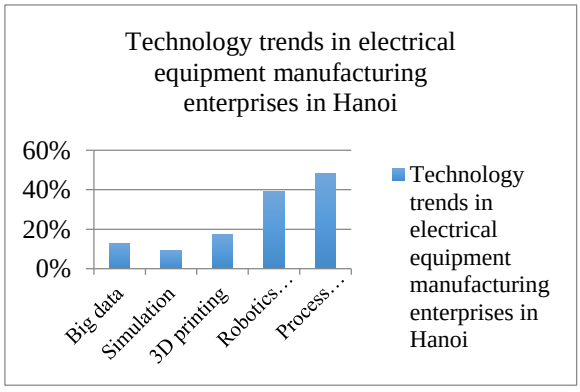

Figure 2: Technology usage trends of electrical equipment manufacturers in Hanoi
Source: Authors' survey results.

Vision and strategy

Most of the enterprises surveyed are relatively new to the concept of Industry 4.0 or

do not have a clear understanding of digital transformation. Most of the transformation businesses want to do digital transformation, but only a very small percentage are determined to develop a detailed plan or allocate capital for digital adoption in the coming year.

Challenges for development

Survey results show that unclear economic benefits and uncertain impact on technology adoption and over-investment in digital transformation are prominent challenges in the digital transformation process of the selected enterprises. At the same time, it can be seen that the lack of information on the impact of digital transformation on businesses is one of the main barriers to digitalization. Moreover, because of the limited financial resources, the enterprises have difficulty investing in machinery, equipment, and human resources. The specific results are shown in Figure 3.

3.2.2. The readiness for digital transformation in electrical equipment manufacturing enterprises in Hanoi

The survey results show:

Digital skills and capabilities: About 90% of electrical equipment manufacturing enterprises are small and medium-sized enterprises, with characteristics of producing single products, small quantities, and diverse product categories. According to the author's survey, more than 20% of businesses said they have enough Information Communication Technology (ICT) skills to effectively maintain and use their digital systems, while the rest of the businesses said that they have difficulties in recruiting and retaining staff with skills and capacity to operate the digital systems currently in use and that will be used in the near future. Many enterprises also lack regular practice using ICT software and systems and software applications that support digital transformation provide users with a comprehensive information system such as data information Business to Business (B2B), Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), finance, warehouse situation, and etc. Approximately 26 % of their state employees are familiar with, and use collaboration software such as virtual teams on a daily basis. However, less than 20% of enterprises stated that they provide regular training or retraining on ICT-related skills for employees.

Strategy: The majority of enterprises surveyed have managed to incorporate digitalization in their corporate or business strategy. However, only one in every ten enterprises has created a detailed roadmap or a coordination unit for digitalization. In addition, around 10% stated the company's leaders are fully knowledgeable and aware of the importance, workings, and implication of Industry 4.0.

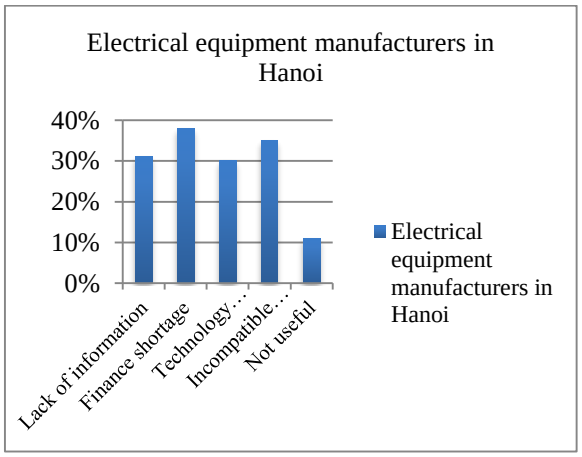

Figure 3: Top challenges to digitalization in electrical equipment manufacturers in Hanoi
Source: Authors' survey results

Finance: The largest barrier to digital adoption for the electrical equipment manufacturing enterprises in Vietnam is finance. Only around 13% of enterprises surveyed reported significant investment in digitalization in the last year and less than 10% indicated an intention to invest significantly in the next five years. The low investment among enterprises may be a result of insufficient available finance and a reluctance to invest in digitisation. Investing in new technology also involves significant uncertainty. Some enterprises declare there is a lack of trusted information available on the benefits of investing in new digital systems,

and they lack the skills to identify the appropriate technology, especially for the initial phases of systems upgrades.

Smart production: About 17% of surveyed enterprises said that interconnected production equipment used in their organizations allow for IT access, real-time information on the organisation's production. Around 9% are applying new technologies such as autonomous production lines and FMS (flexible manufacturing systems). More than 20% of enterprises in manufacturing reported they regularly collect data from all stages of the production process and store it electronically. A smaller proportion (about 10%) has a real-time observation of production processes and has the capability to dynamically respond to changes in demand.

Infrastructure: Machinery and equipment is one of the factors directly involved in the production process, so the modernization of machinery and equipment or technological innovation is very important for every business. An electrical equipment manufacturing enterprise that wants to survive and develop needs to develop a plan for technological innovation. Scientific and technological progress and technological innovation will allow them to improve product quality, create many new products, diversify products, increase output, increase labor productivity, and use raw materials rationally and economically. As a result, such progress and innovation will increase competitiveness, expand markets, promote rapid growth and improve production and business efficiency. Scientific and technological progress and technological innovation are really the right direction for a potential electric equipment manufacturing enterprise. However, the survey results show that about 70% of the enterprises are using old machinery, equipment, and technology from countries such as Germany, Japan, Taiwan, or China, because they have financial difficulties. Machinery and equipment used in the production of electrical equipment are quite expensive, so enterprises cannot afford to buy new technological equipment and adopt a high rate of automation. This has also been analyzed in the financial situation of the businesses above.

Forward and backward linkages: Large companies have effectively digitized their logistics operations. More than 65% of companies actively use multiple integrated sales channels such as websites, blogs, forums, and social media platforms to reach customers. Around 35%, to a certain extent have integrated real-time information for the entire value chain, such as planning, sourcing, production, sales forecasting, warehouse planning, and logistics. However, many companies have not yet been able to do this or only at a few individual stages; only 21% believe they have achieved a high degree of digital integration in the logistics sector.

Overall assessment of the level of digital adoption of electrical equipment manufacturing enterprises is shown in Figure 4.

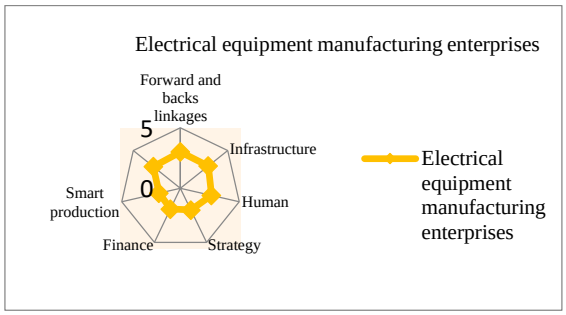

Figure 4: Digital adoption levels across dimensions in electrical equipment manufacturing enterprises
Note: Adoption level: Level 1 - Outsider; Level 2 - Beginner; Level 3 - Intermediate; Level 4 - Experienced; Level 5 - Pioneer/Expert.
Source: Authors' survey results.

From the above results, we arrange the level of digital transformation application in the fields of enterprises from high to low as follows: Forward and backward linkages (3.01), Infrastructure (2.95), Human (2.63), Strategy (2.01), Finance (1.92) and Smart production (1.83). Overall, companies show the highest levels of willingness to adopt digital in their infrastructure and logistics (Forward and backward linkages). However, companies are

not better prepared for financial, strategic, and smart products. The average level of digital transformation of electrical equipment manufacturers in Hanoi is 2.87. We can see that electrical equipment manufacturing enterprises are at the beginning of the digital transformation. Compared with the DAI Business Sub-index of the leading manufacturing enterprises in Vietnam (3.32) [32], the readiness for the digital transformation of electrical equipment manufacturers in Hanoi is still a certain distance in the future.

4. Conclusion and recommendations

Lack of finance and insufficient information were found to be the main barriers to further digitalization at an enterprise level in the electrical equipment manufacturing enterprises in Hanoi. In particular, unclear economic benefits and uncertain impacts of technology adoption, and prohibitively high investments are the most important challenges for digitalization in Vietnam, especially for small and medium enterprises.

During and after the COVID-19 pandemic, businesses need to identify with the fact that digital transformation will become a "must-have option". To match the new spin of the revolution technology network and industrial transformation trends, supporting high-quality development of the new energy industry and facilitating smart energy construction, needing a digital upgrade plan is not just a task of the current business, but also for the development and digital transformation needs of businesses. Businesses need a comprehensive end-to-end solution and one-stop service for security compliance, cloud transformation, big data analytics, and AI applications. These trends mean that the management, operation, service, and transaction models of electrical equipment manufacturers will undergo tremendous changes. Therefore, for electrical equipment manufacturing companies in Hanoi in particular, and manufacturing companies in general, digital transformation is not just using digital technology to enhance the added value of technology products but is also to achieve strategic business directions, operating models, organizational models, and resource allocation. Most of today's electrical equipment manufacturing enterprises have not achieved the combination of the above 4 factors (vision and strategy, culture, distinctive potential, and competence). The business model of enterprises is still "product-based sales", and the product itself has not yet achieved added value in terms of technology.

In order for electrical equipment manufacturing enterprises in Hanoi to achieve a higher level in the digital transformation process, business leaders need to be proactive in strategy, finance, human resources, and infrastructure for the process of digital transformation. Especially, in the future, integrating smart production and green production has become an inevitable trend. It is necessary to use information technology and advanced production technology to reduce costs and increase efficiency, manage energy consumption and energy revolution in production. There is a need to integrate advanced technologies such as automation, lean manufacturing, energy efficiency, and supply chain management and apply them to the entire manufacturing process (including R&D, engineering, manufacturing, services, etc.). Further, there is a need to promote industrial enterprises to achieve high productivity, high quality, high efficiency, high flexibility, and core competitiveness of high-security enterprises through step-by-step technological transformation digitalization, and to promote innovation, green development, coordination, openness, and sharing of the electrical equipment manufacturing industry in general and electrical equipment manufacturers in Hanoi in particular.

In digital transformation, transformation is the subject and digitization is the decisive factor. In other words, transformation comes first, and digitization is a tool of transformation. Enterprise transformation refers to the overall transformation of a company's long-term business direction, operating model and

corresponding organizational methods, and methods of resource allocation. Enterprises need to review the process to make the necessary changes and choose the right technology for the business to transition to the digital transformation stage. This is an opportunity for businesses to look back to see if they are fully ready for digital transformation. The review allows a business to know which technologies need to be improved. Where is the "outdated" process that needs to be changed? Which stage is not ready and how to solve it? When these questions are answered, then the business can make the appropriate adjustments.

In enterprises, the job requires businesses to meet two factors: people and data. People are the most important factor. In other words, the success of digital transformation will be determined correctly by the mindset and vision from the leadership level to all levels of employees. Open communication is a key component of building a digital transformation process. Manager and employee feedback also plays an important role. Based on this feedback, leaders can make changes to optimize training effectiveness. To encourage constructive feedback and foster open discussions, there is a need for open spirits and collaboration. In order for all employees in the organization to understand that digital transformation is an important activity, leaders need to make it clear that digital transformation is a central strategy of the business. This needs to be demonstrated through the actions and plans of the company as well as the establishment of strategic teams in digital transformation.

In addition, data is an integral part of building digital transformation. If used well, data will create a springboard to help businesses transform to digital faster. However, in addition to analyzing existing data within the business, executives also need to pay attention to the data of their strategic partners as well as their competitors. Then, from there, they have an overview of the business value chain before entering the digital transformation race.

5. Limitations of the study

The purpose of the study is to assess the digital transformation awareness and readiness of electrical equipment enterprises in Hanoi. However, due to time and other resource limitations, the sample size of the survey is small and the respondents to the survey did not include the employees' assessment of their enterprises' digital transformation. Future research will attempt to overcome the limitations of this study.

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