Available online at www.HighTechJournal.org

HighTech and Innovation Journal

ISSN: 2723-9535

Vol. 5, No. 3, September, 2024

Digital Skills of Human Resources: Exploratory Research of Innovations in Enterprises

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Received 11 April 2024; Revised 19 August 2024; Accepted 27 August 2024; Published 01 September 2024

Abstract

Background: This study is conducted in the context of the remarkable development of digital technology that has a profound impact on many facets of life, including the comprehensive transformation of abilities and the working style of businesses and the workforce. To survive and develop in an emerging digital society and ever-changing digital environment, workers and business leaders need to equip themselves with the necessary digital skills to adapt to job requirements. *Objective*: This study explores the current status of the digital skills of human resources and its impact on the level of digital transformation readiness of Vietnamese enterprises. At the same time, the inverse relationship between digital skills and the digital divide was explored for the first time in Vietnam. *Methodology*: A secondary research method was used to summarize and analyze the results of surveys conducted by Vietnamese government agencies and previous studies to investigate the current status of digital skills of human resources and factors affecting the digital readiness of Vietnamese enterprises in the context of ongoing DX. *Results*: The results show that the digital skills of enterprise HR are weak, the level of DX readiness is low, and there is a reciprocal relationship between digital skills and the digital divide. The principal findings contribute to policy implications aimed at enhancing digital skills for the workforce and enterprises' HR, and bridging the digital divide within the population in the long term.

Keywords: Digital Transformation; Human Resources; Digital Technology; Digital Skill; Innovation; Enterprise.

1. Introduction

1.1. Background of Research

Under the impact of the 4.0 industrial revolution (4IR), digital transformation (DX) has become an inevitable global trend, bringing unprecedented opportunities to promote business growth [1]. The DX process changes the structure of the workforce and labor market by simultaneously causing job losses and creating new jobs through the use of advanced digital technologies, which not only affects the volume and nature of work but also changes the conceptualization of work and the way people perform their work [2]. The success and future of any DX process depends on human factors [3]. In 2021, Oxford Saïd and EY research teams studied the complex factors behind the high failure rates of DX and concluded that the human factor must be at the center of transformation. Their survey results also showed that in organizations where HR was put at the center of DX, the success rate reached 73%, making 2.6 times higher than those that do not [4].

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http://dx.doi.org/10.28991/HIJ-2024-05-03-013

Digitally skilled human capital has a profound impact on all areas of socio-economic life, facilitating a strong transition from resource-based and labor-intensive to the new knowledge-based development paradigm and digital economy. Accordingly, this also creates major changes in supply and demand in the labor market. Although certain attention has been focused on transforming the workforce and developing human resources (HR) with necessary digital skills to help Vietnamese enterprises meet the requirements of ongoing DX, Vietnam is still classified as one of the groups of countries that are not really ready for 4IR due to the current low level of digitally skilled workforce. According to the Global Innovation Index (GII) 2020, Vietnam maintained its 42nd position in 2019 and 2020 and ranked lower than many ASEAN countries [5]. Furthermore, the Global Talent Competitiveness Index 2023 published by the High Economic School reported that Vietnam ranked 75 out of 134 classified countries, belonging to the group of countries with average rankings; in terms of vocational and technical skills and digital skills among the workforce, Vietnam ranked 71/134 [6]. This situation is becoming more serious as Vietnamese enterprises in their DX process currently face difficulties, including a lack of skilled workforce, cyber security risks, lack of support policies, fear of change, and internal protests, in which the lack of a digitally skilled workforce and weak digital skills of enterprises' HR are considered core obstacles for enterprises executing DX [5, 7]. This context raises the necessity to study workforce digital skills and their impact on Vietnamese enterprises' DX readiness and explore the relationship between the digital divide within the population and workforce digital skills.

1.2. Previous Studies on Digital Skills, Human Resource Digital skills and Digital Divide

Digital skills are originally understood as the ability to find information efficiently and effectively on the Internet, devices, communication applications, and networks to access and manage information [8, 9]. In the EU, this term has the same meaning as "IT skills", "e-skills, or "digital competencies" [10]. This refers to a set of technological abilities that workers need to acquire partially or fully before entering the workforce. Survey data collected by the International Telecommunication Union (ITU) in developing countries show that up to 65% of respondents' reasons for not using the Internet are related to education and digital skills [11]. Digital skills are also defined by UNESCO [12] as a range of abilities to use digital technologies. Digital skills are considered essential assets for workers at all job positions. Hence, the term 'digital skills gap' has emerged, describing the discrepancy between the digital skills required by the labor market and those that the workforce possesses.

Following a task-based approach to digital skills needed by the employed workforce, the Organization for Economic Cooperation and Development [13] has divided ICT users into three levels: (1) basic users who competently use computers and other Internet-related tools essential to the information society, e-government, and work; (2) advanced users who belong to a group of people competently using advanced ICT in specific sectors as a working tool; and (3) ICT specialists, whose occupation is related to developing, operating, and maintaining ICT systems. The European Center for the Development of Vocational Training (Cedefop) and The International Telecommunication Union (ITU), and based on users' ICT abilities, digital skills are classified into three categories: basic, intermediate, and advanced [11, 14]. In the UK, there exists the same way of categorizing and naming digital skill levels, considering that basic digital skills are essential for the majority of people; since 2015 the basic digital skills framework includes 5 categories of essential digital skills for life and work including: "communicating, managing information, transacting, problem solving, being safe and legal online" [15]. Although these three levels of digital skills are named variously to refer to different levels of ICT users' abilities, they are all related to the capacity to perform complex or specialized tasks, including (a) the basic digital literacy and skills that the workforce and every individual should have to live and work properly in a digital society; (b) employment-related digital skills associated with the use of ICT applications in a specific sector; and (c) digital skills as a profession for ICT specialists.

The roles of HR and digital skills in the DX process have been confirmed in a series of previous studies. Even though old business models are being transformed into new ones through the application of digital technology under the impact of digitalization on the economy, human factors still dominate the DX process [16]. The growing demand for HR with basic digital skills and ICT staff for enterprise digitalization leads to a general shortage of digitally skilled HR within the enterprise, as well as in the labor market [17]. In a knowledge-based economy, HR competencies are important for maintaining a competitive advantage because HR skills, abilities, behaviors, and attitudes help achieve organizational goals [18, 19]. Horváth & Szabó [20] believed that HR practices can be the driving force of 4IR in companies; conversely, barriers arise if the labor force lacks appropriate competence and skills.

In the digital age, digital skills are essential for many people to find a new job or maintain their current job position, as employers need digitally skilled employees at the level required by the job. The DX process executed in a company impacts its current activities and creates pressure on employees, requiring them to possess the necessary skills to perform assigned tasks [21]. HR digital skills are important because they underpin how people interact and work. Examining the digital maturity of enterprises, Abramov et al. [22] considered that it is necessary to take into account the peculiarities of HR categories (e.g., skills, qualifications), which play a decisive role in this regard. The strong impact of DX on the labor market was also found by Zhilina et al. [23], who demonstrated a dialectical relationship between HR digital skill level and unemployment rate in geographical regions and separate economic sectors. Kwon & Park [24] in their study

have proved that among the factors (CEO digital leadership, HR, technological excellence, and IT alignment with business) affecting DX in the enterprise, HR has the top position and CEO digital leadership affects other factors as well as the entire DX process of the enterprise. Thus, human factors are still a determinant of digital readiness and the success of DX projects.

To some extent, people's digital skills are disparate due to differences in their socio-demographic characteristics, which creates a gap known as the digital divide in access to digital technology. The term 'digital divide' was first used in the United States in 1995 and was originally defined as the divide or gap between those who have access to new technology and those who do not. It was understood as disparities in access to telephones, personal computers, and the Internet across certain demographic groups in relation to categories of gender, income, education level, race, household type, and geography (residence) [25]. Later, the digital divide was simply understood as 'the gap between people who have access to information/Internet and those who do not [8, 9], or unequal access to digital technology, including digital devices and the Internet [26].

Growing reliance on the Internet and digital technologies requires the workforce to keep up with evolving skill needs. As DX is a top priority in development policy, a digitally skilled workforce is key to successful DX. However, even in developed countries, such as EU member states, there is still a digital skill gap between the demand and supply of digitally skilled workers required by employers. Similar to the digital divide, digital skills are also driven by the socio-demographic characteristics of the population. According to the Digital Economy and Society Index 2022, up to 80% of HR in EU countries have 'at least basic skills' or 'above basic digital skills' in 2021, and by 2020, the proportion of businesses providing IT training accounted for 20%. Basic digital skills across different sociodemographic factors (age, education, place of residence, gender, employment) [27].

The relationship between digital skills and the digital divide is clearly identified in the Resources and Appropriation Theory of Three-level Digital Divide developed by Van Dijk [28, 29], who concluded that inequality in Internet access persists even though it is nearly saturated in developed countries. Differences in the use of digital devices to access the Internet (1st level digital divide) and other factors such as personal resources and personal position as well as Internet usage motivation cause inequalities in material access, which in turn inequalities in material access cause disparities in digital skills and usage (2nd level digital divide) and outcomes (3rd level digital divide). This relationship has been discussed in other studies. Digital skills are not only important for finding or maintaining a job but are also significant for bridging the digital divide [11]. Consensually, enhancing digital skills will help close the digital divide and vice versa [30]. By 2022, the share of individuals accessing the Internet in the least developed countries (LDCs) of the world was 36%, which is very low compared with the world average of 66%. Inevitably, the digital skills of the workforce are always closely related to the digital divide, that is, the internet penetration rate [31, 32].

1.3. Research Gap, Objective and Hypotheses Development in the Vietnamese Context

Reviewing the theoretical and empirical issues of previous literature published abroad on the role of HR digital skills in businesses, the authors found that the concepts and cataloging of digital skills into levels, as well as the close connection between digital skills and the digital divide are clearly argued. However, in Vietnam, these issues have only attracted the attention of scholars and policymakers since the late 2020s.

There are few studies on the role of human factors in the success of DX. Ha & Quoc [33] studied the factors affecting the DX of Vietnamese logistics and concluded that human capital is a determinant. Thuy et al. [34] have the same opinion that digital skills and DX readiness of employees influence work performance. Although there are many specialized studies and surveys conducted by domestic and foreign research organizations on DX processes in service fields such as banking, tourism, and healthcare, and the use of social networks and online applications, they do not touch on issues related to the digital divide or digital skills, but only focus on business goals and potential customers for their own benefit. Even the GSO, the national statistical system, does not have data on the digital divide among the population as well as the digital skills of the workforce; there is no regulation or state agency assigned to be responsible for collecting, compiling, and updating this type of data, although they are necessary for planning socio-economic development and narrowing the gap in digital skills in the labor force market. Meanwhile, creating a database on the digital divide and digital skills among citizens has received special attention in developed countries and developing countries in regions such as China, Singapore, and Malaysia.

Thus, studying and seeking solutions to improve HR digital skills has become an urgent issue. Thus far, in Vietnam, there exists a gap in research on the impact of digitally skilled human resources on the DX readiness of enterprises. In addition, even in existing studies conducted by Vietnamese researchers, the root causes of poor HR digital skills have not been identified; that is, the interrelationship between the digital skills of the working population and the population's digital divide in the Vietnamese context has not been studied. These gaps are quite typical in developing countries, such as Vietnam, where problems with Internet access and DX implementation are encountered. To fill these gaps, this study set out the following objectives: (i) examining the current situation of HR digital skills and DX readiness of Vietnamese enterprises; (ii) exploring the interrelationship between digital skills of the workforce and the digital divide within citizens in order to clarify the causes of weakness in the digital skills of Vietnamese enterprises.

To clarify these objectives, it is necessary to find answers to the following inquiries: (i) the current status of digital skills of Vietnam's human resources; (ii) the impact of digital skills of the workforce on readiness for DX; and (iii) the existence of a relationship between digital skills and digital divide among Vietnamese people. Based on the research background described in 1.1 and the aforementioned analysis, the authors hypothesize that:

1) Digital skills of HR have an impact on the DX readiness of the enterprise;
2) There is an inverse relationship between the digital skills of the workforce and the digital divide among people, which affects DX readiness.

The linkage between digital skills, the digital divide, and digital readiness can be generalized by the conceptual research model shown in Figure 1.

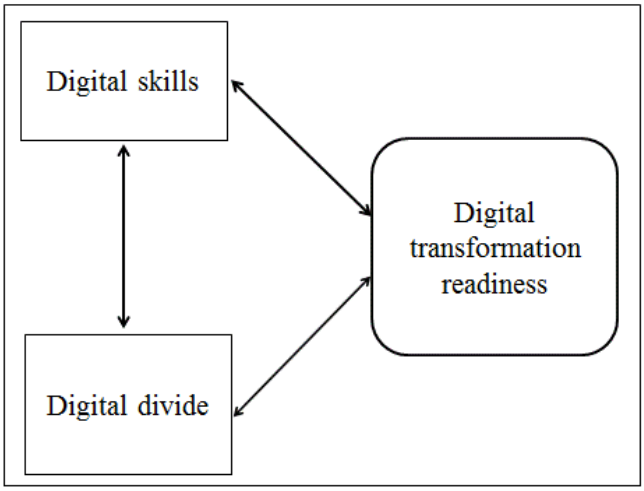

Figure 1. Conceptual research model

The structure of the study is organized as follows: Section 1 presents the research background and offers an overview of related work, the formulation of hypotheses, and research objectives. Section 2 details the research methodology and Section 3 presents the data analysis and results. Section 4 presents the discussion and implications, and Section 5 presents the research conclusions. Section 7 presents the funding for the study, the research declaration is contained in Section 7, and the study concludes with a reference section.

2. Research Methodology

A secondary research method is used in this study. This research method uses existing collected data. Along with materials and data collected from previous studies used in Section 1, to prove the hypotheses, the data were collected from surveys conducted by:

- National Institute of Statistical Science. The survey was conducted nationwide in 2021 with employees and leaders of hundreds of organizations and enterprises in education, health, finance and banking, logistics, and the four priority sectors for DX [7];
- Ministry of Planning and Investment. The Survey on "The Readiness of Vietnamese Enterprises for DX" was conducted at the end of 2022 with the participation of more than 1,000 enterprises in different fields across the country, of which micro enterprises were 26.5%; small and medium enterprises accounted for 61.0% and large enterprises comprised 12.6% [35];
- Hanoi University of Science and Technology (HUST) Research Team. The survey on "Elderly in the Technology Space" was conducted in October-November 2021 with more than 1000 older persons from 41/63 provinces and five centrally controlled municipalities with the participation of HUST students. Out of 1043 valid samples aged 55 and over, 637 respondents aged 60 years and older were considered elderly according to Vietnam's Law on Elderly [36].

The above surveys were conducted nationwide by prestigious agencies and universities. Therefore, the data collected from the surveys were screened for high accuracy.

The research process followed the steps described in Figure 2, based on the research process proposed by George [37].

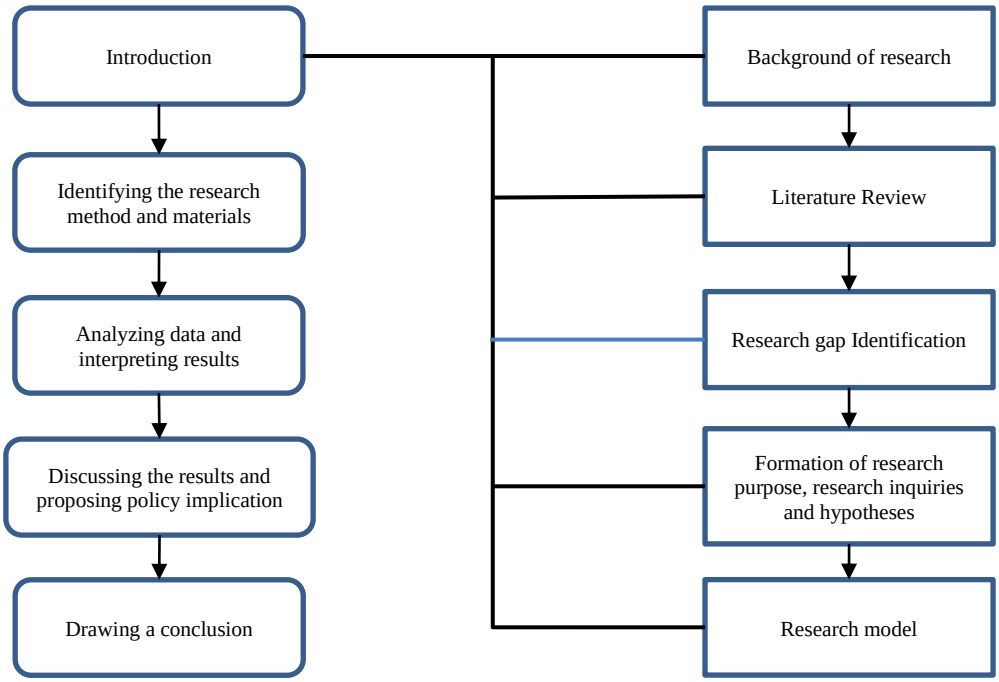

Figure 2. Flowchart of the research methodology

The tasks of each step are described in the flowchart shown in Figure 2. Step 1 (Introduction) provides the research background and relevant literature review, identifies research gaps, and develops hypotheses and research objectives using a meta-analysis. In Step 2, an interpretive research method is used to present the collected material sources and a flowchart of the research methodology. Step 3 details the analysis of the results of surveys conducted by Vietnamese government agencies and previous studies. An analysis and observation method were used to determine the actual state of the research object, such as the current status of digital skills of human resources, the relationship between digital skills and the digital divide through the example of Vietnam, and factors affecting the digital readiness of Vietnamese enterprises in the context of ongoing DX. Step 4 discusses the research results and confirms the similarity of the hypotheses with previous studies by applying the comparative analysis method. Step 5 encompasses the research conclusions using the summarization method.

3. Research Results

3.1. Weak Digital Skills of Human Resource and Desire for Upskilling

Vietnam lacks specialized experts and skilled workers. The World Bank [38], assessing the lack of the necessary skills needed by Vietnam's workforce to fully exploit the digital economy, emphasized that the quality of the Vietnamese labor force is much lower than world standards, the digital skills of enterprises' HR are weak, and ICT specialists are severely lacking with forecasts that the IT workforce shortage will reach 1 million by 2023; only 40% of businesses have enough digitally skilled workers to maintain and fully utilize their digital systems. In terms of digital skills among the population, Vietnam was in the middle group of countries with a rank of 66/100 [39].

Although Vietnam has a large labor force, accounting for 57% of the total population, but among them the proportion of trained workers with degrees/certificates during eight years only increased by 5.6%, from 21.2% in 2015 to 26.8% in Q2/2023 [40], making only one-third of that of emerging countries in Asia such as South Korea, Taiwan, and Singapore.

Among the economic sectors, HR in the industrial manufacturing industry has the weakest digital skills, and may be at risk in the future. According to a forecast by Cameron et al. [41], by 2035, if digital adoption is widespread across the population and industrial sectors, resulting in inclusive growth, up to 38.1% of current jobs in Vietnam may be at risk of transformation or disruption due to the impact of DX and the application of automation systems. A similar prediction stated by the World Bank [38] suggests that Vietnam's economy will lose about 2 million jobs by 2045 if no solution is found to narrow the digital skills gap between the supply and demand of HR in the labor market. This implies that a significant proportion of Vietnamese workers are at risk of unemployment if they are not equipped with new skills, especially digital skills.

According to the survey results conducted by the Institute of Statistical Science in 2020, in the four service industries prioritized for DX implementation, namely healthcare, education, finance and banking, and logistics, education is behind the other three sectors in terms of two criteria: lack of workers with digital skills (29.5%) and digital skills of human resources that do not meet job requirements (16.4%) (see Figure 3).

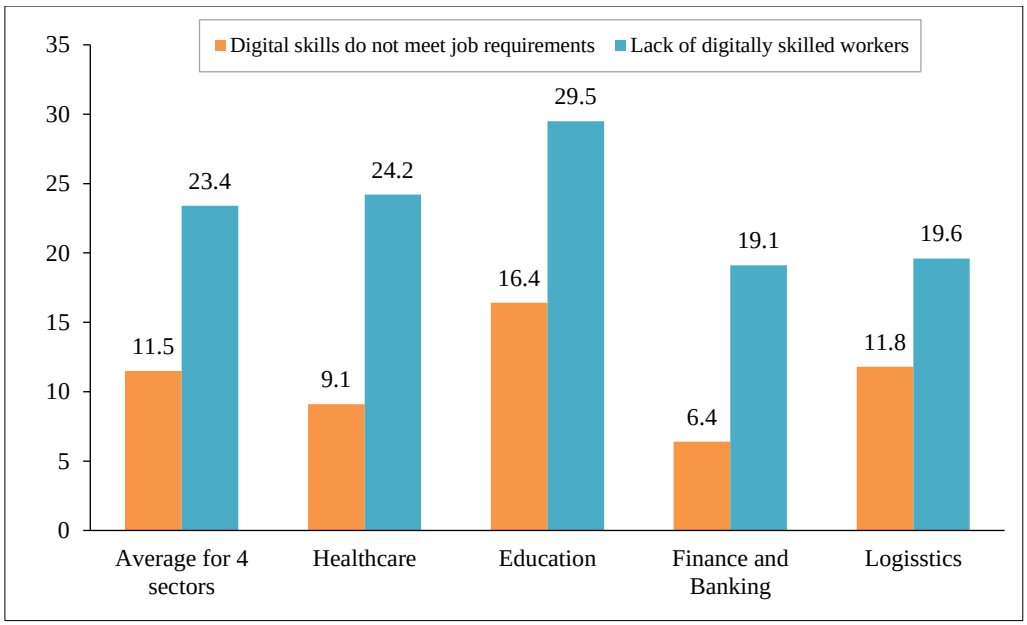

Figure 3. The situation of HR digital capabilities (%)

When entering DX, both business leaders and employees have very different moods. On average, 92.2% of employees have an optimistic view of DX, of which over one-fifth are very optimistic about the benefits of DX. No one was afraid of DX, and only about 6.3% expressed concern about possible job changes (see Figure 4).

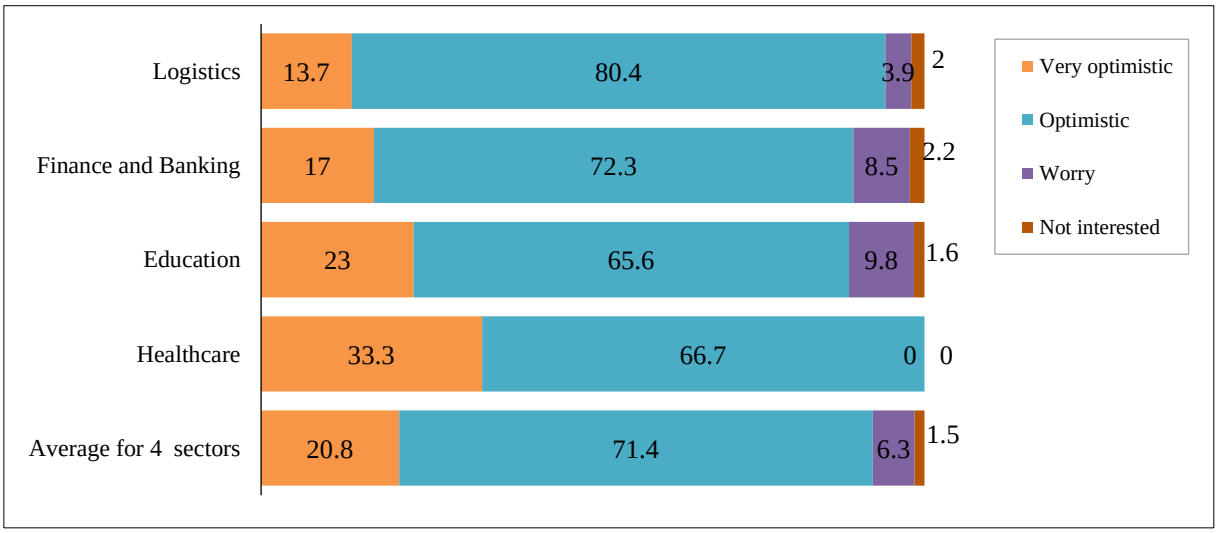

Figure 4. Employees' perception of digital transformation in surveyed sectors (%)

To meet the requirements of the job position, about 97.4% of employees are willing to be trained or re-trained in digital skills. This rate is highest in the healthcare sector (100.0%) and lowest in the banking and finance sectors (95.8%). In terms of skills needed for the job position, 90% of surveyed employees believed that digital skills are needed for the job position and adaptation to DX; the rest said that it is necessary to have other abilities, such as teamwork skills (8%) and soft skills (2%) [7].

Thus, it can be summarized that:

- The competitiveness of Vietnam's labor force in the region is low; most of them have not received vocational training and lack both the technical and digital competence needed for the job.
- The digital skills of the working population are only moderate compared to those of other countries.
- Most workers have a positive attitude towards ongoing DX, and nearly 100% wish to learn new skills or retrain to completely improve their future employability, which is higher than the global average of 77% [5].
- This situation poses a challenge to Vietnam's educational and vocational training systems, and the need for upskilling reskilling employees in the workplace.

3.2. Interrelationship between Digital Divide and Digital Skills in Vietnamese Example

In our opinion, the weak digital skills of the workforce in general and enterprise HR in particular can partly be attributed to the deep digital divide among working-age people. The research conducted by Minh Ngọc [42] showed that the Internet penetration rate among the labor force aged 15-54 was 79%, and there are differences in the proportion of Vietnamese Internet users by age and gender (see Table 1).

Table 1. Age distribution of internet users in Vietnam as of May 2019, by gender

	6-14	15-24	25-34	35-44	45-54	55 +
Male	15%	23%	27%	21%	9%	5%
Female	18%	24%	29%	18%	7%	4%

There is another example of the interrelationship between the digital divide and digital skills. Studying this relationship among 637 Vietnamese elderly aged 60 and older, living in both rural and urban areas in many different provinces of Vietnam, Ngoc et al. [43] found disparities between Internet users and non-Internet users according to demographics, as shown in Table 2.

Table 2. Digital divide analysis of 637 samples by gender, place of residence, and education level of the Internet users' and non-Internet users' respondents (%)

Age groups	Total	Place of residence				Education level					
		Urban areas		Rural and remote areas		Primary and lower second education		High school education		Higher education	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Internet users (502 sample)											
60-64	246 (100%)	67.5%		32.5%		30.9%		50.8%		18.3%	
	246 (100%)	26.8%	40.7%	15.0%	17.5%	12.6%	18.3%	22.4%	28.5	6.9%	11.4%
65- 69	109 (100%)	64.2%		35.8%		29.4%		46.8%		23.8%	
	109 (100%)	37.6%	26.6%	24.8%	11.0%	18.3%	11.0%	27.5%	19.3%	16.5%	7.3%
70-79	122 (100%)	49.2%		50.8%		56.6%		34.4%		9.0%	
	122 (100%)	21.3%	27.9%	28.7%	22.1%	26.2%	30.3%	18.9%	15.6%	4.9%	4.1%
80+	25 (100%)	52.0%		48.0%		68.0%		16.0%		16.0%	
	25 (100%)	24.0%	28.0%	40.0%	8.0%	48%	20%	-	16.0%	16.0%	-
Total	502 (100%)	61.6 %		38.4%		38.6%		44.3%		17.1%	
	502 (100%)	27.7%	33.9%	21.7%	16.7%	18.9%	19.7%	21.6%	22.7%	9.0%	8.1%
	502	100%						100%			
Non-Internet users (135 samples)											
60-64	27 (100%)	26.0 %		74.0%		48.1%		40.7%		11.2%	
	27 (100%)	11.2%	14.8%	33.3%	40.7%	22.2%	25.9%	14.8%	25.9%	7.5%	3.7%
65- 69	22 (100%)	22.7%		77.3%		77.3%		22.7%		0	
	22 (100%)	9.0%	13.7%	22.7%	54.5%	7.1%	59.1%	13.6%	9.0%	0	0
70-79	58 (100%)	32.8%		67.2%		70.7%		27.6%		1.7%	
	58 (100%)	19.0%	13.8%	15.5%	51.7%	48.3%	22.4%	10.3%	17.2%	1.7%	0
80+	28 (100%)	35.7%		64.3%		71.4%		28.6%		0	
	28 (100%)	28.6%	7.1%	21.4%	42.9%	35.7%	35.7%	14.3%	14.3%	0	0
Total	135 (100%)	17.7%	12.6%	21.5%	48.1%	35.6%	31.9%	12.6%	17.0%	2.2%	0.7%
	135 (100%)	135 (100%)						135 (100%)			

The share of older people using online services and utilities that require more comprehensive digital literacy and skills, such as online banking and e-commerce, was 34.26% and 27.29%, respectively. In contrast, the share of the elderly using applications that do not require higher digital skills is high: multimedia calling and messaging (89.44%), entertainment content (82.27%), and social network (70.72%). Despite focusing on the elderly 60 years and older, this study also reflects the fact that the digital divide among Vietnamese older adults and their digital skills are related to each other; they had low digital competence in their working age before the survey was conducted in November 2021 [43].

A similar result was also reported in the *We Are Social* report [44]. Among 77.93 million Internet users (accounting for 79.1% of Vietnam's total population as of January 2023), the percentage of users using the Internet to connect with family, friends, and search for information accounted for 66% and 65.2%, respectively; more difficult online applications related to financial management and e-commerce have a lower percentage of users that accounted for 39.4% and 37%, respectively. This means that in the 5 categories of essential digital skills for life and work specified in the UK [15], Vietnamese people in general are weak in 'problem solving and being safe and legal online.

Thus, there exist differences in digital skills as well as in the digital divide in accessing and using the Internet in daily life and at work by demographic factors that are similar to the argument presented in the Resources and Appropriation Theory of Three-level Digital Divide [28, 29]. In other words, there is a causal inverse relationship between digital divide and digital skills. An analysis of the aforementioned evidence suggests that closing the digital divide by improving the socio-demographic characteristics of the population can enhance digital skills.

3.3. Vietnamese Enterprises' Readiness for Digital Transformation

According to the Report of the Institute of Statistical Science [7], there is currently a digital skills gap between the skills that workers are trained in and the skills that the labor market needs. This is partly due to the low rate of trained workers, accounting for only approximately 26%, equivalent to 13.34 million people. One of the causes of this situation, in our opinion, is that Vietnam's labor market still lacks qualified and skilled workers; training has not kept up with the ongoing DX, and employees have not met the job requirements of the enterprises. An evolving digital economy requires the inclusion of ICT and digital management capacities in vocational training programs to equip workers with digital skills.

The Ministry of Planning and Investment (MPI) conducted a survey on enterprises' readiness for DX by the end of 2022 with the participation of more than 1,000 enterprises in different fields across the country, of which micro enterprises accounted for 26.5%, small and medium enterprises accounted for 61.0%, and large enterprises comprised 12.6% [35]. The survey shows the following results:

- Although most surveyed businesses are aware of the need for digitalization, they have not yet achieved their DX goals as expected: Nearly half of enterprises have failed in DX due to inappropriate solutions to perform DX projects; only 2.2% of enterprises have successfully executed the DX process (see Figure 5).

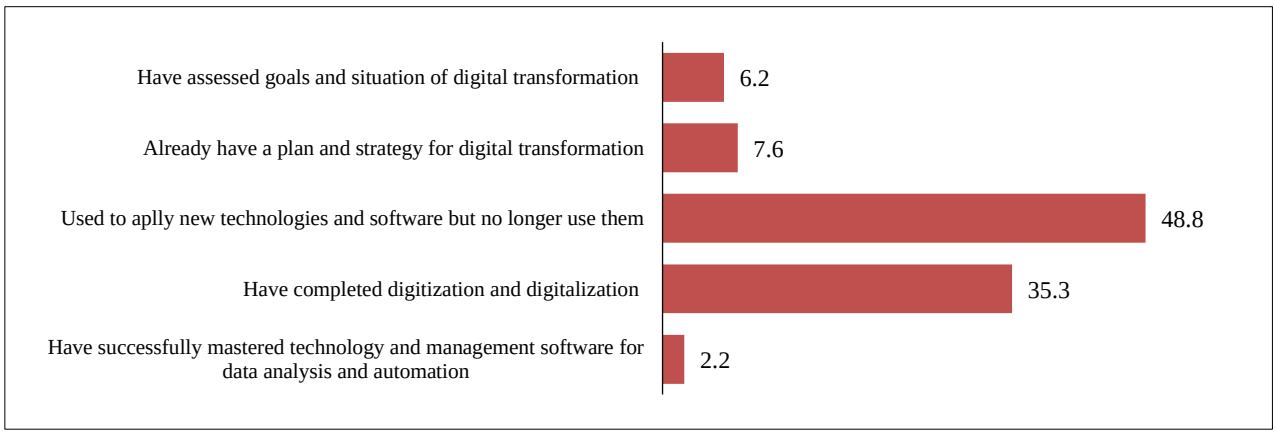

Figure 5. The position of enterprises in the digital transformation roadmap

- Evaluating the level of DX readiness on a scale of 1 to 5 shows that two-thirds (8/12) of the surveyed industries have an above-average level of readiness; industries with activities directly related to manufacturing industries and agriculture, forestry, fishery, e-commerce, accommodation, catering services, etc., have a higher level of readiness for DX than others (see Figure 6).

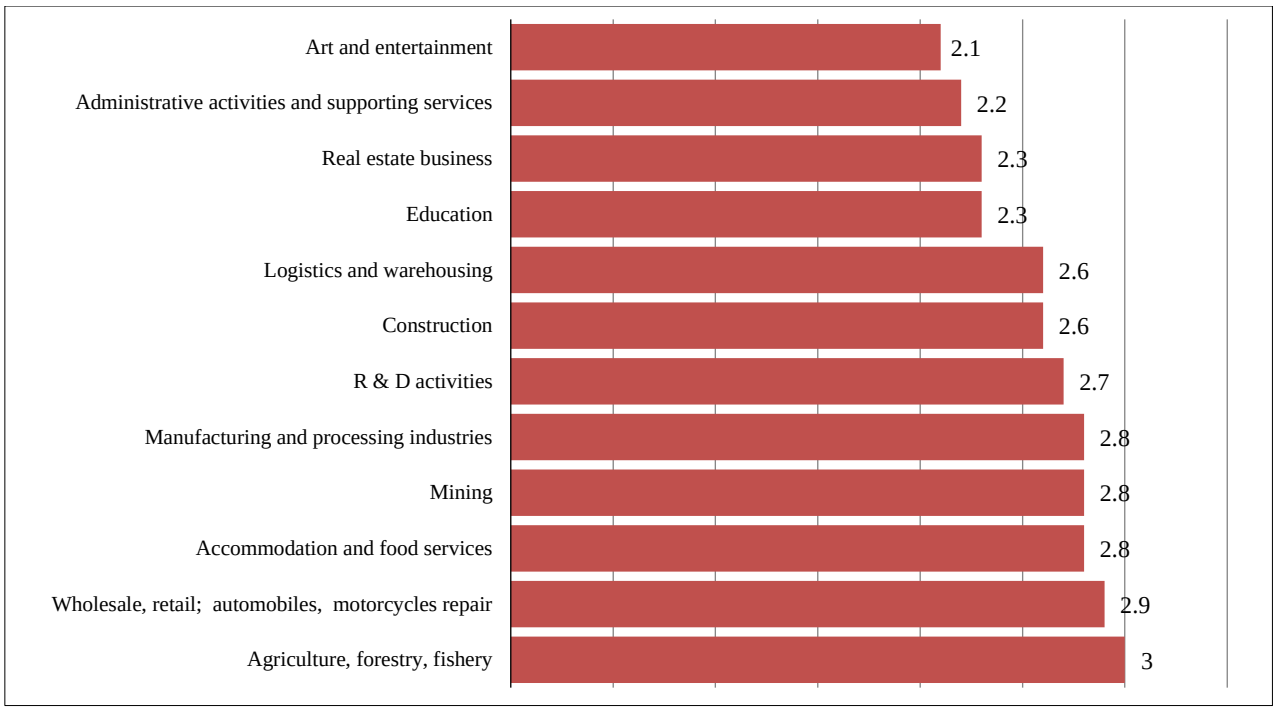

Figure 6. Readiness for digital transformation by industries

The results of a survey conducted by the Institute of Statistical Science [7] show that the low DX readiness of enterprises can be attributed to the challenges they face, in which the lack of appropriate HR management tools and digitally skilled workers are considered core difficulties with response rates of 24.5% and 23.4%, respectively, and 11.5% of workers do not have the necessary technical skills for the job (see Figure 7).

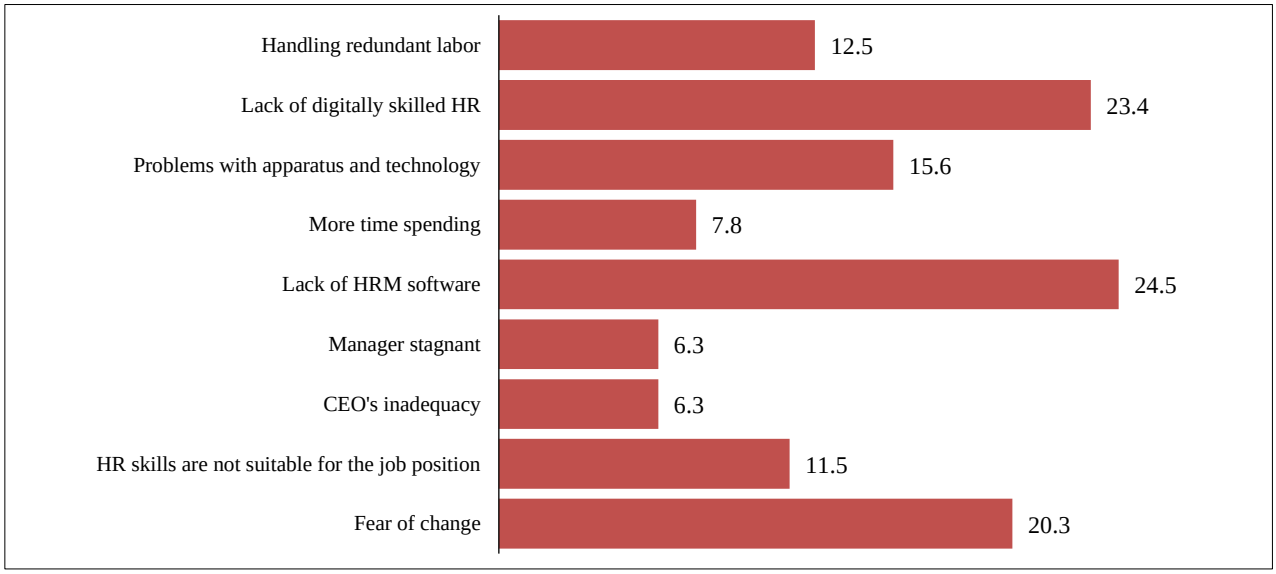

Figure 7. Challenges faced by enterprises in digital transformation

In addition to weak HR digital skills, the shortage of specialized IT personnel (IT experts with advanced digital skills) in enterprises is also the cause of the stagnation of the enterprise's DX execution. The results of a survey carried out by the Ministry of Planning and Investment [35] indicated that among the medium and large enterprises surveyed, 56.3% had less than three IT experts in charge of DX planning; up to 43.7% had less than three IT experts working in the IT department, making fewer than three IT experts working in the ITC department. The situation is not optimistic because of the forecast of TOPDev [45], Vietnam's leading IT recruitment platform, that by 2025, IT human resources in the software industry will still lack approximately 200 thousand experts.

Thus, HR's weak digital skills and shortage of specialized IT specialists have seriously affected the DX process in Vietnamese factories; that is, digital skills impact DX readiness.

4. Discussion and Policy Implications

Generally, the digital skills of the majority of the Vietnamese workforce, including enterprises' HR, are still low and do not meet the requirements of jobs when DX becomes an inevitable trend. The Institute of Statistical Science [7] survey confirmed that the basic digital skill level of HR working in Vietnamese enterprises is still far from satisfying the requirements of the DX process. The average digital skills index among the workforce ranked 71/134 countries by 2023 shows the issues that need to be resolved to make Vietnam's workforce more qualified and competitive in the global labor market. The situation regarding DX readiness among enterprises is alarming. As illustrated in Figure 4, among the surveyed enterprises engaged in DX, only 2.2% have successfully executed DX; up to 48.8% are considered to have failed, leaving their DX projects for many reasons; the rest had just completed data digitization, the first step of DX; and only 8 out of 16 surveyed sectors have achieved above-average readiness for DX. The root causes of this situation have been pointed out by the authors as weak digital skills of HR and digital management teams, shortage of IT experts and technology, etc., that impact digital readiness. The present situation confirms Hypothesis 1 that the digital skills of HR have an impact on the DX readiness of the enterprise and is consistent with arguments in previous studies conducted by PricewaterhouseCoopers [5], Stalmachova et al. [16], Kane et al. [17], Horváth & Szabó [20], and Thuy et al. [34].

To achieve digital readiness and successfully implement DX in Vietnamese enterprises, appropriate solutions are needed to enhance HR digital skills, including business leaders and IT experts, specifically focusing on the following.

- Planning to develop a workforce with necessary digital skills in accordance with the goals of forming a digital government, digital economy, and digital society set out in the "National Digital Transformation Program" encouraging educational institutions to train workers with at least basic digital skills and ICT experts to cover the demand for ICT personnel needed by organizations and enterprises.
- Implementation of the program to support businesses in digital transformation for the period 2021-2025 issued and sponsored by MPI.
- Encouraging retraining enterprises' HR at work and individualized learning of workers.

Similar to the digital divide, the digital skills of the workforce are in different categories due to demographic factors (gender, place of residence, education, race, etc.) and socioeconomic conditions (job and social status, income, etc.). As of January 2023, the Internet penetration rate in Vietnam accounted for approximately 75% of the total population, which is higher than the world average of 64.6% [44]. However, the digital divide, according to Resource and Attribution Theory of the Three-level Digital Divide [28, 29], will persist even if physical access (first level) to the Internet is saturated, because the differences in demographic and socioeconomic characteristics of Internet users still exist and cause inequalities in material access, which leads to disparities in digital skills and usage (second level) and outcomes (third level). Therefore, policy implications should focus on improving citizens' demographic characteristics and socioeconomic status that cause inequality at the first and second levels of the digital divide.

Reviewing literature published abroad and the HR digital skills of Vietnamese enterprises, linking it to the digital divide issue in Vietnam, the authors have found a close relationship between HR digital skills and the digital divide among the population, which is inversely proportional. This means that bridging the digital divide will improve digital skills. This hypothesis is proven in section 4.2 and is similar to the findings of previous studies conducted by Van Dijk [28, 29] and the International Telecommunication Union [11]. Therefore, bridging the digital divide within the population is one of the fundamental and reliable solutions to enhance digital skills for the labor force in general and enterprise HR in particular, which is an issue that needs to be addressed on a national scale in the long term. Therefore, policymakers should focus on the following:

- Incorporating the improvement of the population's demographic and socioeconomic indicators into strategic policies of national and regional development to close the digital divide within the population, assigning a specific state organization responsible for collecting and updating statistics on the digital divide among the people and the digital skills of the labor force according to demographic criteria and socioeconomic status to make reasonable policy adjustments aimed at popularizing Internet access and enhancing people's digital skills.
- Raising awareness of DX for government authorities at all levels so that they have the necessary perception and digital competence, thereby implementing DX content and solutions for each field, and investing in training ICT specialists to meet the demand for HR with advanced digital skills in organizations and enterprises executing DX.
- Focusing on solutions to adapt the education system, including vocational education institutions at all levels, to the needs of the rapid ongoing DX and evolving labor market, enhancing the capacity of teaching staff, and improving the necessary infrastructure and teaching materials, considering that this is one of the most sustainable ways to close the digital divide among the population and the digital skill gap within the future labor force.

According to the survey results shown in the study by Ngoc et al. [43], the proportion of adults learning digital skills with the help of close relatives and instructors around them is 52.8% and 18.6%, respectively, so an effective measure for immediate implementation to bridge the digital skills gap is to learn with the instructors. In Vietnam, the "Community Digital Technology Team," a model of disseminating digital literacy and skills, first appeared spontaneously in one province of Vietnam in July 2021 and was popularized by the Circular of the Ministry of Information and Communications in 2022; by the end of August 2022, there were 45,895 Digital Technology Community Teams with 211,737 members operating in 51/63 provinces and cities nationwide [46].

5. Conclusion

The objective of this study was to explore the current status of digital skills of human resources and their impact on the level of DX readiness of Vietnamese enterprises and the relationship between the digital skills of the workforce and the digital gap between people. The data used for the study came from surveys conducted by the Institute of Statistical Science, the Ministry of Planning and Investment, and previous studies conducted by Vietnamese and foreign researchers. The results of the study confirm that HR digital skills have an impact on enterprises' DX readiness, and the relationship between workforce digital skills and the digital divide between people is causal and inverse; that is, narrowing the digital divide among the population can improve the digital skills of the workforce. The research results also contribute to the validation of the implication that improving people's living conditions and cooperation with the educational and vocational training system to bridge the digital divide in the population as well as the digital skills of the workforce should be considered a national-scale policy for the long term in the context of Vietnam. The limitation of this study is that it relies on secondary data and research results of existing literature using secondary research methods, so the factors affecting digital readiness are not clearly quantified. Further, the authors will focus on the application of the ITU's digital skills toolkit, using quantitative methods to contribute to developing a national digital skills strategy for the workforce, building policies and programs on digital skills enhancement, and on the criteria for assessing the digital skill level of enterprises' HR in priority sectors.

6. Declarations

6.1. Author Contributions

Conceptualization, H.P.T.T. and T.T.B.N.; methodology, T.B.B.N.; validation, H.P.T.T., T.S.L., and D.T.B.; formal analysis, D.M.C.; investigation, T.T.B.N.; resources, T.S.L.; data curation, D.T.B. and D.M.C.; writing—original draft preparation, T.T.B.N., D.T.B., and T.S.L.; writing—review and editing, D.M.C. and H.P.T.T.; visualization, T.S.L. and D.M.C.; supervision, T.T.B.N.; project administration, D.T.B.; funding acquisition, T.T.B.N. All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available in the article.

6.3. Funding

This research is funded by Ministry of Education and Training (MOET) and Hanoi University of Science and Technology (HUST) under project number B2023-BKA-18.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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