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The Development of Human Resources in Information Technology in Vietnam from 2006 to 2020

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Abstract: This article aims to shed light on the development of Vietnam's information technology human resources between 2006 and 2020 by analyzing the guidelines and policies set by the Communist Party and the Government of Vietnam, as well as their training activities, talent attraction, compensation and international cooperation policies. Information technology (IT) and IT human resources play a crucial role in Vietnam's socio-economic development, particularly in the rapidly evolving context of the information and digital revolutions. Since 2006, as Vietnam entered a phase of industrialization and modernization tied to the growth of a knowledge-based economy, the Party and the government have increasingly recognized the importance of applying and developing IT across all fields. In this regard, IT human resources are key to promoting the role of information technology in the country's development strategy. Recently, Vietnam has emerged as a significant player in the global IT industry but workforce shortages have challenged the country's long-term objective of becoming a tech hub in Southeast Asia.

Keywords: Information Technology; IT Human Resources; Vietnam.

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1. Introduction

At the beginning of the 21st century, the global economy entered a new phase of growth. Advances in science and technology, coupled with the rise of the knowledge economy and the forces of globalization and international integration, became inevitable trends for nations worldwide. The most remarkable achievements in this realm can be attributed to IT. IT has emerged as a powerful force within the globalizing landscape, driving economic and social development in every country. In Vietnam, IT is recognized as the key to success in socio-economic development and serves as the primary tool for accelerating the process of industrialization and modernization. Notably, the availability of IT human resources departments plays a pivotal role in achieving the aforementioned success.

In Vietnam, since 2006, the Communist Party of Vietnam has been advocating for the promotion of industrialization and modernization, with a special focus on developing a knowledge-based economy. This approach is considered a "shortcut" to the process of modern industrialization. The primary objective is to directly pursue high technology and new technology to rapidly transform the economic structure. This strategy includes a strong emphasis on the

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rapid expansion of service industries with a high knowledge content and added value, as well as the development of new industries in key economic sectors such as IT. The goal is to help elevate the position of Vietnam as a major player in the field of IT. To achieve these objectives, the development of IT human resources plays a crucial role. These human resources need to possess the necessary qualifications and skills to master modern technology and techniques. The IT workforce should also have a well-balanced structure, enabling its members to meet the requirements of socio-economic development in a timely manner. Additionally, they should be capable of serving both the domestic market and a portion of the foreign market.

Previous research mainly focused on analyzing the current situation of IT human resources in the short term, or approach from the perspective of economic management or human resource management (Cao Hao Thi 2011; To Hong Nam 2019; Do Van Quang 2020). This qualitative research aims to clarify the development process of IT human resources in Vietnam from 2006 to 2020, proposing some solutions for overcoming the current limitations. To this aim, historical approaches, document analysis, and comparative methods were utilized in this study. In addition, in-depth interviews and questionnaire surveys were also employed to provide more practical findings. An online survey was conducted on 264 IT students from various universities and colleges in Hanoi, including Hanoi University of Science and Technology, University of Technology - Hanoi National University, Hanoi University of Education, Phuong Dong University, and Hanoi Polytechnic College of Technology, from September to November 2022. Five in-depth interviews were made with government officials and company managers working in the field of IT from September to October 2022. As anonymity was guaranteed to all respondents, their statements were referenced with an indication of "anonymous interview" or given italic characters in quotation marks. Besides, primary materials including official documents and data of the Communist Party, Government, Ministry of Information and Communications were consulted to provide a balanced and meticulous analysis.

2. Guidelines and policies of the Communist Party of Vietnam and the Government on developing information technology human resources

During the period from 2006 to 2020, Vietnam set ambitious goals for the development of IT and IT human resources. This was clearly reflected in the guidelines and policies of the Party and Government, which aimed to transform Vietnam into a leading IT country and to achieve breakthroughs in the development of IT human resources, not only at the regional level but also internationally.

In 2006, the National Assembly enacted the Information Technology Law, which played a crucial role in regulating the necessary conditions for the development of the IT industry as a key economic sector. Additionally, it promoted the widespread use of information technology across all industries and sectors, as well as at all levels, while simultaneously fostering the growth of IT human resources. This Law stipulated that the Government has a policy to develop the scale and enhance the quality of IT human resource training. Priority was given to IT application and development

programs and projects which must include a category for IT human resources training. Organizations and individuals were encouraged to establish IT human resource training facilities in accordance with the law and they would receive incentives equivalent to those given to software manufacturing enterprises. Moreover, the Government recognized IT certificates issued by foreign organizations for use in Vietnam. Individuals specializing in IT application and development in state agencies were entitled to preferential working conditions. The Government also encouraged organizations and individuals to explore and expand the global labor market, creating job opportunities abroad for Vietnamese workers who engage in IT activities. This must be done in compliance with Vietnamese law, as well as the laws of the host country and any relevant international treaties to which Vietnam is a member (National Assembly 2006).

On July 7, 2007, the Ministry of Posts and Telecommunications (MOPT)[1] issued Directive 07/CT-BBCVT, also known as the "Take-off strategy," which outlined Vietnam's IT and communications development strategy for the period 2011-2020. The strategy focused on the development of qualified and high-quality IT human resources as a key priority. To achieve this, it encouraged and facilitated the adoption of various models such as socialization, market-oriented training, joint training programs between enterprises, institutes, and schools, joint ventures, and international collaborations. These models aimed to provide the market with a sufficient quantity of IT human resources that are of high quality and meet international standards. Additionally, the strategy included special policies and incentives to attract both domestic and foreign talented individuals and experts, particularly those with qualifications and experience in the IT field, to actively contribute to the IT industry's development (Ministry of Posts and Telecommunications 2007).

The Party and the Government have placed increasing emphasis on IT human resources, as evidenced by the issuance of several specialized documents on IT human resource development planning (Ministry of Information and Communications, 2007; Prime Minister, 2009). Developing IT human resources was considered to be closely linked to the innovation of education and training, particularly in higher education. The strategy emphasized the need for fundamental and comprehensive innovations in IT human resource training to align with international standards, resulting in a significant improvement in training quality. It also promoted socialization and strengthened international cooperation, leveraging both domestic and foreign available resources, for IT human resource development (Ministry of Information and Communications, 2007). The goal for 2020 is to ensure that IT human resources are qualified and capable of mastering modern technology and techniques, with a well-balanced structure, to meet the needs of social construction, and the development of an information and knowledge-based economy. The aim was to have enough IT human resources to serve the domestic market as well as a portion of the foreign market (Prime Minister 2009).

Since 2010, Vietnam has been working towards the goal of becoming a leading country in IT. Decision No. 1755/QD-TTg

[1] In August 2007, the ministry was renamed to Ministry of Information and Communications (MIC) and this name remains until today.

(September 22, 2010) issued by the Prime Minister, approved the project "Making Vietnam a strong country in information and communication technology" and emphasized the need to develop IT human resources to reach international standards. The project aimed to have a total of 1 million people involved in the IT industry, including those working domestically and those participating in export activities (Prime Minister 2010). Furthermore, the Government focused on enhancing information, forecasting, and aligning the development of Vietnamese IT human resources with both domestic and international market demands. The priority was to invest in facilities and establish specific mechanisms to increase autonomy in key IT training institutions.

To further advance the development of the IT industry and effectively implement the project aimed at strengthening Vietnam's position in the field of IT and communications, the Politburo issued Resolution No. 36-NQ/TW on July 1, 2014. This Resolution, titled "Promoting the application and development of IT to meet the requirements of sustainable development and international integration," emphasized the significance of cultivating high-quality IT human resources that adhere to international standards. The Party policy underscored the allocation of resources for the development of IT human resources, the establishment of a comprehensive system for titles, salaries, bonuses, and appropriate allowances for officials, civil servants, and IT employees, as well as the enhancement of research activities aimed at acquiring and mastering new technology, open source software, and open technology (Government 2015).

In the context of the impact of Industry 4.0, Resolution No. 52-NQ/TW was issued by the Politburo on September 27, 2019. This resolution underscored the importance of Vietnam's proactive participation in the revolution as a requirement and an opportunity for socio-economic breakthroughs. The Party acknowledged the pivotal role played by IT human resources in driving Vietnam's active engagement in the revolution. To cultivate these resources, the Party advocated for significant changes in education and vocational training policies, content, and methods to develop a workforce capable of embracing a new trend in production technology. In addition, the Party emphasized the imperative of robustly developing the digital economy, which was to be built upon science, technology, innovation, and high-quality human resources. The investment in the development of IT human resources was also highlighted by the Party (Politburo 2019). In 2020, Vietnam initiated the implementation of its national digital transformation process. The Government has established the objective for Vietnam to emerge as a digital, stable, and prosperous nation by 2030, pioneering the adoption of novel technologies and models. The Government intends to revolutionize the management and administrative activities of the Government, as well as the production and business operations of enterprises comprehensively and fundamentally. Furthermore, the Government endeavors to revolutionize the lifestyle and work patterns of individuals, fostering a secure, humane, and widespread digital environment across the entire nation. Concurrently, the Government strives to accomplish the dual objective of cultivating a digital government, digital economy, and digital society, while nurturing the establishment of globally competitive

Vietnamese digital technology enterprises (Prime Minister 2020). The development of information technology (IT) human resources is acknowledged as a crucial endeavor in attaining the aforementioned objectives.

In general, from 2006 to 2020, IT was identified by the Party and the State as a critical factor in building a knowledge-based economy and the implementation of national digital transformation. In addition to the enhancement of IT infrastructure, the Party and State have placed great importance on investing in the development of IT human resources. The guidelines and policies implemented during this period have played a significant role in strategically guiding the development of IT and IT human resources. Directives, resolutions, laws, decrees, and decisions from the Party, the National Assembly, the Government, the Ministry of Information and Communications, and the Ministry of Education and Training all exemplify increased investment and a strong emphasis on the development of IT human resources. These endeavors aimed to meet the growing needs of societal demands and to achieve regional and international standards in terms of both quantity and quality (Politburo 2019).

3. Mechanisms for cultivating human resources in the field of Information Technology

3.1. Training Information Technology human resources

Since 2006, the Government has implemented a policy aimed at enhancing the capacity of IT training in existing facilities and expanding the scope of IT, electronics, and telecommunications training throughout the country. This initiative has primarily focused on major cities such as Hanoi, Hai Phong, Thai Nguyen, Vinh, Hue, Da Nang, Da Lat, Ho Chi Minh City, and Can Tho, while also establishing new IT training facilities in the Northwest, Central Highlands, and Mekong Delta regions. Moreover, the Government has actively encouraged investments in the establishment of universities with 100% foreign capital, as well as domestic and foreign joint ventures and partnerships, in order to further develop human resources in the fields of IT, electronics, and telecommunications. As a result, there has been a significant increase in the number of universities, colleges, and enrollment quotas.

Table 1: *IT admission targets in universities, colleges, and vocational schools for the period 2006 - 2020*

Year	Universities and colleges			College and vocational secondary school		
	Number of schools	Enrollment criteria (students)	Actual number of enrolled students	Number of schools	Enrollment criteria (students)	Actual number of enrolled students
2006	192	30,350	-	-	-	-
2007	219	39,990	-	-	-	-
2008	271	50,050	-	-	-	-
2009	271	56,406	-	-	-	-

2010	277	60,332	56,338	-	-	-
2011	290	64,796	55,197	113	-	32,632
2012	290	65,501	57,917	143	-	25,527
2013	290	67,518	55,000	228	-	24,569
2014	290	67,236	-	265	-	18,199
2015	290	67,397	-	331	-	20,330
2016	250	68,883	53,123	204	18,311	-
2017	131	48,631	39,877	412	67,673	-
2018	149	51,114	41,913	412	67,662	-
2019	158	68,435	56,117	442	52,424	-
2020	158	82,085	68,951	442	56,838	-

Source: Ministry of Information and Communications 2009, 2010, 2011, 2012, 2013a, 2014, 2017; 2018, 2019a, 2020a, 2021.

The above summary table demonstrated that in 2006, Vietnam had 192 educational institutions dedicated to training IT professionals, with an enrollment target of 30,350 students. By 2010, the number of universities and colleges had increased to 277, and the enrollment target had nearly doubled to 60,332 students. In other words, the scale of training expanded rapidly. Between 2011 and 2015, out of a total of 400 institutions, 290 (accounting for 72.5%) offered IT training, with enrollment targets on the rise. However, the rate of increase was not as swift as in the previous period.

Colleges and vocational secondary schools also experienced significant growth. In 2011, there were 113 institutions, which had increased to 331 by 2015 (almost tripled). Nevertheless, the actual number of enrolled students declined. This fluctuation could be attributed to the impact of the economic crisis, as numerous IT graduates struggled to find employment. Consequently, despite the increase in the number of educational institutions enrolling students, many colleges and vocational schools failed to meet their enrollment quotas, and some were unable to recruit students at all. The decrease in student enrollment led to a decline in the number of IT professionals entering the industry in subsequent years. Meanwhile, the demand for IT professionals rose due to the influence of Industry 4.0 and digital transformation, resulting in higher salary levels for IT workers in businesses. From 2015 to 2020, the average salary of workers in the software and digital content field experienced rapid growth (see Table 2). Consequently, the IT industry held great appeal for students, pupils, and society as a whole.

In 2020, the Ministry of Education and Training (MOET) approved the prioritization of increasing enrollment quotas in schools, specifically in the field of Information Technology (IT). This decision was made in line with the Party and State's guidelines and policies on actively participating in the Fourth Industrial Revolution and National Digital Transformation. As a result, the enrollment

target for IT programs saw a significant increase compared to previous years. In 2020, there were 158 universities and colleges throughout the country offering IT training, with an enrollment target of 82,085 students, marking a rapid growth of almost 1.7 times compared to 2017. Additionally, there were 442 colleges and vocational schools with an enrollment target of 56,838 students. The actual student enrollment rate was relatively high, reaching 84% in universities and colleges and 68.27% in colleges and vocational schools (Ministry of Information and Communications 2021: 57).

The number of university and college students graduating in IT between (2016 and 2020 was estimated to be over 50,000 people per year (Ministry of Information and Communications 2020a: 17). For vocational schools, the graduation rate reached 52.4%, equivalent to about 9,600 graduates (Ministry of Information and Communications, 2017). The capacity of university training in IT was over 51,000 students per year, while vocational training (college) in IT can accommodate over 68,000 students per year, totaling approximately 120,000 students per year (Nguyen Thien Nhan 2019).

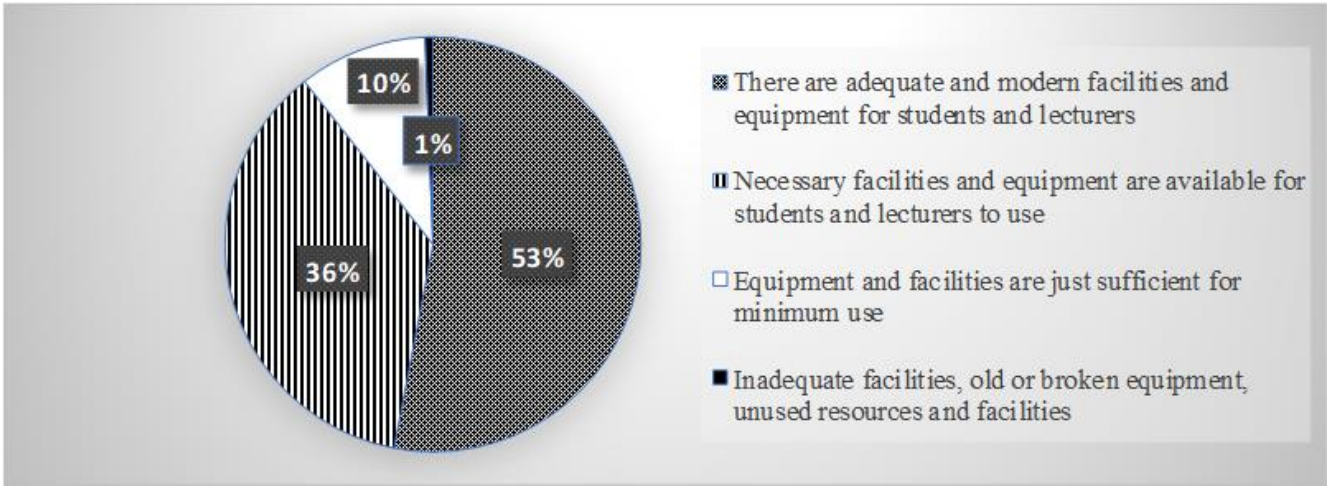
In order to enhance the quality of IT training, universities and colleges made investments in physical and technical facilities, innovating education and training methods, and placed emphasis on improving the professional qualifications and English proficiency of their IT teaching staff. Many institutions implemented policies to attract Vietnamese scientists abroad and international IT experts to participate in training and scientific research. Additionally, they actively promoted collaborations for high-quality training and facilitating exchanges between lecturers and experts from foreign countries. Moreover, they encouraged the involvement of experts, technical staff, and managers with professional experience in enterprises in IT human resource training. Many training institutions utilized IT documents and textbooks in English and conducted classes in English. Also, they offered incentives and encouraged students to complete their graduation projects and theses in English (Bui Thi Bich Thuan, 2024).

Furthermore, efforts were made to strengthen and enhance the knowledge and skills of IT human resources with high programming skills and qualifications through international cooperation activities. Collaborations with Microsoft, CISCO, CompTIA, and USTDA were established to effectively implement professional training programs. Management agencies and academies actively facilitate exchange programs to train IT staff and provide training for the implementation of business cooperation projects, pilot projects, and the gradual development of new technology products.

The Ministry of Education and Training created opportunities for universities to enhance collaboration with leading international institutions in training IT lecturers and students. Various forms of collaboration were implemented, such as exchanging scientific documents, scholars, lecturers, and students. Joint training, organizing short-term courses, summer semester study abroad programs, conferences, and coordinating research projects are also common. Additionally, software production contracts and joint training partnerships were established with prestigious universities in the United States, England, Australia, New Zealand, Japan, etc.

Training institutions were actively engaged in improving teaching methods, enhancing lecturer quality, and investing in facilities. Teaching methods were becoming more diverse, with a strong emphasis on practical application. According to survey results, over 80% of students considered the school facilities to be good or very good. 53% of students believed that the school provided adequate facilities and equipment for both students and lecturers, which were modern and of high quality. Furthermore, 36.4% of students felt that the necessary facilities and equipment for students and lecturers were available. These findings demonstrated the increased investment in facilities and equipment for IT training by educational institutions (see Figure 1).

Figure 1: *Level of facilities in IT training of some universities and colleges in Hanoi (Unit: %)*



Source: Survey's results

However, despite the presence of considerable number of IT training facilities, the quality of training remains inconsistent. Only few training institutions possessed adequate capacity, equipment, and training methods that conform to international standards. The training offered by these schools lacks practicality and fails to meet the expectations of businesses. In addition, the output standards of these schools did not align with the demands of the market and the requirements of businesses.

Furthermore, there was limited emphasis on developing soft skills and foreign language proficiency in IT human resource training (see more in Figure 2).

Figure 2: *Proficiency in soft skills and foreign languages of IT faculty students at some universities and colleges in Hanoi (Unit: %)*

Source: Survey's results

Figure 2 illustrates that many IT students lack confidence in their soft skills, such as troubleshooting, problem-solving, communication, presentation, teamwork, project planning, and customer care. In terms of foreign language proficiency, over 50% of students rated themselves at an average, poor, or very poor levels. This was one of the reasons why many students face difficulties in entering the international labor market immediately after graduation.

3.2. Attracting, Utilizing, and Supporting Human Resources in the field of Information Technology

In State administrative agencies

In 2006, the National Assembly passed a Law on IT, in which, article 25 stated that IT was a priority field, promoting research and development, international cooperation, human resource development, and the construction of information infrastructure that meets the requirements for applying information technology in the operations of state agencies. Article 44 stipulated that "*individuals specializing in IT application and development within state agencies were entitled to preferential working conditions*" (National Assembly of the Socialist Republic of Vietnam, 2006). Therefore, preferential policies for specialized IT personnel were established by law (National Assembly 2006).

In 2007, the Government issued Decree 64/2007/ND-CP regarding IT application in the operation of state agencies. This decree stated that IT officers within state agencies are entitled to preferential working conditions, such as incentives for using information infrastructure and equipment, incentives for training and improving IT skills, and other incentives as provided by law. Furthermore, officials, civil servants, and public employees had access to free Internet at their respective state agencies (Government of the Socialist Republic of Vietnam, 2007). The decree also encouraged state agencies to establish regulations on income incentives for IT human resources within their organizations, as well as regulations on standards, responsibilities, rights, and requirements for assessing the level of task completion of officials, civil servants, and public employees in relation to the application of IT in their work. It was the responsibility of state agencies to ensure an adequate number of specialized IT staff in accordance with their IT application plans (Government 2007).

Decree 64/2007/ND-CP served as the foundation for ministries, ministerial-level agencies, and localities to implement policies aimed at attracting, utilizing, and rewarding IT human resources. From 2012 to 2015, various ministries, ministerial-level agencies, provinces, and centrally-run cities in Vietnam issued preferential policies for specialized IT personnel.

The prevailing practice in localities regarding the level of support for IT staff was determined through the application of an allowance coefficient (1, 1.5, or 2 times the basic salary) or a fixed monthly amount (ranging from 500,000 to 3,000,000 VND/person/month). Typically, funding for this purpose was sourced from the units' annual autonomous funding (To Hong Nam 2019: 112). Additionally, some localities have implemented their own policies to attract high-quality IT professionals, such as direct recruitment into civil service positions, initial financial support for talent attraction, and various other incentives.

Furthermore, IT personnel in state agencies benefitted from incentives related to training and development. Expenditure on IT training fluctuated annually, but generally showed an upward trend within state management agencies. The level of training expenditure for local IT ministries also experienced significant growth, increasing from 7,436 VND over a two-year period (2005 - 2006) (Office of the National Steering Committee for IT 2008), to 296,979 VND in 2020 (Ministry of Information and Communications 2020b: 30). However, the amount allocated for training, which was still relatively modest at less than 300,000 VND per officer per year, fell short of actual requirements and is insufficient to attract and encourage officers to pursue advanced training opportunities.

Nevertheless, the proportion of ministries, ministerial-level agencies, provinces, and centrally-run cities that have established compensation policies specifically for specialized IT staff remained relatively low. In 2012, only 13% of ministries and ministerial-level agencies, as well as 27% of provinces and centrally-run cities, had implemented preferential policies for specialized IT personnel (Office of the National Steering Committee on IT 2012: 12, 15). By 2015, these figures had risen to 26% and 28.6% respectively (Ministry of Information and Communications, 2015a: 33). Until now, the majority of ministries, ministerial-level agencies, provinces, and centrally-run cities still did not have remuneration policies in place for IT officers.

The incentive policies for IT human resources in state agencies, as issued by the State, were only at the recommendation level. For example, state agencies were encouraged to issue regulations on income incentives for IT human resources within their own agency. However, there were no general regulations for the implementation of these policies on a national scale. The implementation of preferential policies varied depending on the flexibility of ministries, branches, and localities, as well as certain time periods. The reality was that the majority of agencies, from central to local levels, have not yet realized the importance of issuing remuneration policies for IT staff. Only about 20% of ministries, ministerial-level agencies, provinces, and centrally run cities issued preferential policies (Ministry of Information and Communications 2015b). However, these policies were not uniform across different locations and depend on each locality's budget direction.

Interviewees share that IT officers in some ministries and branches receive salaries based on coefficients and salary levels prescribed by the State, without any additional allowances or incentives. The salary regime was not competitive, with salary increases mainly occurring every three years and being relatively insignificant. The support policy did not meet the reality of the situation, thus failing to encourage the dedication of highly qualified staff. Policies to attract, employ, and remunerate IT staff in state administrative agencies differed significantly from those implemented by IT companies and enterprises, especially larger ones (*anonymous interviews*). As a result, several IT officers in state administrative agencies, after receiving training, improving their expertise, and gaining work experience, left to work in private companies that offer higher salaries. This situation created a "brain drain" effect.

In IT enterprises

In IT industrial enterprises, the recruitment of personnel was influenced by the business strategy and current circumstances. Each enterprise formulated a tailored policy to attract and retain human resources that aligned with its objectives. This approach was crucial in ensuring that the enterprise maintained an adequate and competent workforce.

Table 2: *Average salary of IT workers in IT enterprises from 2008 to 2020 (Unit: USD/person/year)*

Year	Hardware industry	Software industry	Digital content industry	IT services
2008	1,440	3,600	2,820	-
2009	1,809	4,250	3,505	-
2010	2.201	5.123	4,896	-
2011	2,279	5,034	5,267	-
2012	2,281	5,009	5.201	-
2013	2,301	5,025	5,268	-
2015	2,859	6,215	6.120	5,376
2016	3,866	6,849	6,189	5,609
2017	4,452	7,570	6,737	5,909
2018	5,392	8,578	7,696	6,932
2019	5,336	9,642	7,820	7.155
2020	4,824	9,419	7.201	5,537

Source: Ministry of Information and Communications 2009, 2010, 2011, 2012, 2013a, 2014, 2017; 2018, 2019a, 2020a, 2021.

The above table illustrated the upward trend in salaries among workers in the IT sector over the years. Specifically, compared to 2008, the wages in the hardware industry had increased by a factor of 3.35, in the software industry by a factor

of 2.16, and in the digital content industry by a factor of 2.55. It was worth noting that the average monthly income of IT professionals surpassed that of workers in various other economic sectors and even exceeded the national average income. Among all economic sectors, only the finance and banking sectors reported higher incomes for their workers, while the IT sector ranked second. Notably, the income of IT workers was three times as high as that of workers in the agriculture, forestry, and fisheries sectors by a significant margin, in 2019 (General Statistics Office 2021b: 245).

Our respondents agreed that IT businesses primarily used competitive income levels, bonuses, and welfare programs to effectively attract IT professionals. The results of interviews with workers and managers in IT enterprises show that: Salary policies in these businesses were typically based on job level and position, with each position having several salary ranges (typically 5 - 6 ranges). The specific salary offered depends on the employee's qualifications and job responsibilities. Additionally, IT businesses often offered bonuses for outstanding achievements, as well as various allowances, perks, and benefits for their employees (Bui Thi Bich Thuan 2024).

4. Results on the development of IT human resource

4.1 A substantial surge in the number of IT professionals

In terms of the quantity of IT professionals, there was a significant growth in Vietnam's IT workforce across all domains during the period under consideration, with a particularly noticeable expansion in the IT industry. This trend is illustrated in the subsequent table:

Table 3: *Data on IT human resources in the IT industry from 2008 to 2020 (Unit: Person)*

Year	Total number	Hardware industry	Software industry	Digital content industry	IT service human resources (not including sales and distribution)
2008	200,000	110,000	57,000	33,000	-
2009	226,300	121,300	64,000	41,000	-
2010	250,290	127,548	71,814	50,928	-
2011	306,754	167,660	78,894	60,200	-
2012	352,742	208,680	80,820	63,242	-
2013	441,008	284,508	88,820	67,680	-
2014	578,920	-	-	-	-
2015	721,584	533,003	81,373	44,320	62,888
2016	780,926	568,288	97,387	46,647	68,605
2017	922,521	678,917	112,004	55,908	75,692

2018	973,692	717,955	127,366	51,952	76,419
2019	1,005,224	760,097	143,149	42,497	59,481
2020	1,081,268	842,458	149,072	34,377	55,361

Source: Ministry of Information and Communications 2009, 2010, 2011, 2012, 2013a, 2014, 2017; 2018, 2019a, 2020a, 2021.

The above table illustrates a significant growth rate in the number of human resources working in the IT industry. Specifically, in 2008, the total number of individuals employed in this sector amounted to 200,000, which then increased 5.4 times to 1,081,268 people by 2020.

Moreover, it is worth mentioning that the ratio of specialized IT staff employed in state administrative agencies has also experienced notable growth. Between 2007 and 2020, the ratio of full-time officials in ministries, ministerial-level agencies, provinces and centrally-run cities nearly doubled. In 2007, the ratio of full-time officials in ministries and ministerial-level agencies stood at 2.9%, while in provinces and centrally-run cities, it was 0.8% (Office of the National Steering Committee on IT 2008: 56 and 60). By 2020, these figures had increased to 5.8% and 1.4%, respectively (Ministry of Information and Communications 2020b: 27 and 30).

4.2 Improvement in the quality of IT human resources

With the expansion of IT human resource training and innovative teaching methods, there has been a rise in the number of individuals receiving formal, comprehensive and systematic training. According to Cao Hao Thi (2011: 36), in 2008, 63% of human resources had received training in IT majors, while the remaining individuals had pursued training in other majors and subsequently obtained additional IT training. Fast forward to 2020, IT human resources in Vietnam predominantly held university degrees or higher qualifications, with the distribution being as follows: postgraduate (7%), university (74%), college (14%), intermediate (2%), and high school (3%) (VietnamWorks 2020: 20). Notably, in order to meet regional and international standards, the majority of IT human resources obtained multiple international IT certifications (such as PMP, MCSE, CISM, CISA, etc.) and have improved their foreign language proficiency, particularly in English. In fact, VietnamWorks (2020: 20) reported that 47% of IT human resources hold 4-5 certificates, 39% possess 3-4 certificates, 10% have 1-2 certificates, and only 4% do not possess any international certifications

4.3 Improvements in the labor productivity of the IT human resource

The labor productivity of the information and communications industry surpassed that of other economic sectors and exhibits a consistently high growth rate. From 2011 to 2015, the average labor productivity stood at 588.3 million VND/worker, with a growth rate of 4.29%. In the period from 2016 to 2020, the average labor productivity reached 859.8 million VND/worker, experiencing a growth rate of 8.12%. The information and communications industry outperform sectors such as agriculture, forestry, and fisheries; manufacturing and processing industry; construction; transportation,

warehousing, and others. It significantly exceeded the overall productivity of the entire economic sector (General Statistics Office 2021a: 30 and 83-85).

Despite the abovementioned achievements, in the period 2006 - 2020, the development of IT human resources still faces some limitations, including:

4.4 Inadequate quality and quantity of information technology human resources

In the period 2006 - 2020, the demand for IT human resources consistently increased. Since 2015, the demand has grown by 47% annually, while the number of IT graduates has only increased by 8% per year (VietnamWorks 2015). Although the quantity of IT human resources showed substantial growth, the rapid expansion of IT applications in various domains of the economy, social management, and individual lifestyles resulted in an ever-increasing need for IT professionals. Furthermore, Vietnam emerged as a fertile ground for leading technology corporations in Asia, including developed neighboring countries like Japan and Korea. These companies actively sought IT professionals in large numbers, exacerbating the scarcity of IT human resources and their inability to meet societal demands.

According to the Report of the Ministry of Information and Communications, in 2016, approximately 30% of trained IT professionals were able to meet the demands of society, while, the remaining businesses had to provide additional training. IT professionals only met slightly over 60% of social needs. The quality of IT professionals was still limited, especially among new graduates who lack soft skills, proficiency in English, critical thinking, self-study skills and teamwork abilities. Furthermore, 72% of IT students lacked practical experience, and 42% lacked teamwork and other essential skills. Despite a large number of graduates, businesses still faced a shortage of skilled employees. Consequently, businesses often needed to provide additional training for a period of 6 months to 1 year (Ministry of Information and Communications 2016: 3). Therefore, while most economic sectors, both domestic and foreign organizations and businesses suffered from serious lack of IT professionals, there were still IT graduates who struggled to find jobs, resulting in a situation of "both shortage and excess".

4.5 Vietnam's IT workforce lagged behind the rest of the world

The IT industry in Vietnam, particularly its IT human resources, lagged significantly behind other countries worldwide. The evaluation of Vietnam's telecommunications sector primarily relies on the IT Development Index (ICT Development Index) published by the International Telecommunication Union (ITU). The index consistently places Vietnam’s IT human resource skills near the bottom. According to the ITU’s 2017 data, Vietnam ranked 108th out of 176 countries in terms of overall IT development, with an even lower ranking of 113th regarding IT human resource skills (International Telecommunication Union 2017). From 2007 to 2017, Vietnam's ranking for IT human resource skills declined from 102nd to 113th. In addition, Vietnam's e-Government ranking in 2020 was 86th out of 193 countries (23rd out of 47 in Asia and 6th out of 11 in Southeast Asia), representing a two-place improvement compared to 2018 (Ministry of Information and Communications 2021). However, among the component indices,

the human resources index remained the lowest (117th out of 193). Consequently, IT human resources continued to be a weakness in Vietnam.

Due to Vietnam's initial status as a financially disadvantaged and technologically underdeveloped nation, the opportunities for cultivating IT human resources remain limited. Furthermore, the rapid pace of IT advancement perpetuated a constant disparity between training programs and the real demand for IT professionals. The content and methods employed in IT education within schools frequently failed to align with the requirements of companies and organizations seeking expertise in this field. Moreover, significant deficiencies existed in the mechanisms and policies pertaining salaries and working conditions for IT professionals, particularly those engaged in state administrative bodies. As a result, Vietnam heavily relied on the importation, transferring, and application of advanced IT achievements from other countries, and could not establish itself as a frontrunner in IT development (Bui Thi Bich Thuan 2024).

To foster the development of IT human resources, the following solutions could be proposed. Firstly, it is imperative for the Party and the Government to enhance mechanisms, policies, and legislation regarding the management, construction, and development of IT human resources. This should primarily focus on formulating a strategy that comprehensively and synchronously addresses the attraction, utilization, and treatment of IT human resources throughout the entire process—from identification, selection, training, and utilization, to career advancement, appointment, and compensation (anonymous interviews). Secondly, there is a need to expand the scale of training programs while ensuring their quality and structure. This can be achieved by fostering collaboration between training institutions and businesses. It is crucial to establish mechanisms and policies that recognize and support the development of this partnership. Thirdly, it is essential to update and supplement training programs in emerging fields, particularly in digital technology, and standardize training programs in accordance with international standards. Fourthly, there is a need to establish and enhance the quality of the teaching staff through flexible methods. This should involve allocating lecturers to work in businesses and engage in collaborative projects between educational institutions and enterprises *(anonymous interviews)*. Additionally, sending lecturers for training or exchange programs to learn from the experiences of advanced IT countries should be encouraged. Fifthly, it is essential to strengthen international cooperation in IT human resources training, particularly by forging partnerships with countries and training institutions with highly developed science, technology, and IT sectors. Lastly, there is a need to innovate salary and income policies in state administrative agencies. These policies should link salaries and wages to performance, efficiency, and productivity based on the principles of a market economy.

5. Conclusion

From 2006 to 2020, there was an increased awareness among the Party, Government and society as a whole regarding the important role and significance of IT and IT human resources. The Party and Government gradually translated this awareness into concrete

policies by enacting the Law on Information Technology, and issuing resolutions, decisions, and directives that prioritize the development of IT human resources. In Vietnam, the development of IT human resources primarily revolved around training, talent attraction, employment, and compensation activities. These endeavors yielded significant outcomes, as the quantity and quality of IT human resources consistently improved. However, due to various objective and subjective factors, the quantity and quality of Vietnamese IT human resources still fell short. Hence, the development of IT human resources remains a pressing issue for Vietnam in its present context.

In light of the continuous advancements in science and technology, particularly in IT, which has become the backbone of the digital economy, it is crucial for Vietnam to embrace digital technology as the fundamental production force, digital human resources as the cornerstone, and digital innovation as the driving force. Only then can Vietnam keep pace with the Fourth Industrial Revolution, enabling the country to integrate more effectively and successfully into the global arena.

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