

Improving the quality of education and training of human resources for science and technology development, renovation and national digital transformation

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● **Abstract:** Improving the quality of education and training of high-quality human resources is a key focus for achieving breakthroughs in the strategy for developing science, technology, renovation and national digital transformation. This article analyzes and evaluates the achievements and limitations and proposes recommendations to improve the quality of education and training of high-quality human resources to meet the requirements for developing science, technology, renovation and national digital transformation in Vietnam in the coming time.

● **Keywords:** education and training; high-quality human resources; renovation; national digital transformation; science and technology development.

1. Introduction

The Communist Party of Vietnam always affirms that people are both the center, the driving force and the goal of national development. In all societies, workers are the core of the productive forces and the decisive factor in determining the level of development of those forces. Entering the “new era”, where “digital production” becomes central, “digital human resources” emerge as the core of the productive forces. Recognizing the opportunities and driving forces of this new stage of national development, on December 22, 2024, the Politburo issued Resolution No. 57-NQ/TW on strategic breakthroughs in science, technology, renovation and national digital transformation. The Resolution affirms “Developing and making use of high-quality human resources and talents to meet the requirements of science, technology, renovation and national digital transformation”⁽¹⁾. At the same time, the Resolution specifically requires: “Increasing investment, promoting renovation, and improving the quality of education and training to ensure a high-quality workforce that meets the requirements of science and technology development, renovation, and digital

transformation”⁽²⁾. Therefore, enhancing the quality of education and training for high-quality human resources is a core issue that needs to be studied and applied appropriately in Vietnam’s current context.

2. Content

2.1. Current status of education quality and training of high-quality human resources to meet the requirements of science, technology development, renovation, and national digital transformation in Vietnam.

In the context of the increasingly strong development trend of Industrial Revolution 4.0, the scientific and technological revolution, and global digital transformation, the Party and the State have promptly issued policies and guidelines to proactively and actively participate in that common trend. The Communist Party of Vietnam places special emphasis on the requirements and solutions related to improving the quality of education and training in the process of developing human resources to meet the requirements of science and technology development, innovation, and digital transformation.

These policies are reflected in Resolution No. 52-NQ/TW dated September 27, 2019, of the Politburo on a number of policies and strategies to proactively participate in Industrial Revolution 4.0. The Resolution sets out the requirement: “To comprehensively review and renew the content and curriculum of education and training in the direction of developing the capacity to access creative thinking and adaptability to continuously changing and developing technological environments; to introduce into the general education program the content of digital skills and minimum foreign language skills. To innovate teaching and learning methods based on the application of digital technology; to take the assessment of enterprises as a measure of the training quality of universities in the field of information technology. To encourage new models of education and training based on digital platforms”⁽³⁾. The 13th National Party Congress affirmed: “Developing human resources, especially high-quality human resources; prioritizing the development of human resources for leadership, management and key sectors based on improving, creating a strong, comprehensive and fundamental change in the quality of education and training associated with recruitment mechanisms, using and rewarding talents, promoting research, transferring applications and strongly developing science and technology, and renovation” as one of the three strategic breakthroughs⁽⁴⁾. In particular, emphasis is placed on “educating individuals to uphold ethics, discipline, order,

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and civic responsibility; having life skills, working skills, foreign languages, information technology, digital technology, creative thinking and international integration (global citizens)⁽⁵⁾, and so on.

To effectively implement the set goals, the Prime Minister issued Decision No. 146/QĐ-TTg dated January 28, 2022, approving the Project of Raising Understanding, Universalizing Skills and Developing Human Resources for National Digital Transformation by 2025, with a Vision to 2030; Decision No. 411/QĐ-TTg dated March 31, 2022, approving the National Strategy for Digital Economy and Digital Society Development by 2025, with a Vision to 2030... In which key solutions are proposed to train high-quality human resources. Specifically, it calls for training 1,000 digital transformation experts (by 2030); 5,000 engineers and bachelors majoring in digital technology (by 2025); 20,000 high-quality engineers, bachelors, and practical bachelors majoring in digital technology (by 2030) at universities and colleges with strengths in digital transformation training. To complete and implement the “Digital Higher Education” model (in at least 50% of public universities nationwide); organize integrated education methods based on an interdisciplinary and application-based approach (STEM) and digital skills (50% of schools); to train teachers in digital technology fields and increase training standards for technology fields and practical engineers⁽⁶⁾, and so on.

Based on the Party’s guidelines and the State’s policies, in recent times, the mission of educating and training high-quality human resources to meet the requirements of science, technology development, renovation, and national digital transformation in Vietnam has achieved tangible results. Specifically:

Firstly, the training and fostering digital transformation experts, engineers, and high-quality bachelors majoring in digital technology

Since 2020, the Ministry of Information and Communications has implemented a training program for 100 e-government experts in digital government⁽⁷⁾. This is the core, key force for digital transformation in ministries, sectors, and localities. In 2022 alone, The Ministry of Information and Communication (MIC) organized 02 training conferences for 100 e-government experts in Ba Ria - Vung Tau province and Ha Giang province with the goal of providing in-depth knowledge of information technology, digital transformation, and lessons learned in implementing e-government, digital government, digital transformation around the world and in Vietnam. On that basis, a network of e-government and digital transformation experts from the central to local levels was formed, contributing to enhancing understanding, learning from experience, removing difficulties, and promoting cooperation between agencies, localities, and enterprises in implementing the digital transformation process.

In addition, to advance the goal of training and developing 100 digital transformation experts, in 2023, the Ministry of Planning and Investment designed and provided an international coach capacity-building program for the Industry 4.0 expert network in the form of Training of Trainers (ToT) workshop⁽⁸⁾.

According to the 2023 Digital Transformation Report of MIC, the Ministry has chaired the organization of 60 digital transformation courses on the Mass Open Online Courses (MOOC) for 305,000 officials, civil servants, public employees and workers in state agencies (The 2024 report shows 412,677 officials (an increase of 35.3% compared to that in 2023); 20 courses to popularize digital skills for the public with 23 million people visiting on the MOOC platform; 02 training courses for members of community digital technology groups; supporting 11 ministries and branches, and 43 localities to use the MOOC platform for free. As of November 2023, all 63 provinces and centrally-governed cities had established 80.7 thousand community digital technology groups with nearly 379,000 members participating in community digital technology groups at the national, commune, village, and town levels; 54 out of 63 provinces and centrally-governed cities have completed 100% of the application of the MOOC platform to the commune level⁽⁹⁾.

Regarding the training of high-quality human resources specializing in digital technology: By the end of 2024, Vietnam had about 1.5 million workers working in the field of information technology (IT) and digital technology; about 168 universities and 520 vocational schools training in information and communication technology (ICT), with the total number of graduates reaching over 84,000, of which about 50,000 students have university degrees, about 34,000 students have college and intermediate degrees; the total enrollment quota is about 100,000 per year⁽¹⁰⁾.

The Ministry of Education and Training (MOET) issued Official Dispatch No. 5444/BGDĐT-GDĐH dated November 16, 2017, on the application of a specific mechanism for training majors in the IT field at the university level to serve the goals of digital transformation. Since 2019, a number of universities have offered training in AI; many large companies, enterprises, and corporations have also pursued their own strategies for training AI human resources. In 2019, the School of Information and Communication Technology under the Hanoi University of Science and Technology was the first unit to offer training in Data Science and Artificial Intelligence under an advanced model when it officially enrolled students in Data Science and Artificial Intelligence (since 2020, the School has continued to implement a master's training program).

Many corporations and enterprises have developed training programs in artificial intelligence, such as: The Big Data Institute under Vingroup has implemented a program for graduating students and young engineers to develop high-quality AI human resources; at the



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same time, it has implemented many support activities through the Renovation Fund “Vingroup - VINIF”. FPT Group is also one of the pioneering enterprises proactively building high-quality human resources in AI (in 2018, FPT University officially introduced an AI major into its curriculum). It is expected that the AI workforce will be supplemented by 1,300 students majoring in AI at FPT University and 300 students trained in practical AI annually by FPT⁽¹¹⁾.

In fact, the combination between schools and businesses in training digital human resources is increasingly developing. In training digital human resources, the Academy of Posts and Telecommunications Technology and VMO Holdings Technology Joint Stock Company have implemented a “3-ization” training cooperation model (corporatization, certification, and internationalization) with the training time shortened from 4.5 years to 3.5 years. In the training of digital tourism human resources, ezCloud - a company providing a tourism management and business platforms, has cooperated with about 20 universities and colleges nationwide to integrate it into the school’s curriculum. Ho Chi Minh City University of Transport has cooperated with Vietnam SmartHub Logistics (VSL) to bring the digital seaport platform into service for teaching and practice for 1,000 students⁽¹²⁾.

In addition to the achievements gained, the training of digital transformation experts, engineers, and bachelors in the field of digital technology still faces some limitations and shortcomings. The human resources specializing in information technology and digital technology in agencies, organizations, and emerging economic sectors are still lacking and uneven. The rate of civil servants and public employees specializing in information technology who are trained, retrained, and fostered in digital transformation is still low. The dissemination of digital skills to the public and to the labor force working in sectors and occupations remains slow. The quantity and quality of engineers, bachelors, and technicians in information technology and digital transformation are still limited, not meeting the demands posed by digital transformation. The tasks of developing national digital transformation human resources have been slowly implemented, such as digital transformation in vocational education and the pilot implementation of the digital university education model⁽¹³⁾.

Although the proportion of IT specialists has increased over the years, it is still low compared to the occupational structure of other occupational groups. According to statistics, by the end of 2022, the number of digital transformation specialists is still low, accounting for an average of 2.64% of the total number of civil servants and public employees in ministries, branches and localities (of which the provincial level averaged 2.56%, the ministerial and branch level averaged 4.05%); meanwhile, according to the recommendation of MIC, the minimum requirement for the number of digital transformation specialists is about 10%⁽¹⁴⁾.

In addition, information technology human resources are currently in a state of significant shortage. According to TopDev’s report: In 2021, businesses needed 450,000 employees, but the available workforce could only meet 430,000. In 2022,

Table 1: Current needs of human resource in Information Technology sector

Year	IT personnel needed	IT personnel shortage
2022	530,000	150,000
2023	550,000	150,000
2024	650,000	170,000
2025	700,000	200,000
2026	750,000	220,000

* Source: Author's synthesis from TopDev's report

this shortage rose to 150,000 employees while the market's recruitment demand was 530,000 people. In 2023, the whole industry lacked about 1 million workers. Among them, IT - Software enterprises belong to the group with the highest shortage rate. IT human resources have consistently ranked among the top 3 "sought-after" positions in recent times⁽¹⁵⁾. TopDev also predicts that the shortage of IT human resources in Vietnam will continue into 2025 and 2026 (see Table 1).

Regarding AI human resources, currently only about 10% of the demand for the Vietnamese labor market is being met. The fundamental reason stems from the fact that the qualifications of programmers do not meet enterprise requirements at all three levels: engineering, advanced training, and business teams.

Secondly, in STEM education and "digital higher education"

Recognizing the importance of STEM education in the general development trend, Vietnam has implemented many policies and activities to promote STEM education at all levels. In 2016, the Ministry of Education and Training (MOET) in coordination with the British Council, piloted STEM education in 14 schools in various provinces and cities across the country to create a foundation for the national training program. From this result, many forms of STEM education have been organized such as: STEM Festivals, extracurricular clubs, technology-engineering competitions... Many student initiatives have been highly appreciated by society, such as improving learning methods (redrawing the periodic table of chemical elements, timetable reminder software...), improving labor tools (delivery robots, automatic irrigation systems for vegetable cultivation...), environmental research (measuring water pollution concentration in West Lake (Hanoi...), measuring rainwater volume..., researching technical improvements (Vietnam's Covid-19 anti-epidemic helmet - Vihelm...). MOET has organized training in educational institutions from primary to high school levels on STEM/STEAM methods such as Online seminars on developing STEM experience programs for students, which attracted the participation of many education departments and schools...

However, the proportion of students studying in STEM fields is relatively low compared to other countries in the world, reaching only 55/10,000 people. In recent years, the proportion of students studying in STEM fields as a percentage of total



Primary pupils in a STEM lesson _ Photo: P.T.

university students in Vietnam has only been at about 27% - 30% (in 2021 it was about 28.7%). This rate is much lower than some countries in the region and Europe, such as Singapore (46%), Malaysia (50%), South Korea (35%), Finland (36%), and Germany (39%). Particularly for natural sciences and mathematics, the rate of student enrollment in Vietnam is only about 1.5% (1/3 the rate in Finland, 1/4 compared to the rate in South Korea, and 1/5 of the rate in Singapore and Germany)⁽¹⁶⁾.

Regarding the “Digital Higher Education” model, MOET has selected 05 higher education institutions to pilot the project of building a digital higher education model, including: Ho Chi Minh City National University, Hanoi National University, Hanoi University of Science and Technology, Danang University, and the Academy of Posts and Telecommunications Technology. Accordingly, these units have researched many international models related to digital universities and selected the collaborative and shared digital higher education model for cooperation and implementation. Ho Chi Minh City National University has set a specific goal: By 2030, it will build more than 100 MOOCs; in which, in 2024, the university will continue to build 21 MOOCs; in 2025, it is expected to build more than 20 MOOCs and by 2030, more than 100 MOOCs will be completed throughout the whole system⁽¹⁷⁾.

However, the implementation of this model in practice still faces many difficulties and shortcomings. The awareness of educational managers, teachers, students, and pupils about the necessity, role, and significance of digital transformation is still limited. The number of “digital higher education models” shared and used jointly is still low (standardizing, sharing, and jointly utilizing professional and management data between higher education institutions and with state management agencies).

Research and development of the overall architecture for the “digital higher education model” to help higher education institutions plan for synchronized resource investment and roadmaps remains limited. Difficulties also exist in terms of resources, investment funding, digital capacity, digital skills of staff, lecturers, and students, and so on.

2.2. Some recommendations for improving the quality of education and training of high-quality human resources to meet the requirements of science, technology development, renovation, and national digital transformation in Vietnam

To implement Resolution No. 57-NQ/TW dated December 22, 2024, of the Politburo on breakthroughs of science, technology, renovation, and national digital transformation, on January 9, 2025, the Government issued Resolution No. 03/NQ-CP on the Government’s Action Program. Accordingly, the Resolution identified 14 groups of solutions directly related to education and training such as comprehensive STEM education development, specifically: Prioritizing financial support for facilities and enterprises participating in training in digital technology and strategic technology; implementing preferential policies to attract leading scientists at home and abroad; developing a network of lecturers; incentives for digital technology experts working in state agencies⁽¹⁸⁾. On that basis, in order to contribute to improving the quality of education and training of high-quality human resources to meet the requirements of science, technology development, renovation, and national digital transformation, it is necessary to implement the following recommendations:

Firstly, training subjects should not only focus on professional and specialized ICT human resources but also pay attention to the training of general ICT human resource. In fact, in some countries that are strongly developing digital transformation (such as China), the education system only focuses on cultivating professional ICT talents, leading to a serious shortage of comprehensive ICT talents. Therefore, in the education and training of high-quality human resources to meet the requirements of science, technology development, renovation, and national digital transformation in our country, attention must be paid to a workforce capable of not only understanding technology and business processes, but also developing traditional industries associated with digital technology.

Secondly, promote research and issue specific action plans in a short timeframe (about 3 years) to promote and enhance the training and development of high-quality human resources to serve digital transformation. In this regard, it is necessary to establish several



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practical and feasible initiatives related to content such as: Implementing digital engineering training projects; promoting digital skills improvement activities; international cooperation and exchange on digital human resources; enhancing startup training for digital talents; building and developing vocational and digital skills competitions, and so on.

Thirdly, develop and promulgate standardized training programs for strategic technology sectors like AI, Big Data, and semiconductor microchips. Clearly define the objectives of these programs to ensure the training quality of educational institutions in the fields of new technology and strategic technology, meeting the output standards of training programs according to the national qualification framework. At the same time, ensure the work capacity of graduates and meet social requirements for human resources in the digital transformation process. In addition to general standards, the diversity and specific characteristics of each training institution should be encouraged in order to form, develop, and improve quality to meet societal demands in training program development.

Fourthly, research mechanisms and policies to attract lecturers in the field of digital technology. In Vietnam today, the number of lecturers teaching new technology and strategic technology (such as AI, Big Data...) is still quite small, and practical experience in developing applications in these fields is still limited. Moreover, in the context of rapidly changing new technologies and techniques related to AI and Big Data, the adaptability and updating capacity of teaching staff is still slow.... Research in AI and Big Data requires investment in infrastructure, servers, and large funding sources, yet most universities in Vietnam still face many difficulties in this regard.

To improve the professional qualifications and practical skills of teaching staff in this field, it is necessary to focus on the following aspects: 1) Promote cooperation and training exchanges with countries that have advanced education systems; 2) Invite leading global experts to participate in the training of teaching staff; 3) Encourage self-study and self-training capacities so that lecturers can proactively approach changes in the current context; 4) Strengthen links and exchanges with technology corporations in Vietnam and globally in training teaching staff; 5) Develop policies to encourage key lecturers at training institutions to participate in the operation of enterprises in relevant stages; 6) Research and implement mechanisms and policies to attract talented experts to participate in training.

3. Conclusion

In the face of the strong development and impact of Industrial Revolution 4.0, the development of science, technology, renovation, and digital transformation has consistently been identified by our Party as a key and decisive factor to the development of the country. This is also the prerequisite for our country to develop and confidently enter the “new era of development”. Improving the quality of education and training to ensure high-quality human resources to meet the requirements of science,

technology, renovation, and digital transformation development is a key solution. It is necessary to focus on training comprehensive ICT human resources; building and implementing standard training programs for strategic technology sectors; developing a team of lecturers in digital technology disciplines ■

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● Endnotes:

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