

INDUSTRIAL REVOLUTION 4.0 AND REQUIREMENTS FOR HIGHER EDUCATION IN VIETNAM

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Abstract: This article does not ambitiously (and cannot) summarize a full assessment of the status of Vietnamese higher education, in order to answer the question of what the requirements for Vietnamese higher education in industrial revolution 4.0. Instead, we would outline some shortcomings of Vietnamese higher education (related to the requirements of the industrial revolution 4.0). On that basis, a number of solutions would be proposed to renovate higher education in Vietnam today to meet thus requirements.

Keywords: industrial revolution 4.0, higher education, Vietnam.

1. INDUSTRIAL REVOLUTION 4.0 IN ESSENCE

The fourth Industrial Revolution, i.e. Industry 4.0, focuses on interconnectivity, machine learning, real-time data and automation in manufacture process. The revolution includes Cyber - Physical Systems (CPS), Internet of Things (IoT) and Cloud Computing. Within the revolution, every citizen will become digital businessman, every business will become digital business, every leader will become digital leader, every government will become digital government¹.

Industry 4.0 in essence is based on digital platform, a combination of intelligence technology to optimize production processes and manufacture, and emphasize multiple technologies that have been and will impose greater social impacts such as 3D printing technology, biotechnology, novel material technology, automation technology, robots. Industry 4.0 is certainly the trend for automation and data mining in manufacture technology. It includes physical networks, Internet connectivity and cloud computing. This revolution does not only involve intelligent machines and systems, but also much far reaches to broader horizon. At the same time, the world are observing waves after waves of new breakthroughs in different fields ranging from gene sequencing to nanotechnology, from renewable energies to quantum computing. The revolution requires not only skillful and creative human resources, but also high level of knowledge in information technology, international, manufacture process and socio-economic environment.

2. CURRENT SHORTCOMINGS OF VIETNAMESE HIGHER EDUCATION COMPARED TO INDUSTRY 4.0'S REQUIREMENTS

In the past decades, Vietnam's tertiary education has developed remarkably and achieved significant achievements, which help improving citizen's intellectual standards, strengthening human resources to contribute to the national industrialization and modernization, international integration, infrastructure construction, democracy and liberty protection. However, there are some shortcomings of Vietnamese education compared to Industry 4.0's requirements:

¹ Archive of National workshop - "The impact of the 4.0 industrial revolution on labor relations and employment quality in Vietnamese FDI enterprises today", Ho Chi Minh City National University Publisher

Firstly, In recent years, while investing in high quality human resources, we have neglected inadequate in levels between business administration and teachers - who directly perform the teaching tasks, thus have not been ready for globalization and integration, especially Industry 4.0. Shortage of lecturers and teachers are frequent in many education centers; students per lecturers ratio are beyond standard regulations; teaching hours regularly exceed standard (61% of training institutions are accredited). The average rate of student per teacher (including universities and colleges) in Asia is 12.5; meanwhile Vietnam's figure is 29.4, which is 4 times higher than Japan's and Germany's; 2 times higher than the UK's and South Korea's, 2.5 times higher than Laos' and Malaysia's².

The number of organic lecturers in schools with comprehensive education structure is still inadequate. While the number of lecturers who are professor, associate professor and possess doctoral degree is still low, those with university degree remain plenty. During 2017-2018 school - year, the total number of lecturers in Vietnam universities is 74,991 (public sector: 59,232 teachers; non-public sector: 15,759 sectors). In which, there are 20,198 lecturers with PhD qualifications or above (26.93%); 44,634 lecturers with Master's degree (59.52%); 632 lecturers with first and second degree expertise (0.84%); 9,495 lecturers with universities and colleges' degree (12.66%); 32 with other qualifications (0.04%). Some training institutions appear to assign teaching staff with bachelor's degree to perform theoretical lecture².

In addition, the skillful level of information technology and foreign languages among teachers in the context of current integration is limited, especially in non-specialized schools. Many training institutions have lecturers who do not possess certificate in information technology, foreign languages and pedagogical skills (35% of training institutions are accredited)². Although the Prime Minister issued Decision 2080/QĐ-TTg dated 22/12/2017 approving the adjustment and supplement of the Foreign Language Teaching and Learning Project in the national education system for the period of 2017-2025 and Decision No.117/QĐ-TTg dated 25/01/2017 approving Project "Enhancing the application of IT in managing and supporting teaching and learning activities, scientific research contributing to quality improvement by 2020", many lecturers at higher education institutions have not met the standard of foreign languages, while their IT certificates exist only for status quo.

Secondly, Despite of many innovations in programs contents, teaching methods, examinations and assessments, Vietnam's higher education still focuses on equipping students with theoretical knowledge, while has not yet associated with the rapid change of socio-economic environment and movement of job market; has not encouraged creativity, practical competence, especially among students - one of the very important factors help forming the approach to Industry 4.0. Undergraduate programs are filled with theoretical knowledge. With new knowledge being produced more and more constantly updated into the program, overloadness is irreparable, if not more severe. To learn is hard, yet acquiring and practical application is even more difficult. In particular for the system of examination and assessment, while memorizing professional knowledge is considered at most important, entrance examination and examinations in the learning process and evaluation all consider specific knowledge as the main objective. Examination methodologies to assess professional knowledge then produce unwanted consequences - or in another word, a "disease" hard to cure: rote learning, topic selective learning and cheating. Meanwhile, essential soft skills such as communication, teamwork, presentation, time management, which all require combination of knowledge application, technology, and characteristics, are neglected. Especially, time management skills to help students avoid procrastination, dwelling in social networks and entertainment, leading to ineffective work and productivity reduction, have not been paid enough attention.

Thirdly, capacity of scientific research and technology transfer has not met the requirements. Research activities, technology transfer and community service are still limited. Finance allocation is not yet sustainable, in which spending on scientific research is much lower than standard (28% of accredited training institutions)³.

Awareness of autonomy and the role of scientific research activities in training institutions is also incomplete. The results of scientific research activities are still not commensurate with the objectives and requirements for higher education institutions. The applicability of research projects is inadequate while the number of published scientific works in prestigious international journals is not high. In addition, implementation has not ensured research plan that many is overdue for scientific approval, meanwhile, the ratio of scientific research projects per lecturers is low (49% of the accredited educational institutions). Without proper investment in scientific research, many higher education institutions are unable to balance between revenues from scientific research and technology transfer and the University's funding for this activity (71% of accredited educational institutions)².

² Ministry of Education and Training (2018), Final Report for the 2017-2018 school year and direction of the school year of 2018 - 2019 for higher education and teacher training, Hanoi, September 2018.

Fourth, Over the past years, Vietnam's Communist Party and the Government have made great efforts in education investment (accounting for 20% of the total governmental budget expenditure), yet it is clearly seen the limitations of Vietnamese education are facilities shortage for laboratories, computer rooms, Internet connection systems. Current systems have not yet created a friendly and prominent working environment, while self-study and literature archive are highly limited among students. In fact, only 13.8% of the school possess ground area, while half possess land area that meets the official requirement; only 38.9% of accredited schools have libraries that apply Vietnamese library standards. In addition, some higher education institutions have not yet fully implemented the quality assurance conditions under school establishment proposal, resulting in low quality of training, difficulties in enrollment, and insufficient resources. Moreover, 51% of accredited training facilities do not have enough construction floor area to serve training and scientific research activities according to regulations; while 68% lack updated textbooks and reference documents in Vietnamese and foreign languages for teaching, scientific research and learning purposes³.

Fifth, in fact, most enterprises are not satisfied with education quality and newly graduates' skills due to the lack of knowledge and ability to communicate in foreign languages and the level of information technology. Survey from 18 universities in Vietnam showed an average freshman's English skill scored 220 to 245 over 990 points in TOEIC, with this score, students need about 360 hours of training (480 periods) to achieved 450-500 points in TOEIC - a minimum job application requirement by many businesses. Each year, Vietnam produces about 400,000 bachelors, yet 6 out of 10 lack essential skills and English proficiency. The majority of graduates cannot communicate in foreign languages due to the lack of basic knowledge about grammar and vocabulary⁴.

Regarding students' information technology level: At the seminar on development of high-level ICT human resources on March 29, 2019, Minister of Education and Training Phung Xuan Nha, said, "*Currently, the whole country has 153 information technology training (ICT) institutions, each year nearly 35,000 ICT students graduate. About 30% graduates work in ICT businesses, the rest work on ICT expertise in other agencies.. This number does not meet business needs, especially in the context of ICT becoming a large economic sector based on knowledge and technology on a scale of 100 billion USD, export value of about 93 billion USD, trade surplus of over 25 billion USD and nearly one million workers. According to the growth rate of information technology enterprises, by 2020, this industry needs 100,000 high quality bachelors. But the result shows that only 30% are ready to work in the industry immediately.*" This issue requires intensive review on training process, and the involvement and collaboration between businesses and training facilities.⁵

For higher education institutions (not specializing in information technology), although many propose the information technology output standards for students, in general, students only learn basic operations (Document, Excel and PowerPoint editor), while most are not introduced with advanced information technology such as software, data analysis and big data suitable for research or work in businesses and management. Meanwhile, Industry 4.0 requires workers to not only meet IT standards but also well-verse the newest and high-level ones.

Sixthly, in spite of many innovation efforts in the past years, output quality in Vietnam higher institution has not been improved, which leads to increasing unemployment for bachelor graduate. According to the Labor Market Update Newsletter published by the Institute of Labor Science and Social Affairs (Ministry of Labor, War Invalids and Social Affairs) on the afternoon of December 26, Quarter III/2017, "*the number of unemployed people with university degrees is 237 or more people (4.51%), this figure has increased 53.9 thousand people compared to the second quarter. In the community college level, there are 84.8 thousand unemployed, an increase of 1.9 thousand people compared to the second quarter of 2017. The unemployment rate of this group decreased slightly to 4.88% but remained at the highest level. For technical school category, there are 95.5 thousand unemployed people, an increase of 3.1 thousand people, the unemployment rate is 3.77%*".⁶ Considerably, not only lacking in professional knowledge, Vietnamese workers are also incompetent in the application of artificial intelligence (AI) in predictive analysis, talent management and human resource development.

³ Ministry of Education and Training (2018), Summary Report for the 2017-2018 school year and Directions for the 2018-2019 school year for higher education and teacher training, Hanoi, September 2018.

⁴ <https://www.tienphong.vn/giao-duc/9400-ty-dong-va-noi-buon-mang-ten-hoc-ngoai-ngu-1090975.tpo>

⁵ <https://vnexpress.net/giao-duc/sinh-vien-cong-nghe-thong-tin-chua-dap-ung-yeu-cau-3902422.html>

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⁶ Labor Market Update Newsletter - Institute of Labor Science and Social Affairs (Ministry of Labor, War Invalids and Social Affairs) published on December 26, Quarter III /2017

3. INDUSTRY 4.0'S REQUIREMENTS FOR HIGHER EDUCATION IN VIETNAM

Under the impacts of Industry 4.0, in order to maximize education and training system as quality production of human resources, especially in the context of increasingly globalization, while in certain fields, labor can move between countries under AEC commitments, Vietnam's higher education needs drastic and strong adjustments in the following basic directions:

Firstly, the application of new technologies in teaching and learning require executive enforcement activities from educational management agencies and training institutions, thus the adaptation in lecturers and students. While the main teaching and learning method is now done directly in class, this can be transferred to wireless and online via the Internet. Online programs and internet-based courses are trending worldwide. Via this, learners can acquire and apply knowledge from a distant geographical area from teacher and institution, even accessible at any time of day. Similarly, a professor can instruct lessons for many students in different countries. Increased autonomy in learning would pose positive impact on learners' goals of self-improvement.

Secondly, from the requirements of Industry 4.0, innovations are required in only methodology but also the training content. This signals changes in defining the structure and teaching content of the training industry. The trend of STEM-based training - a model that combines 4 separate subjects: Science (Technology), Technology (Technology), Engineering (Engineering), Mathematics (Mathematics) - appears to develop strongly recently. The STEM model has three important characteristics: an interdisciplinary approach, theoretical combining with practical lessons, international learning connection. By combining knowledge, the STEM education model encourages learners to solve problems through integrated knowledge.⁷

In addition to STEM model training, changes in socio-economic life have led to changes in demand - need balance. The need of information and communication technology skills training as well as data processing is gaining attention under the realm of intergrated and connecting lifestyle. Besides, due to the deeper integration of the economy, the demand for common international languages also increases. As mentioned above, as workers' desirable skills are required to change, teaching content and guidelines among training institutions also need to be changed for better equipping learners. All of this would impact the training field, learning curriculum and content as well.

Thirdly, management innovation in training institutions should be posed as an urgent requirement due to the impact of above two factors. Indeed, from another perspective, Industry 4.0 requires higher education to change comprehensively and adequately, from senior management agencies to each individual in the system to create desirable labor force. The education and training industry is an industry that has a direct impact on human resources through training activities that provide knowledge, skills training and working attitude education for employees. Industry 4.0 has been setting the basic requirements for education and training, which are the most important contents in the development strategy of many countries worldwide in response to the fast pace of Industry 4.0.

Fourthly, it is necessary to develop a clear education development strategy, which indicates the shift of training professions as well as aims to improve the skills of trained human resources. Thus, we suggest considering the education development strategy as atmost important and stepping stone to implement the strategy of scientific, technological and economic development. From the example of US and Japan when applying STEM policy in priority and adequately invesment for students in science and technology, the system can reorient better career for Vietnamese students.

Currently in Vietnam, many excellent students often choose majors in economics, foreign trade, finance, banking while not as many get into technology and engineering schools. This has led to a shortage of personnel in the fields of digital technology, automation and information technology. According to a report by VietnamWorks, in the last 3 years, the number of IT jobs has increased on average 47% per year, but the number of employees only increased at 8% rate

⁷ Tran Thi Van Hoa (2017), *Industrial Revolution 4.0 and its problem for socio-economic development and international integration of Vietnam*, Publishing House. National Truth and Politics, Hanoi.

(Nguyen Thanh, 2016). The “misleading” choices of young people entering university remain a major barrier that prevents Vietnam's human resources from meeting the current Industry 4.0 requirements.⁸

Fifthly, there should be clear policies in improving education, human resources through improving practical skills, especially soft skills and English skills. Thusly, higher education institutions should be encouraged to: (1) Increase English training programs at schools, thereby improving students' ability to apply English; (2) Training and improving English proficiency for lecturers, training professional, teaching staff with good English proficiency; (3) Build close connection between enterprises and training institutions, while considering the process of training human resources as a joint responsibility of different stakeholders, not the schools alone; (4) Increase the number of teaching modules undertaken by real-world practitioners in training programs to increase the practicality of training programs; (5) Increase published articles in prestigious journals according to standard lists such as ISI and Scopus, increase the citation index for training institutions of basic science; (6) Impose clear career-oriented policies to avoid deviation and imbalance in theoretical study but not training skills and working attitudes.

Sixthly, it is necessary to have policies to encourage training institutions to invest in technological innovation, applying new technologies in training and training management, thereby contributing to improve technology innovation index and economy growth index. Specifically, changes should be made in: (1) Investing in increasing expenditure on science and technology, modern technical infrastructure for training, especially vocational training; (2) Innovating training management, applying intelligent management systems; (3) Technology and engineering schools must focus on engaging businesses to conduct research and development, at best to create innovative patterns, in order to attract students to participate in creative activities while still in school.

Seventh, higher education institutions need to invest in programs and policies to improve the information and communication technology index through: (1) Building open data sources to share knowledge; (2) Develop informatics output standards to meet international standards and requirements, thereby serving as foundation and goals for training smart technology skills in the learning process; (3) Building a learning society through the development of high quality online training programs to meet the lifelong learning needs of each individual. It is also encouraged to require students to take some online modules (at least 10%) to increase flexibility, adapting skills to use information technology devices. In specific:

- (i) Encourage policies to improve the education and training index, to prioritize science and technology disciplines such as mathematics, physics, biology, etc.
- (ii) Enhance training in using informatics technology and smart devices for learners;
- (iii) Strengthen copyright protection and intellectual property, linking science and technology activities with practical applications, thereby improving information and communication technology index;
- (iv) Encourage innovation and application of modern technology in all industries and fields. Building and developing training programs to stimulate entrepreneurship, a sense of continuous innovation for learners;

As such, Industry 4.0 is setting new requirements for future human resources. This requires higher education in Vietnam to create human resources with superior competence, professional competence, the ability to work with smart technology and foreign language skills, to be able to “stand on the shoulders of giants” and make good use of this revolution, thus leading our country to thrive in the future.

4. CONCLUSION

The rapid and strong development trends of Industry 4.0 has been posing extremely urgent requirements for the comprehensive renovation of education and training in Vietnam. While Industry 4.0 is a new, topical, and inevitable issue of the movement, this paper urges the system to (i) Conduct investment, in-depth inquiry; (ii) Act immediately and comprehensively; (iii) Be fast and adaptive; (iv) With careful preparation. Therefore, this paper sends the message to the readers: “The world is changing day by day, hour by hour, instead of sitting and waiting, we should not only adapt to new situations, but also equip ourselves with new knowledge and creative dynamism exist and develop”.

⁸ Tran Thi Van Hoa (2017), *Industrial Revolution 4.0 and its problem for socio-economic development and international integration of Vietnam*, Publishing House. National Truth and Politics, Hanoi.

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