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THE TRANSITION OF VIETNAMESE HIGHER EDUCATION SYSTEM ADAPTING TO 4th INDUSTRIAL REVOLUTION

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Abstract: Higher education plays a vital role in each country; it is broadly defined as one of the critical drivers of growth performance, prosperity, and competitiveness. After applying the policy "Doi Moi" (economic renovation) since 1986, many sectors of the economy, as well as education, have had an immediate and significant impact in Vietnam. Currently, higher education institutions in Vietnam are facing some challenges in implementing sustainable development goals to meet the requirements of industrialization and modernization of the country as well as international integration. This paper aims to examine the challenges of Vietnamese higher education systems in light of the 4th industrial revolution, and based on that, determine the appropriate transition of this system to adapt to the increasingly higher requirements of the labour market. This paper argues that the Vietnamese higher education sector needs to adopt a suitable change regarding teaching and apply a new approach to educational services to effectively adapt to the 4th industrial revolution.

Keywords: Higher education, 4th industrial revolution, Vietnam

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Introduction

Industrial Revolution 4.0 has opened up new opportunities, and challenges for human life as information technology, the internet, and virtual reality systems play a crucial role. In essence, this revolution will change the way people think, live and work, thereby helping the economy thrive. Academicians and students from all universities are required to upgrade their knowledge and skills to adapt to the developing trend based on the increasingly important role of the cyber-physical system in everybody's life.

The development of the fourth industrial revolution offers an excellent possibility for developing countries to accelerate their industrialization and modernisation, including Vietnam. Vietnam is facing the challenges of low-level labour-productivity

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to be ready for the new stage of industrial revolution 4.0 (Huynh Van Thai 2017, p. 1). Based on the perceptions of the challenges that the Industrial Revolution 4.0 brings, Vietnam's higher education system needs to take appropriate adaptation steps to address these challenges as well as create employees with the necessary skills to meet the job requirements of the employer.

The purpose of this paper is to examine the challenges for Vietnamese higher education systems in light of the 4th industrial revolution, and based on that, determine the appropriate transition of this system to adapt to the increasing higher requirements of the labour market. This paper argues that the Vietnamese higher education sector needs to adopt a suitable change regarding teaching, and apply a new approach to educational services to effectively adapt to the 4.0 industrial revolution.

Methodology

This research was based on reviewing the literature that is related to the 4th industrial revolution and the higher education system in Vietnam in order to highlight the nature of industrial revolution 4.0 and its impact on every aspect of the society, especially on the higher education system, and the labour market. Based on analysing the problems of the current higher education system in Vietnam, the authors will present some solutions as policy implications for transforming this system to adapt to the 4th industrial revolution.

Background

The fundamental characteristics of Industrial Revolution 4.0 and its impact on the labour market.

a. Vertical networking of smart production systems

The first principal characteristic of industry 4.0 is the vertical networking of smart production systems in the factories of the future (Kagermann et al. 2013, p. 19). These factories will be equipped with several physical and informational subsystems, such as actuators and sensors, control system, production management, manufacturing, and corporate planning (Wang et al. 2016, p. 2). In this system, various IT systems with different hierarchical levels will be aggregated to deliver an end-to-end solution (Kagermann et al. 2013, p. 20). Cyber-physical systems (CPS) are used to enable factories to react quickly to changes in demand or stock levels and deficiencies. In turn, the plant needs to have a design which allows CPS to be adopted. Hence, the configuration rules from which case-specific topologies can be derived automatically will replace the concrete structures and specification of production processes (Brettel et al. 2014, p. 38). As a consequence, the concept of a "smart factory" appears based on applying vertical integration. A smart factory provides essential real-time quality, the advantage of cost and time resources in comparison with classic production systems (MacDougall 2014, p. 10). These advantages are achieved through the flexible network of a CPS-based production system which, to no small extent, automatically oversee production processes (MacDougall 2014, p. 10). In a smart factory, it locks all the

processing stages, with discrepancies registered automatically (Schlaepfer et al. 2015, p. 6). Additionally, CPS as the central hub for data and fleet management, provides peer-to-peer health evaluation and component fusion based prediction methods where all of these applications are supposed to increase asset uptime and relatively increase productivity and service quality (Lee, Bagheri 2015, p. 300). Schlaepfer et al. (2015, p. 6) demonstrated that applying the internet of things will provide customers with even more added services like predictive maintenance with condition monitoring.

b. Horizontal integration via new generation of global value chain networks

Horizontal integration concerns the variety of IT systems which are used in the different stages of production and business planning processes that comprise an exchange of materials, energy and information both within an enterprise (e.g. inbound logistics, production, outbound logistics, marketing) and between several different firms (value networks) (Kagermann et al. 2013, p. 20). Based on these establishments, the created networks will optimize the systems in real-time and enable integrated transparency, as well as offer a high level of flexibility (Schlaepfer et al. 2015, p. 7).

Besides that, businesses have to concentrate on their core competencies, while other activities are outsourced to partners in the network to improve their global competitive advantages. The organization of systems increases the capacities without the necessity for further investments (Brettel et al. 2014, p. 39). In an increasingly complex world, the involvement of various firms in resolving problems is a necessary condition for ground--breaking innovations and new business models can only be developed when several companies contribute their respective complementary competences (Koch et al. 2014, p. 34). Meanwhile, this kind of horizontal integration can create transparency due to the corresponding information, and state of individual machines which are available. Hence, it is easier to make a priority decision on how to optimize the maintenance process in the system.

The supply chain also has to be created to allow the adaptation of routes and schedules to exploit the flexibility potential of collaborations (Brettel et al. 2014, p. 39). In the condition of supply chain management, agility goes hand in hand with the ability to track commodity flows but also data concerning delivery reliability and customer satisfaction. Hence, similar to networked production systems, horizontal networks provide networking via CPS, which creates transparency and flexibility across the entire process chain from purchasing through production to sales (Schlaepfer et al. 2015, p. 7).

c. Through-engineering across the entire value chain

The third principal characteristic of the 4.0 industrial revolution is cross-disciplinary through-engineering across the whole value chain and the full life-cycle of products and clients (Schlaepfer et al. 2015, p. 7).

This engineering happens seamlessly during the design, improvement, and creation of new products and services. New products need new and/or modified production systems. The improvement and production of new products and production systems are integrated and coordinated with product life cycles, enabling new synergies to be created between product development and production systems.

The fact that data and information are also available at all stages of a product's lifecycle, enabling new, more flexible processes to be defined from the data via modeling to prototypes and the production stage, is characteristic of through-engineering.

d. Acceleration through exponential technologies

The fourth main characteristic of industry 4.0 is the impact of exponential technologies as an accelerant or catalyst that enables individualized solutions, flexibility and cost savings in industrial processes (Schlaepfer et al. 2015, p. 8).

Industry 4.0 already requires automation solutions to be highly cognitive and highly autonomous. Artificial intelligence (AI), advanced robotics and sensor technology, as well as 3D printing, have the potential to increase autonomy further still and to speed up individualization and flexibilization.

The impact of industrial revolution 4.0 on the labor market

Industrial Revolution 4.0 will also set new requirements for the knowledge and skills of workers. They can be divided into three groups:

- Knowledge and skills which are related to cognitive, systematic thinking, critical thinking, adaptive skills, and creative skills.
- Physical skills: language skills, digital skills, communication skills.
- Social skills: communication, behavior, relationships, teamwork.

Thus, applying knowledge and skills to innovate is more important than the previous specialized knowledge and skills.

However, in addition to the tremendous positive effects mentioned above, Industrial Revolution 4.0 also poses many challenges, especially those that will dramatically change the structure of labor and labor markets. Automation systems will gradually replace manual labor in the economy as a whole; the shift from workers to machines will increase the gap between the profitability per capital dollar and profitability per labor dollar. This will affect the income of simple workers and increase unemployment. The high proportion of high-quality labor increases, resulting in an increasingly fragmented employment market into high-skill and low-skill markets that will lead to increased fragmentation or creating the demand for completely new jobs compared to the past, which requires active preparation and appropriate regulatory policies.

The problems of the higher education system in Vietnam

As Vietnam's economy develops rapidly, the demand for highly qualified workers is increasing for research, innovation and development activities, while the education and training system of Vietnam has not met these requirements despite significant reforms in the past (World Bank 2008, p. 121). In the early 2000s, the Vietnamese education system was criticized for training too many bachelors in science and technology (Le 2014, p. 22); such graduates sometimes had to take jobs below and different from those for which they were trained in university (Vallely, Wilkinson 2008, p. 2). Besides, the higher education system has not fulfilled the role of incubator in creating new knowledge and enhancing labor productivity. The consequence of these constraints on providing innovative and essential skills is that the adaptation of new

technologies has been hindered and the gap between the demand and supply of critical skills seems to have widened (World Bank 2008, p. 13).

Furthermore, the relevance and quality of the higher education programs as well as equal access and inclusiveness for all citizens, especially the poor, are of great concern (World Bank 2008, p. 13). One of the other issues which is related to the quality of the education system is indicated by (Vallely, Wilkinson 2008, p. 2) the fact that there is no Vietnamese university ranked in any league table of leading Asian Universities or global rankings regarding their teaching or research quality. Comparing with some countries in the Asian area like China, Korea, and Singapore, the authors of these studies also emphasize that Vietnamese universities are isolated from international scholars and have very little evidence of research publications. In this aspect, it is clear that Vietnam appears to lag far behind not only compared to developed countries but also Southeast and East Asian ones. However, at the same time it must be noted that universities in Vietnam have made significant progress in expanding the number of research publications and citations in the past 20 years (Welch 2012), especially in the context of the boosting economic conditions in recent years.

Another issue of the curricula in the higher education system in Vietnam is that it does not provide Vietnamese graduates the needed skills for professional life (Vallely, Wilkinson 2008, p. 2). These issues pose challenges for international investors when recruiting locally educated and trained labors, although they have suitable undergraduate qualifications.

Consequently, with the contemporary state of the Vietnamese higher education system mentioned above, there are some barriers and negative implications for the development of a skilled workforce and attracting foreign direct investment, and, the most important thing is for competitiveness in the long-term and the growth of Vietnam in the global knowledge economy.

New thinking for the transition of Vietnamese higher education system

Teaching methods in the Fourth Industrial Revolution (Teaching 4.0)

a. Digital simulation for teaching, learning, and training

Education institutions have to act now to recognize the immense potential of mobile devices to change the way that students are taught and trained and also how they learn. Take digital simulation; it is a handy tool for engineers to analyze and predict the state of physical systems in the real world. In the era of the 4.0 industrial revolution, when cyber-physical systems become the new model, digital simulations play a significant role in both practical applications and education. Within the area of digital simulation, finite element analysis (FEA) is a clever technique which has been examined in a variety of engineering fields like analyzing buildings (Marwala, Boulkaibet, Adhikari 2016, p. 5; Marwala 2012, p. 7; Marwala 2010, p. 10). Modern FEA is regularly performed with the support of computers. The result is that students can understand important concepts more intuitively, and designers can conduct complex modeling and interpret results easily.

b. Adopting massive open online courses (MOOCs) and mobile applications

Traditional teaching has been restrained for a long time in the following way: students are required to group in a lecture hall to listen to the lecture of a professor or sit around a table to discuss a certain topic with classmates. Technological innovation is decreasing those limitations and bringing many advances to higher education. Massive open online courses, or MOOCs, is an education method that provides stand-alone education online and helps students to access the materials anywhere, anytime. There are some well-known educational service providers such as Coursera, edX, Udacity, Topica, or Lynda, providing students millions of online materials. Many universities in Vietnam have successfully applied this education model. For instance, the FUNiX University of FPT is the first online university in Vietnam with no classroom and real lecturers. They have just 500 mentors - leading technology experts who support students in the learning process. This process is done online, where teachers and students communicate without going to class. FUNiX can build a training program to quickly update this knowledge for students. Another channel to access lessons is through mobile applications, which are often developed separately for each subject. These applications are developed by experts or organizations, software companies by digitizing academic materials, turning them into applications and distributing through application stores. EniseiStudio is one of the mobile software development groups that creates mobile applications for students in the economic sector. It has also been successfully applied in some universities in Vietnam. The advantage of these applications is that they operate like a small social network that helps connect those who are studying the same subject to discuss each lesson as well as provide them additional tools such as flashcard sets, multiple choice questions, or search for introductory courses which are related to the subjects on Coursera. The applications from EniseiStudio also link the subject with relevant information on social networks, helping learners to update the latest content.

c. Cultivating Innovative Talent

There is a lack of innovative talent in most developing or under-developed countries, especially at the high end. To entirely take advantage of the possibility of another wave of industrialization, the higher education system of a country should not only concentrate on educating knowledge-based skilled persons but also have a good look at fostering innovative talent, especially highly qualified experts and technologists. These experts must be taught in an interdisciplinary background where technologists should understand both the humanities, science and vice versa.

Service in the Fourth Industrial Revolution (Service 4.0)

a. Education-as-a-Service (EaaS)

Typically, in the age of the 4^{th} industrial revolution, technology change at an extremely rapid pace will transform the blueprint of many fields. Regarding higher education, the massive increase in Internet broadband connectivity, affordable mobile devices, and rich content of education will start a trend of transforming how training is achieved. There will be many techniques such as cloud computing that might eventually disrupt existing higher education systems by creating a new method

of educating people. With the assistance of cloud computing in education, many fundamental strategic questions such as establishing the most efficient and affordable form of education; developing the necessary skills for 21st-century students to adapt to the new job market most appropriately, will be resolved rapidly by government decision-makers and business practitioners. When universities think of adopting EaaS, they often imagine advertising campaigns, big budgets for promotion, and a massive amount of investment in infrastructure. However, the root of EaaS is the belief that the needs of students should be met adequately. Consequently, when a higher education organization sets out to attract a potential student as a customer, it needs to offer more activities for all-round education to prove that it can satisfy all the needs of the customer, though, it is not a simple process. EaaS is not a concept of pseudo differentiation via a switch in a logo, location, or making empty promises with vague words. Moreover, higher education institutions have to play the role of stakeholders like governments, accrediting agencies, academics, management, support staff, and students. Introducing EaaS with changes into an active education scheme as mentioned above will achieve these broader aims.

b. Internationally-linked programmes

In the rapidly developing context of the 4th industrial revolution, the Vietnamese education system needs to make more institutional links, both domestically and internationally, to offer more professional qualifications and varied degree programmes. Among these plans, the following types are worth considering: First, cooperation between a local education provider with a foreign education institution to generate a connected system enabling course credits that can be earned at a variety of locations, a so-called a twining programme. When this programme finishes, the international education provider will award a qualification. Second, franchising this programme so that the foreign education organization can authorize a local education provider to deliver their courses/applications, and the international education provider awards the qualification. Third, a double or joint degree is an arrangement where local and foreign education providers cooperate to offer a programme for a diploma that is awarded jointly or from each of them. Fourth, blended learning where domestic and international education providers deliver programmes to enroll students in all mixed forms such as e-learning and on-site learning.

Discussion

Industrial Revolution 4.0 will bring great opportunities and challenges for the Vietnamese higher education system. To adapt to this revolution, the managers of the education system in Vietnam must first identify the core training areas, future-oriented training areas to meet the needs of the times and higher standards of enterprises. Specific areas on which to focus training include information technology, network management, data mining, security, materials, biomedical, robotics, etc.

What is more, training institutions need to design more flexible programs, more up-to-date knowledge for students and focus on developing skills relevant to the 4th industrial revolution - systematic and interdisciplinary thinking. The essential skills for human resources in a technology interactive environment should include teamwork skills, creative skills, critical thinking, thinking systems, decision-making skills in uncertain conditions, etc.

Besides that, the ways of organizing lessons in universities have to change by sing more tools such as online training, designing virtual environments for learners and teachers to interact, as well as conduct research or experiments.

Teachers must constantly update their knowledge by regularly participating in training classes, seminars, and conferences. Furthermore, universities must establish concrete cooperation with businesses in research, training and consultancy activities. This will bring an excellent opportunity for teachers to access real manufacturing and business conditions to make suitable adjustments in teaching.

Conclusions

The 4th Industrial Revolution will bring tremendous changes to people's lives and the socioeconomic conditions, and this is not only a challenge but also a great opportunity for the Vietnamese higher education sector in training human resources according to the new demands of the time.

References

1. Brettel et al. (2014), *How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective*. "International Journal of Mechanical, Industrial Science, and Engineering", Vol. 8.
2. Huynh Van Thai (2017), *The 4.0 Industrial Revolution Affecting Higher Education Organizations' Operation in Vietnam*, "International Journal of Management Technology", Vol. 4.
3. Kagermann et al. (2013), *Recommendations for Implementing the Strategic Initiative Industry 4.0: Securing the Future of the German Manufacturing Industry; Final Report of the Industry 4.0 Working Group,* Forschungsunion, acatech – National Academy of Science and Engineering.
4. Koch et al. (2014), *Industry 4.0: Opportunities and Challenges of the Industrial Internet*, Strategy & PwC.
5. Le H.T.K. (2014), *Vietnamese Higher Education in the Globalization Context: A Question of Qualitative or Quantitative Targets*, "International Education Journal: Comparative Perspectives", Vol. 13.
6. Lee J., Bagheri B. (2015), *Cyber-Physical Systems in Future Maintenance*, [in:] *9th WCEAM Research Papers: Volume 1 Proceedings of 2014 World Congress on Engineering Asset Management*, Springer, Lecture Notes in Mechanical Engineering book series (LNME). DOI: 10.1007/978-3-319-15536-4_25.
7. Macdougall W. (2014), *Industrie 4.0: Smart Manufacturing for the Future*, Germany Trade & Invest, Berlin.
8. Marwala T. (2010), *Finite Element Model Updating Using Computational Intelligence Techniques: Applications to Structural Dynamics*, Springer Science & Business Media, London. DOI: 10.1007/978-1-84996-323-7.

9. Marwala T. (2012), *Condition Monitoring Using Computational Intelligence Methods: Applications in Mechanical and Electrical Systems*, Springer Science & Business Media, London. DOI: 10.1007/978-1-4471-2380-4.
10. Marwala T., Boulkaibet I., Adhikari S. (2016), *Probabilistic Finite Element Model Updating Using Bayesian Statistics: Applications to Aeronautical and Mechanical Engineering*, John Wiley & Sons, Chichester.
11. Schlaepfer R.C. et al. (2015), *Industry 4.0 Challenges and Solutions for the Digital Transformation and Use of Exponential Technologies*, Deloitte, Zurich, http://www2.deloitte.com/content/dam/Deloitte/ch/Documents/manufacturing/ch-en-manufacturing-industry-4-0-24102014. pdf (accessed: 20.12.2015).
12. Vallely T.J., Wilkinson B. (2008), *Vietnamese Higher Education: Crisis and Response (Vol. Memorandum, Higher Education Task Force)*, Harvard Kennedy School. Ash Institute for Democratic Governance and Innovation, Cambridge.
13. Wang et al. (2016), *Implementing Smart Factory of Industry 4.0: An Outlook*, "International Journal of Distributed Sensor Networks", Vol. 12. DOI: 10.1155/2016/3159805.
14. Welch A.R. (2012), *Contributing to the Southeast Asian Knowledge Economy? Australian Offshore Campuses in Malaysia and Vietnam*, [in:] Nelson A.R., Wei I.P. (eds.), *The Global University*. *Historical Studies in Education*, Palgrave Macmillan, New York. DOI: 10.1057/9780230392465_3.
15. World Bank (2008), *Vietnam: Higher Education and Skills for Growth. Washington DC: Human Development Department, East Asia, and Pacific Region*, The World Bank.
16. Xing B. (2015), *Massive Online Open Course Assisted Mechatronics Learning A Hybrid Approach*, Furthering Higher Education Possibilities through Massive Open Online Courses. DOI: 10.4018/978-1-4666-8279-5.ch012.
17. Xing B. (2017), *Visible Light Based Throughput Downlink Connectivity for the Cognitive Radio Networks*, [in:] Matin M. (eds.), *Spectrum Access and Management for Cognitive Radio Networks. Signals and Communication Technology*, Springer, Singapore. DOI: 10.1007/978-981-10-2254-8.
18. Xing B., Gao W.-J. (2016), *Innovative Computational Intelligence: A Rough Guide to 134 Clever Algorithms*, Springer International Publishing, Switzerland. DOI: 10.1007/978-3-319-03404-1.

PRZEJŚCIE WIETNAMSKIEGO SYSTEMU EDUKACJI WYŻSZEJ DO CZWARTEJ REWOLUCJI PRZEMYSŁOWEJ

Streszczenie: Szkolnictwo wyższe odgrywa ważną rolę w każdym kraju i jest szeroko definiowane jako jeden z głównych czynników wzrostu, dobrobytu i konkurencyjności. Po zastosowaniu polityki „Doi Moi" (renowacja ekonomiczna) od 1986 r. wiele sektorów gospodarki i edukacji wywarło natychmiastowy i znaczący wpływ na Wietnam. Obecnie instytucje szkolnictwa wyższego w Wietnamie stoją przed wyzwaniami związanymi z realizacją celów zrównoważonego rozwoju, aby sprostać wymogom industrializacji i modernizacji kraju oraz integracji międzynarodowej. Niniejszy artykuł ma na celu zbadanie wyzwań stawianych wietnamskim systemom szkolnictwa wyższego w świetle czwartej rewolucji przemysłowej i na tej podstawie determinuje właściwe przejście tego systemu w celu dostosowania się do wciąż rosnących wymagań rynku pracy. W publikacji stwierdzono, że wietnamski sektor szkolnictwa wyższego musi przyjąć odpowiednią zmianę w nauczaniu i zastosować nowe podejście do usług edukacyjnych, aby skutecznie dostosować się do czwartej rewolucji przemysłowej.

Słowa kluczowe: szkolnictwo wyższe, czwarta rewolucja przemysłowa, Wietnam