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Research Article

THE IMPACTS OF THE INDUSTRIAL REVOLUTION 4.0 ON THE ISSUE OF EMPLOYMENT AND REQUIREMENTS FOR UNIVERSITIES ON THE TRAINING OF VIETNAMESE HUMAN RESOURCES

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ABSTRACT

The industrial revolution 4.0 with new technologies has changed the production platform and the nature of many industries. In addition to the emergence of new occupations, the world has also witnessed the loss of certain specific, repetitive jobs and increasingly demanding types of quality human resources. Therefore, the research about the impact of the fourth industrial revolution on jobs and the necessity for training high quality human resources in universities is a meaningful and necessary. The paper first analyzes the positive and negative impacts of the industrial revolution 4.0 on the jobs, followed by some recommendations for universities in identifying key training areas, future-oriented training fields, especially the training programs associated with the technology 4.0, and strengthening cooperation between universities and enterprises in training human resources, at the same time, developing soft skills for students to meet the human resources for the digital era.

Keywords: employment; industrial revolution 4.0; training human resources

1. The impacts of the Industrial Revolution 4.0 on employment

Each revolution tends to lead to strong changes of structure of human resources and jobs. Similar to three previous revolutions, the fourth revolution has high potentials to bring back more benefits for labors such as more work efficiency and then high income as a return. In addition, many new products and services created will help to increase the quality of our life. It is special that the opening of the laboring markets creates new jobs, and at the same time new technology will eliminate some jobs and replace them by new jobs As a result, some are unemployed.

1.1. Positive impacts

At first, the 4.0 revolution makes significant changes in ways of producing and managing methods. Previous production facilities, production lines and administrative

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management methods will be replaced by in-line "smart factories," "smart offices and cities," linked together into a system. This is happening because of their ability of connecting with computers, mobile devices, large databases from multiple sources. The information processing features are multiplied by technological breakthroughs by artificial intelligence, robotics, 3D printing technology, nanotechnology, cloud computing technology, biotechnology, new material technology...

In a production environment, mobile software applications allow managers to access a variety of data about the production lines, such as performances of devices, line performance, data visualization tools, and alerts at any time and at anywhere. This allows establishment and production managers to work outside the control room with a broader view of ongoing activities of production; thereby reducing some statistical staff and other office staff, less storing papers and books. In addition, "smart production can contribute to reducing defected products, identifying device malfunctions and malfunctions faster. Monitoring of the operating time of equipment and production lines can help detect any slightest change in production levels, equipment performance, and product quality" (Nguyen, 2018). Thus, it is possible to hire fewer warranty staffs and technical inspectors.

Second, the industrial revolution 4.0 will open a new era for various business investment options, optimize the use of resources, boost productivity, and save labor. Technology 4.0 has a strong impact on the personnel structure in factories. FPT-software chairman Hoang Nam Tien said that, "A sewing robot is currently priced at about US $ 200.000 (in 2017). But in less than 3 years it will be reduced to 20.000-30.000 USD. No cheap workers can compete with machines because they work 24/7 and they do not need days off, 365 days, do not need other types of costs. Machines make faster, better quality and importantly, is cheaper". In Vietnam, the appearance of the Grab and Uber technology taxi is the most obvious manifestation of the adoption of 4.0 technology. Thay are competing strongly with traditional taxis. In addition, IoT can also help promote the use of sensors to combine different devices, automatically put data into applications to manage factories and businesses. Job placement in factories and businesses is a more economical way.

Third, the leaps of automation technology will significantly reduce transaction costs when automation robots and virtual assistants become popular. Business customer queries will be answered by consulting robots. In the financial market, computers can quickly read tens of thousands of e-mails... More employers are using the "human cloud" to get things done. As Klaus Schwab (2016) argued:

> Professional activities are dissected into precise assignments and discrete projects and then thrown into a virtual cloud of aspiring workers located anywhere in the world. This is the new on-demand economy, where providers of labor are no longer employees in the traditional sense but rather independent workers who perform specific tasks (p. 86).

As Arun Sundararajan, a professor at the Stern School of Business at New York University (NYU), puts it in a New York Times column by journalist Farhad Manjoo: "We may end up with a future in which a fraction of the workforce will do a portfolio of things to generate an income – you could be an Uber driver, an Instacart shopper, an Airbnb host and a Taskrabbit" (Klaus Schwab, 2018, p. 86 as cited in Farhad Manjoo).

"Human cloud" technology will bring many advantages for companies in the digital economy because they will save significant costs related to minimum wage, labor use tax, welfare and society. This technology also gives freedom to a part of workers by superior mobility when participating in a virtual global network. They are free to choose jobs, even companies that they work for, because the human resource platform does not force workers to declare and disclose personal information.

In Vietnam, the ways of training and recruitment of employees has also changed completely. Start-ups, websites introducing and consulting jobs have become more and more popular. This has helped millions of job seekers, the concept of a freelancer is becoming more and more popular. "In 2016, according to the statistics of a website for freelancers (Lance.vn), there are nearly 170,000 people working in this form, in the fields of information technology, graphic design, translation..." (Nguyen, 2018). This data were presented at the second APEC Senior Officials Meeting, SOM-2, held in Hanoi, May 15 2017 about the high-level policy dialogue on human resource development in a digital age.

1.2. Negative impacts

Although the technology has brought about some positive impacts mentioned above, it can also be seen that the industrial revolution 4.0 also has many negative impacts on the labor market and employment.

First, new technology will drastically change the nature of work in all industries when computers are replacing some jobs. The fact that previous revolutions have also proved, new technologies will always eliminate some jobs, replace them with new jobs. The app economy provides an example of a new job ecosystem.

At the beginning of 2008, Steve Jobs, the founder of Apple, allowed outside developers to create applications for the iPhone. As a result, by mid-2015, the global app economy was expected to generate over $100 billion in revenues, surpassing the film industry, which has been in existence for over a century.

Second, the industrial revolution 4.0 will create major changes in labor supply and demand worldwide and the risk of unemployment. The economy with a high degree of automation and creativity requires workers to adapt quickly to the change of production or they will be redundant and unemployed. "In some areas, with the emergence of robots, artificial intelligence is forecasted that the number of employees will only need 1/10 of the current level" (Le, 2018). Thus, the industrial revolution 4.0 can create a risk of disrupting the labor market in the context of a large labor force. The advantage of cheap labor will be

lost. The risk of lagging further is more evident... Many types of jobs, especially those with repetitive mechanical characteristics and requiring precise and automated manual labor continue to increase. Most careers such as lawyers, financial analysts, doctors, accountants, insurance brokers or librarians may be partially or fully automated. According to the United Nations forecast that about 75% of workers in the world may lose their jobs in the next few decades. Another study by the International Labor Organization (ILO) shows that about 56% of workers in five Southeast Asian countries are at risk of losing their jobs because of robots (Central Institute for Economic Management Information - Document Center, 2018).

In particular, Vietnam is one of the countries most affected by the industrial revolution 4.0. According to research by Carl Benedikt Frey (economist) and Michael Osborne (self-study machine expert) from Oxford Martin School on the impact of technological innovation on unemployment, Table 1 illustrates some professions most prone to automation by ranking 702 different careers, in order of automation, the least risk word ("0" corresponds to no risk of automation) to the highest risk ("1" corresponds to a certain risk) replaced by a computer in some form (as cited in Klaus Schwab, 2018, p. 72) (See Table 1).

Table 1. *Examples of professions most prone to automation*

Probability	Occupation
0.99	Telemarketers
0.99	Tax preparers
0.98	Insurance Appraisers, Auto Damage
0.98	Umprisex, Referees, and Other Sports Officials
0.98	Legal secretaries
0.97	Hosts and Hostesses, Restaurant, Lounge, and Coffee shop
0.97	Real Estate Brokers
0.97	Farm Labour Contractors
0.96	Secretaries and Administrative Assistants, Except Legal, Medical & Executive
0.94	Couriers anh Messengers

Source: Benedikt and Osborne (2013) as cited in Klaus Schwab, 2018, p.72

According to the study of the Organization for Economic Co-operation and Development (OECD), in the future, 9% of current jobs are at risk of being completely replaced by automation; about 47% of current jobs in the US may disappear because of automation; 30% of jobs will undergo retooling, including new skills. When the era of robotization and automation is widely applied, millions of people will be unemployed. For example, with the textile industry, operations such as cutting and sewing machines can be replaced by automatic machines. With electronic assembly industries, consulting, and customer care, robots or automatic answering systems can be used in order to increase work efficiency.

Third, when automation replaces manual labors in the economy and when robots replace people in many areas, jobs that are less likely to be automated will require social skills and creativity. In the era of industrial revolution 4.0, there is a stronger polarization of the labor market, employment will increase for intellectual and creative jobs with high salary. It is noted that some professions are unlikely to be most automated such as Mental Health and Substance Abuse Social Workers, Choreographers, Physicians and Surgeons… (See Table 2).

Table 2. *Examples of professions least prone to automation*

Probability	Occupation
0.0031	Mental Health and Substance Abuse Social Workers
0.0040	Choreographers
0.0042	Physicians and Surgeons
00.0043	Psychologist
0.0055	Human Resources Managers
0.0065	Computer Systems Analyst
0.0077	Anthropologists and Archeologists
0.010	Marine Engineers and Naval Architects
0.0130	Sales Managers
0.0150	Chief Executives

Source: Benedikt and Osborne (2013) as cited in Klaus Schwab, 2018, p.73

The Future of Jobs Report about the impact on employment, jobs, and skills up to 2020 in 10 industries and 15 economies shows that complex problem solving, social and systems skills will be far more in demand in 2020 (17%, 18%. 19% and 36%) when compared to physical abilities and content skills (4% and 10%) (Klaus Schwab, 2018, p.77). This is a significant challenge in the context where Vietnam's labor is in a state of low professional and technical qualifications, low labor productivity, weak skills and other soft skills...

> There are about 9% of businesses facing difficulties in recruiting skilled workers and 67% of these businesses believe that the main reason is the lack of workers having enough skills as required. More than 70% of small and medium-sized enterprises and enterprises in rural areas said that the main reason of difficulties in recruitment is the lack of skilled workers (Le, 2018).

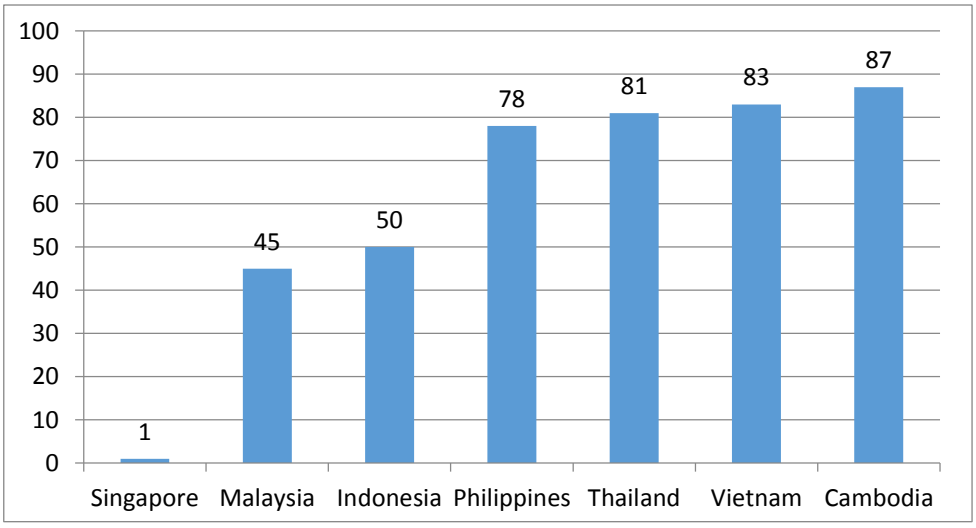
In the industrial revolution 4.0, cheap labor is no longer a competitive advantage of countries worldwide. A series of old jobs will be lost, the international labor market will be strongly polarized between low-skilled and high-skilled workers. The advent of artificial intelligence (smart robot) also reduces the need to use low-skilled labors. In particular, the industrial revolution 4.0 not only threatens the employment of low-skilled workers but even middle-skilled workers will be affected if they are not equipped with new skills - creative skills. Therefore, with the rapid technological development in the future, the demand for highly qualified and skilled workers is an indispensable requirement.

Fourth, the 4th industrial revolution has a strong impact on gender gaps, especially the role of women in the economy, politics, and society in the digital, material, technological, and biological era. Men often dominate in high demanding professions such as computer science, mathematics, engineering, manufacturing, construction, and installation. In contrast, women dominate in jobs such as operator, administrative, and retail staffs. These jobs have a higher risk of unemployment.

However, the World Futures Report of the World Economic Forum (WEF) also evaluated a positive sign for female-specific professions that machines cannot do but would be even more necessary in the era of the 4th industrial revolution. These are jobs requiring human abilities and natural qualities such as emotional and psychological ones that often belong to women. They are psychologists, therapists, coaches, nursing, and other health care professions. Therefore, it is necessary to grasp and take advantage of the transition economy to redesign labor policies and business practices to ensure that both men and women are empowered to the fullest extent.

Fifth, the industrial revolution 4.0 poses a high demand for quality of human resources due to the large shortage of human resources in the digital market. "It is forecasted that by 2020, the European region may lack about 825,000 digital experts" (Thi Huong Lan Ha, 2019). This is also a big challenge for developing countries, including Vietnam. According to the WEF's Future Production Readiness Report 2018, Vietnam is ranked among the last in the 81/100 high-skilled labor rankings (see chart 1), even ranked behind Thailand and the Philippines in the group of ASEAN countries.

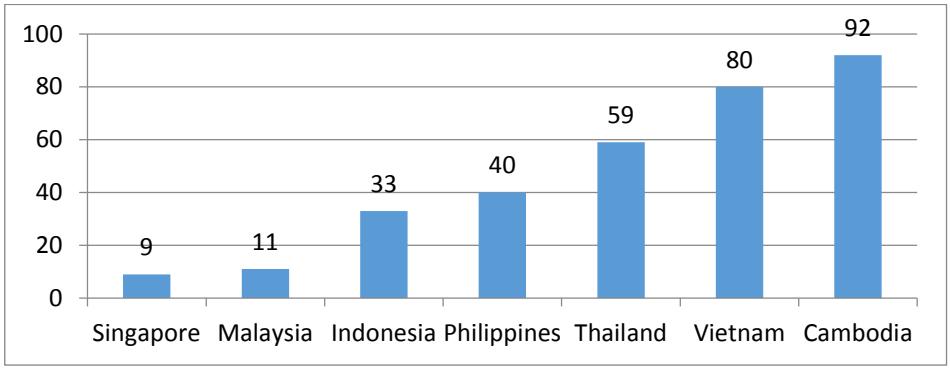
Chart 1. *Ranking of high skilled labor index of Vietnam and ASEAN countries*



Source: WEF Readiness for Future of Production Report 2018 (Central Institute for Economic Management Information - Document Center, 2018)

Also in this report, Vietnam's ranking of vocational training quality is only 80 out of 100, compared to the group of ASEAN countries, only before Cambodia (92/100)

Chart 2. *Ranking of vocational training quality index of Vietnam and ASEAN countries*



Source: WEF Readiness for Future of Production Report 2018 (Central Institute for Economic Management Information - Document Center, 2018)

The data may suggest a great pressure for Vietnam to improve the qualifications of workers because the current workforce is still mainly low-skilled workers and the number of workers who have not received professional training are high. Art tends to decrease, but still accounts for the majority of the social labor force.

2. The requirements set for universities to train Vietnamese human resources to meet the industrial revolution 4.0

Vietnam and developing countries in the world are facing with great challenges of lack of labors with high quality and professional skills meeting the demand of human resources for the fourth industrial revolution. Therefore, universities in Vietnam need to be aware of the difficulties and challenges. They need to have appropriate strategies for the development of science and technology, change the training methods and investment facilities and materials to educate and train human resources with high-quality in the digital era.

First of all, it is necessary to renew training activities to adapt to the 4.0 industrial revolution. Universities need to identify key training areas, future-oriented training areas to meet the age needs and prepare training resources to meet industry requirements such as information technology, network management, data exploitation, security, materials, biomedical, and robots... In the field of information technology, some new skills and knowledge need to be considered in training programs such as Mechatronics and Information technology, in which special attention is paid to the field of data science, security, information security and the specialized training of ICT, blockchain, and artificial intelligence (AI).

Training programs need to be designed to be more flexible, more up-to-date as regards knowledge so that they can focus on developing skills in line with the 4.0 industrial revolution, especially systematic and interdisciplinary thinking. In addition to the knowledge of careers, it is necessary to expand the supply of social and natural knowledge blocks, information technology, network management... in order to make learners quickly

adapt to change of technology and working effectively in a highly connected environment, between fields, between virtual and real worlds.

First designing short-term training courses or programs that can supplement knowledge to different subjects at businesses to meet social needs when there is a shift in profession structure and technology change. Universities need to be more open and join dialogue with society and the labor market to offer practical and effective programs, but still do not lose their unique academic nature and educational missions.

On the other hand, training to meet the requirements of industrial revolution 4.0 requires teaching staff to have a high level of expertise, information technology and network. At the same time, they actively participate in research to improve qualifications and link research with technical transfer activities, especially simulation studies, interactive research...

Second, developing adaptive skills for the 4.0 revolution. Currently, Vietnam's labor force still lack soft skills, foreign language skills, teamwork ability, information technology skills, and creativity. Many workers, even after training, have not met the requirements of employers. They, therefore, have to retrain graduates. It is necessary for universities to equip students with soft skills and making them explicit, in particular in student learning outcomes, especially creative skills and thinking, adaptability when work changes constantly.

The objectives of training are to teach learners to create new things, to reach a level that they can build robots and become global citizens with innovative and creative thinking capabilities, enough quality to acquire advanced techniques in this era of digital revolution.

Thirdly, it is necessary to create links and cooperation between universities and enterprises in training human resources. In the digital age 4.0, it will be very effective when students are learning and working in a real environment. Therefore, it is necessary to focus on connecting the training activities with the activities of enterprises. Boosting university-bussiness cooperation (UBC) is necessary. Companies have a strategy to nurture human resources right from the second and third year and have flexible plans for students to work together and promote the formation of training institutions in enterprises to share general resources, from which both universities and businesses actively take the initiatives and catch up the needs of the labor market.

Not only domestic cooperation, higher education institutions need to strengthen links with international enterprises and universities to build laboratories in the form of public-private partnerships. Laboratories are not only for students to practice but also as an intensive research center according to their orders to create high-quality products and services. The content of cooperation consists of research and development in the form of contracts, commercializing research results, and coordinating the implementation of training programs. At the same time, research cooperation will provide universities with

considerable funding to increase scientific and technological potentials and improve training quality.

Experience of some countries in the world shows that in order to make this connection successful, there is a need for close attention and coordination of the goverment, enterprises, and universities. The government should have a policy mechanism to create conditions, environment and a legal framework for the relationship between universities and enterprises, between research and technology transfer with production and business. Autonomy should be given to the fields of applied science for universities, research institutes together with the protection of intellectual property rights and creating an equal competitive environment in research activities. For enterprises, it is necessary to proactively define their training needs, research, selection of topics, cost estimates, and selection of competent personnel to participate. Universities need to focus on building a contingent of teachers and researchers, attracting domestic and foreign experts to cooperate with the university. At the same time, there should be specific plans for students to connect with businesses, where they can work in the future so that they can see what competencies are required at work places and what to be learnt.

Fourth, developing science and technology, investing in facilities and improving the quality of technology incubators. Investing in facilities, research, practice, modern libraries of automation, digital, information technology... at universities to have a centralized work environment is one of the prerequisites for the creation of a young, high-skilled human resource to meet the demand of industrial revolution 4.0. At the same time, using technology and modern teaching tools and facilities such as online training, virtual environment design so that learners and teachers can interact, communicate with each other and practice at virtual labs or simulations, using computer systems and big data to design the program...

On the other hand, the government should have policies to support the formation and development of innovative start-ups in universities about technology, create ecosystems for innovative start-up businesses. Promoting international cooperations in research and development and technology transfer is at the heart of economic policies in many countries and territories around the world. For example, in Taiwan, in the early 1960s, between businesses and institutes, universities cooperated with bussinesses to implement joint projects and create start-up businesses (business incubators), and business community (Hong Son Nguyen, 2015). A dynamic, aspirational small and medium enterprise to get rich thanks to its close association with its team of scientists. Or as in Israel, the government is very active in providing policies to support innovative enterprises. According to statistics, every USD invested in research and development will contribute to the economy of 6 USD worth of industrial products. Since the beginning of the 1990s Israel has been booming, reaching 2009 GDP values higher than expected progressions

according to the previous growth trend to 25 billion USD, equivalent to 10% of GDP. In fact, some universities in our country have also participated in consulting and training personnel for many large corporations and companies such as Vinapco, Samsung, PVPower, VTC...

3. Conclusion

Although the 4th industrial revolution and the thinking of alternative labor automation will have strong impacts on the labor market and work space around the world, it does not mean that we will have to stop in front of confrontation between people and machines. In fact, in most cases, the combination of digital, physical and biological technologies that are driving current changes will help improve the quality of human resources. Therefore, universities need to innovate strongly contents, training models, and teaching methods to create labor forces who are willing to work with increasingly intelligent, capable, and connected machines.

❖ ***Conflict of Interest:*** *Author have no conflict of interest to declare.*

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TÁC ĐỘNG CỦA CÁCH MẠNG CÔNG NGHIỆP 4.0 ĐẾN VẤN ĐỀ VIỆC LÀM VÀ NHỮNG YÊU CẦU ĐẶT RA ĐỐI VỚI CÁC TRƯỜNG ĐẠI HỌC VỀ VIỆC ĐÀO TẠO NGUỒN NHÂN LỰC VIỆT NAM

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TÓM TẮT

Cách mạng công nghiệp 4.0 với những công nghệ mới đã làm thay đổi nền tảng sản xuất, tính chất công việc của nhiều ngành nghề. Bên cạnh việc xuất hiện những ngành nghề mới, thế giới cũng chứng kiến sự mất đi của một số loại hình công việc có tính chất đặc thù, lặp đi lặp lại và những yêu cầu ngày càng cao về nguồn nhân lực chất lượng. Do đó, nghiên cứu về tác động của cách mạng công nghiệp 4.0 đến vấn đề việc làm và sự cần thiết về việc đào tạo nguồn nhân lực chất lượng cao đối với các trường đại học hiện nay là vấn đề có ý nghĩa lí luận và thực tiễn sâu sắc. Bài viết trên cơ sở phân tích những tác động tích cực và tiêu cực của cuộc cách mạng công nghiệp 4.0 đến vấn đề việc làm, từ đó đưa ra một số khuyến nghị cho các trường đại học trong việc xác định các lĩnh vực đào tạo trọng tâm, các lĩnh vực đào tạo hướng về tương lai, nhất là những chương trình đào tạo gắn với công nghệ 4.0, đẩy mạnh tăng cường hợp tác giữa nhà trường và doanh nghiệp trong đào tạo nguồn nhân lực, đồng thời phát triển các kĩ năng mềm cho sinh viên nhằm đáp ứng nguồn nhân lực cho thời kì kĩ thuật số.

Từ khóa: việc làm; cách mạng công nghiệp 4.0; đào tạo nguồn nhân lực