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The 4thindustrial revolution and Korean university's role change

Sang-Kyu Park
Department of Business Administration, Gwangju University

4차산업혁명과 한국대학의 역할 변화

박상규
광주대학교 경영학과

Abstract The interest about 4th Industrial Revolution was impressively increased from newspapers, iindustry, government and academic sectors. Especially AI what could be felt by the skin of many peoples, already overpassed the ability of the human's even in creative areas. Namely, now many people start fo feel that the effect of the revolution is just infront of themselves. There were several issues in this trend, the ability of deep learning by machine, the identity of the human, the change of job environment and the concern about the social change etc. Recently many studies have been made about the 4th industrial revolution in many fields like as AI(artificial intelligence), CRISPR, big data and driverless car etc. As many positive effects and pessimistic effects are existed at the same time and many preventing actions are being suggested recently, these opinions will be compared and analyzed and better solutions will be found eventually. Several educational, political, scientific, social and ethical effects and solutions were studied and suggested in this study. Clear implication from the study is that the world we will live from now on is changing faster than ever in the social, industrial, political and educational environment. If it will reform the social systems according to those changes, a society (nation or government) will grasp the chance of its development or take-off, otherwise, it will consume the resources ineffectively and lose the competition as a whole society. But the method of that reform is not that apparent in many aspects as the revolution is progressing currently and its definition should be made whether in industrial or scientific aspect. The person or nation who will define it will have the advantage of leading the future of that business or society.

Key Words : Breaking the barrier, Common property of the society, Reward the failure, Common sharing, Curriculum of creativeness, Robot tax, Basic income, Culture of admitting

요 약 최근 각 언론, 기업계, 정부 유관기관 및 학계 등 많은 분야에서 4차 산업에 대한 관심이 폭발적으로 증가하였다, 특히 우리가 피부로 느낄 수 있는 분야인 인공지능이 인간능력을 이미 크게 앞서고 있다는 것을 깨닫고 나서 많은 사람들은 4차산업혁명이 실제로 우리 코 앞에 와있다는 것을 실감할 수 있었다. 이렇게 대부분 사람들의 생각보다 빠르게 다가온 4차산업을 어떻게 효율적으로 대응해야 할까? 특히 최근의 인공지능, 빅데이터, 무인자동차 및 유전자가위 등에 대한 상반된 견해들을 비교분석하는 방식으로 연구를 진행해 본다. 이러한 분석과 연구를 통하여 교육적, 정치적, 사회적, 윤리적 그리고 과학적 영향들을 파악해 본 결과, 현재까지 뚜렷하게 정립되어 있는 개념이나 체계, 시스템이 존재하지 않는다는 것을 이해할 수 있었고 오히려 4차산업혁명의 개념, 체계를 앞서서 정의하고 정립하는 국가나 기업, 개인들이 산업의 주도권을 확보할 수 있다는 것을 알게 되었다. 그러나 한국사회와 대학은 오히려 현재 2차산업혁명의 체계와 문화에서 머물러있는 듯한 모습을 보이고 있는데, 이러한 현실인식 위에서 새로운 산업혁명의 트렌드를 맞추어 따라갈 수 있는 방안들을 찾아보고자 한다.

주제어 : 장벽타파, 사회의 공동자산, 실패에 대한 보상, 공유, 창조커리큘럼, 로봇세, 기본소득, 인정의 문화

*This Study was conducted by research funds from Gwangju University in 2017.
*Corresponding Author : Sang-Kyu Park(skpark41@gwangju.ac.kr)
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1. Uncertainty and Failure

"My team would be rewarded instead of being punished when they failed[1]." That comment was made by Mr. Astro Teller (CEO of Google X)(2017) who surprised the world by developing the innovative products like 'self-driving car', 'Google glass'. As many successful business leaders are stressing about Korean industrial environment, 'failure' is not easily allowed under Korean business culture. Several reasons could be analyzed for that non-generous environment for young challengers. The business environment that the number of small company is comparatively rare could make the startups to get a small chance of another challenge. For last fifty years, Korean economy has been successful by supporting several big giants companies and made them lead the whole industries. Even the global economy also adopted the neoliberalism which overlooked global companies to expand their business territory.

But a few corporates put their eyes onto the future change where the new industrial revolution is coming and business leaders also will be changed. They seemed to understand that the spirit of innovation will overpass the other business factors like capital investment, technology, productivity etc. And that spirit comes from the experience of failure instead of the pleasure of success. Those companies rewarded the failure rather than decreasing their salary with wisdom. As Dove Miran mentioned in his recent book(2017), "I feel regret that the sense of failure leads to the extreme situation[2]." Not only the business culture but also the role of the government and the universities are critical to evoke the environment of diminishing the fear for the non-success result. The government should support and implement various programs of startup and the universities also introduce the curriculum of encouraging the establishing new business. As most of the new innovative business (even new industry) were founded by young generation or students, not by old generation or established businessmen. The sense that failure is the common property of the society makes it healthier by breaking the barrier between the generations and it will adopt the new environment naturally.

2. Science, Safety, and Ethics

It is quite controvercial to find the new way between cautious attitude and innovative attitude when future technology could give us both the potential benefit and the potential risk. The dispute about the stem-cell which was exaggerated of its effect by expressing that it will save millions' lives and prevent the aging reminds us what attitude we have to take about CRISPR. Recent result of the research about cloning a human embryo made noisy response gave us the hope to cure the genetic heart mutation by using CRISPR. But in case of the real clinical treatment, we have many other options which have different risks and different success possibilities as Dr. Paul Knoepfler commented in his TED lecture(2015)[3]. While the public and the press is applauding the positive future of the laboratory research, the potential risks and uncovered questions could be buried under the snow. As the survey shows, most people are not agreeing with the applying CRISPR to human being directly while they are expecting much about the future of the technology. Many new technologies are giving us the great hope to solve much problems what we are facing like energy, life, food and equality. In order to avoid the social environment of impatient mind often leading to unexpected disaster, we have to settle the culture of general wide discussion inside the societies (universities, researchers, politicians and public). At the same time the universities have to introduce the academic environment of fundamental change of discussion and acknowledging the deep breaths.

3. AI, Robot and Employment

Technology progress of artificial intelligence and robot may lead to a disaster of massive unemployment and economic regression. Quite many leaders (like Steven Hocking, Bill Gates etc.) are insisting to prevent the development of the artificial intelligence which is smarter than human. According to the research report(2017) by Carl Frey and Michael Osborne (Oxford Univ.), "47% of current job will be substituted by computer within ten to twenty years[4]." Even WEF predicted that 7.1 million jobs will be disappeared in major advanced countries by the year 2020. Other technological advances like the driverless-car, deep-learning AI etc. are expanding those fears. But opposite predictions are not small as James Surowiecki(2004) insisted, "It will not happen that robot takes the job of human in widespread fields[5]." If the effect of robot is pervading in the real industry, American economy should be regressed in employment and advanced in productivity but such phenomenon did not happen. The industrial productivity was lowered to 1.2 percent after 2007 while the average increasing rate was 3 percent from year 1947 to 1973 and the rate was again dropped to 0.6 percent in recent two years. And present unemployment rate is under 5 percent which is ever lower level instead of massive firing. One example is the relationship between bank employee and ATM. Even though the machine was supplied more than 400 thousands after 1990 but bank employee were increased after year 2000 through 2010. Most banks increased the number of store because the cost of opening new one decreased as the average employee number per store reduced. Likaifu is insisting that singularity of cyborg will not occurred within 100 years as many predictions about super artificial intelligence are lack of scientific basis. Even the artificial intelligence will be developed to the level of surpassing human in some fields but it will show the ability in certain jobs which will be ordered by human because it cannot have synthetic ability and human mind. Eric Horvitz of Microsoft is maintaining that the relationship between artificial intelligence and human will be a cooperative supplementing the other rather than competitors to each other for next several decades. Whether artificial intelligence will be developed to become a super ability level or not in 10 or 20 years, it depends on our direction basically. We have enough time to decide the way of co-existing with the artificial intelligence. The role of human will focus on developing the emotional and social service while the artificial intelligence supports that job more effectively for realizing the love for humanity. Students should understand that direction correctively rather than having fear about the future. And they choose their job on a long range view instead of deciding it short perspective as the future became more difficult to predict than ever. They should be trained and equipped with the power of deciding the right direction under the uncertain future. That ability comes from the understanding the overall new industrial and technological change and liberal arts knowledge must be accumulated while they spend more time for social contribution and network for realizing the common sharing and love for others.

4. Government policy and Educational system

Technological innovation has a risk of describing a technology utopia which will guarantee our rose color future(Suh, Dongjin, 2017)[6]. Many specialists worry about building a policy of the government for 4th industrial revolution as it appears to hurry while its' real effects are not certain yet. It will take some more time to have concrete concept of that revolution, agreed by most people, it still has unclear political and social propaganda for the time being. Whether big data should be included in the 3rd industrial revolution or industry4.0, nobody can insists strongly yet. For last twenty years Korean economy has shown a prominent progress in information technology (3rd industrial revolution) but it must be reviewed that whether it was a balanced development between technology and culture or not. Unbalanced development frustrated quite

many scientists and engineers while limited political professors monopolized government funds. Even for the 4th industrial revolution resources, similar symptom could happen before the concept and direction will be clear. It will weaken the motivation for most scientists to develop their technology further. Under the flag of 4th industrial revolution, what we have to do now is starting with changing educational system for students to move to the creative curriculum instead of memory-driven curriculum and to move to income-driven economy instead of winner-take all system. At the same time government officers should have a insight of catching the deep trend of industry and economy. If government and civil society can cooperate to make a 'ethical committee for 4th industrial revolution', it will help whole society to decide the right direction for the future and it will also help whole economy will continue to keep the global leadership after information technology. Taking a proper step will introduce to strengthen the fundamental of science and also strengthen the economical competing capability. Next consideration should be the educational system for students to adapt to new industrial era as Siemens introduced new smart system for their factory. Smart factory is the convergence of manufacturing and information technology. Network and digitalization of manufacturing process increased the productivity 8 times but keeping employee number as before by changing their role in the process. Increased productivity made them to put more resources on product development, design, processing innovation and emergence countermeasure. Improving the system still is the role of human. The change of employee role requires the change of educational system. Startup experience will be more helpful to create idea than skill or other experiences.

5. System for synergy with Industries

Open-door policy and sharing are the key words for next change. Amazon looks stronger than Google as it has more friends than Google. Amazon artificial intelligence system is more used by other companies and it will have much more data than competitors as Cha, Doowon analyzed(2017)[7]. Most of Korean companies are developing new products adapting artificial intelligence but sharing and open-door policy is not a major trend yet. LG built a research center of artificial intelligence and robot advanced center in this year, which enlarged and divided the previous intelligence laboratory. Two centers build the artificial intelligence platform for smart home appliances, television, automobile components and mobile devices. That platform will recognize, sensing and reason various voice and video from customer information, weather forecast etc. Lotte made alliance with IBM for introducing Watson solution system which is cloud based recognizing technology for utilizing big data and artificial intelligence. The new system will be applied to 'smart shopping advisor' and 'smart decision making supporting platform'. New platform will help to establish the strategies for new product development. Smart shopping advisor is the chatbot-based application which help customers for various shopping activities by chatting instead of searching information. POSCO is developing a smart factory which collecting data from every production process and the technology of internet of things, big data and artificial intelligence. Those technologies are converged and realize the optimum condition process which will lead to better quality, cost performance and productivity. Hyundai motor opened a smart safety technology center for developing driverless car utilizing artificial intelligence. Building a research laboratory is not enough for developing next generation products. The experience and accumulation of data is required by data analyzing technology, platform technology, formal and informal data. Each corporation has its own way to adapt to the future technology competition but considering the strong relationship between artificial intelligence and big data, different approach should be pursued.

University needs to take a responsibility connecting one company to another or others. Data hub will be a new concept connecting different industries, different business and universities have to develop the technology of connecting others and analyzing those mixed data.

6. Creating Ability and Inference

Next industrial revolution is the mixture of manufacturing and information technology. Everything will be connected through internet and the data of human and things will be collected, accumulated and utilized. For fostering students who can survive in the new wave and can contribute to the society, development of thinking power is necessary by converging creative education. STEAM education is well adopted by educational institution under the new industrial environment. Science, technology, engineering, art and mathematic are composing it and these five contents should be converged and used for solving problems which will be happened in real business and industrial situation. Inference is the core ability to converge those five components. It is the procedure to introduce the result from given information and the capability of inference comes from thinking capacity. Simple curiosity or imagination is not enough for converging various aspect of the changing trend. Thinking procedure of comparing massive and controversial information and securing the justification of usefulness from huge information is requested. Inference is the prerequisite for creativeness in knowledge information society. Education authority should develop the curriculum and teaching material for introducing the education inside the university. Inference mathematics will help students to improve his thinking capacity and the sense of pleasure from self-researching and consideration. Average Korean student is included in mid-low level in his interest of mathematics within OECD countries. Inferring procedure of solving the problem will strengthen the ability of thinking in mathematics and science. Logical inference education is for selecting right information from various information and materials. Time-space inference education is for handling and inducing a better solution from huge information about time and space. At the same time the evaluation tool and system of inference ability must be developed and introduced. And education and training for teachers are critical in this system. In 4th industrial revolution, education reform should move from memory-driven education to inference-driven education. The responsibility of teacher is helping students to find collect information and create and produce some output from it by student himself.

7. Social Effect and Solution

Robocalypse is the mixed word of robot and apocalypse, meaning that wide introducing of robot will be ended by massive unemployment. There is steaming dispute about this issue in advanced countries. Recent study found that "Since these superstar firms have higher profit levels, they also tend to have a lower share of labor in sales and value-added."(David Autor, David Dorn & Lawrence F.Katz, 2017)[8]. This study shows that technological innovation made productive increase and the employment of each industry decreased but it also increased general income and buying capacity and overall employment was not changed by using the data of each industry of advanced countries after '70s. Even though the effect was diminished after year 2000 but the level is not worth of fear. Acemoglu and Robinson(2012)'s study shows opposite result about American labor market that industrial robot affect the wage and employment of labors negatively[9]. But the degree was smaller than the import from China far beyond compare level and some investment to the automation, like computers, didn't affect labor market significantly. Other study of Carl Frey indicates that fifty percent of current job will be substituted by robot and artificial intelligence but

this result just shows the technical possibility. But considering the complexity of job definition of real world, it is also criticized by others. Some other study is saying the changing rate of job was even lowered after 2000 in American labor market. The concern about job losing by machine was existed always but employment situation was improved for last two hundred years after 1st industrial revolution. That is the basis of optimistic forecast about the labor environment. Improvement of productivity created many higher wage and higher education jobs and real fear is the wage gap between high income and low income instead of huge unemployment. Polarization of income distribution is the issue what robot will make and we have to focus on it. Innovation and productivity improvement is getting slow after the financial crisis even with technological advancement and the inequality and low growth is another issue what must be handled from now on. Technological innovation takes mass jobs and laborer looks for low wage and productive job and their social position will be getting weaker and weaker. On the other hand technical monopoly corporates will get more profit than before but because of slow demand, investment and growth will be affected negatively and every party involved will face stagnation. New policy of robottax and basic income should be considered and studied even with practical difficulty.The topic of 4th industrial revolution was discussed and suggested during the presidency election period in this year. But the revolution looks like a political issue rather than an economic one in Korea and it is not even popular in other countries. As recent study by Lee Kangguk(2017) shows the number of industrial robots reached 531 units per ten thousand laborers in 2015, increased from 171 in 2005 and reached to number one share in the world[10]. Discussion and study of 4th Industrial Revolution is necessary for drawing up government plan and university education curriculum but it should be studied and discussed not just for positive direction and several negative issues of robocalypse and inequality etc.

8. Digital Environment and Creativeness

According to Newsweek report 'the crisis of risk creativity' of October 2010, the creativeness gets weaker under the digital environment. As intellectual quality has been mounting continuously according to improving of living environment children's creativeness was worsening paradoxically. It was prominently shown in the group of kindergarten through elementary school students because younger children who concentrating on digital device and sticking to school record and obedient to parent. Various study results about the source of creativity were shown recently whether genetic reason or training in childhood and it was not clarified yet as it has characteristic of defining complexity and systematic training and learning. Based on the study result by Mihaly Csikszentmihalyi(2003), Creativity is made from the interaction of certain cultural background, person who brings the change and the field which acknowledge that change[11]. Typical creative persons like Davinci, Mozart, Edison and etc., created outstanding achievements from certain social and cultural background and personal endeavor, not just from born genius. The common characteristic of those achievements is the life for his working and the effort based on strong curiosity. Isaac Asimov(2004) insisted that most of society is not satisfied with the creativity[12]. As Apple corp. advertised in the series of 'think different' 1997, most of genius was evaluated as a social misfit or trouble maker. The essence of creativeness is 'thinking differently' but non-current idea will be resisted strongly from society and it will face a failure of the working. Henry Matisse mentioned that "originality requires braveness". Restricting the creativity is not only the society but even the individual has some prejudice of excluding the originality according to the research result of Kaufman(2010)[13]. The brain of human naturally has the tendency of avoiding the risk and recognizing the creativity as uncertain and uncomfortable. 80 percent of adults consider the creativity as exhausting and inconvenient.

While respecting the different thinking, people exclude it in contradicting real world. The fact that even in the field of right answer is not existing artificial intelligence is superior, creativeness is more critical human capability. In order to educate originality for young student, new thinking and try should be accepted openly to individual or society. Young children are usually learning fear while they are making mistake with full of curiosity. If society is not prepared to accept the mistake, creating new things seems to be impossible forever. The culture of admitting the difference and opposite opinion will cultivate the environment for 4th industrial revolution and creativity.

9. Conclusion

In order to adapt to the new industrial change, we analyzed various aspects of educational, political, scientific, social and ethical effects and solutions were deducted and suggested in this paper. Clear message from it is that we should make a culture of admitting the difference and opposite opinion and the educational system for students to adapt to new industrial will cultivate the environment for the new trend of business and industry. And the role of the government and the universities are critical to evoke the environment of diminishing the fear for non-success result. For making the healthy environment of the society, we have to settle the culture of general wide discussion inside the societies (universities, researchers, politicians and public). At the same time the universities have to introduce the academic environment of fundamental change of discussion and acknowledging the deep breaths. The society help student choosing their job on a long range view instead of deciding it short perspective as the future became more difficult to predict than ever. They should be trained and equipped with the power of deciding the right direction under the uncertain future. One another role of the university is taking a responsibility connecting one company to another or others. Data hub will be a new concept connecting different industries, different business and universities have to develop the technology of connecting others and analyzing those mixed data. Logical inference education is for selecting right information from various information and materials. Time-space inference education is for handling and inducing a better solution from huge information about time and space. At the same time the evaluation tool and system of inference ability must be developed and introduced. Every reform or revolution has dark effect to the society and technical monopoly corporates will get more profit than before but because of slow demand, investment and growth will be affected negatively and every party involved will face stagnation. New policy of robot tax and basic income should be considered and studied even with practical difficulty. When we allocate proper and balanced role between artificial intelligence and let them cooperate each other effectively, human will focus on developing the emotional and social service while the artificial intelligence supports that job more effectively for realizing the love for humanity.

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박 상 규(Park, Sang Kyu) [정회원]

- 1984년 2월 : 고려대학교 경영학과(경영학사)
- 2015년 2월 : 성균관대학교 경영학과(경영석사)
- 2016년 3월 ~ 현재 : 광주대학교 경영학과 교수

- 관심분야 : 마케팅, IT
- E-Mail : skpark41@gwangju.ac.kr