The Fourth Industrial Revolution, Aging Workers, Older Learners, and Lifelong Learning

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Abstract: This paper reviews the literatures related to the challenges to older workers in the Fourth Industrial Revolution. Also, it is explored how adult education interrupts to expand learning and working opportunities for aging people in this unprecedented technological development.

Keywords: Aging Workers, Learning throughout Lifecycle, The Fourth Industrial Revolution, Reforming Education

Introduction

The Fourth Industrial Revolution, which is represented by terms such as Big Data, Internet of Things, or 3D printing, has recently become an urgent social topic. Simultaneously, aging has been discussed as a critical social transformation in the 21st century. According to the World Population Ageing Report from the UN (2013; 2017), the number of older people is rapidly increasing. However, these two social changes have never been discussed together. The continual development of technology in the Fourth Industrial Revolution is always followed by the fear of losing one's job, and this is liable to become a very sensitive topic for older workers, due to the constant need for flexibility, upgrading and learning that is grounded in technological advancement, which is characterized as the dimmed border among the "digital, physical, and biological spheres" (Schwab, 2015). In this transformational era, it lacks of discussion connecting the challenges and opportunities in technological development, the shifts in human resources due to aging, and the role of adult and continuing education for maintaining older workers in labor market. In reality, a number of studies have revealed that lifelong education specifically for adult workers needs to be highlighted again in amalgamating technological development and human resource development in this aging society.

Aging has been discussed as a critical social transformation in the 21st century. This is mainly due to the high birth rate in the early and middle parts of the twentieth century and lengthening life spans. In 1950, the population who were aged 60 years or over was 202 million; however, the number is four times higher in 2013 or 841 million (UN, 2013). Also, the rapid expansion of older populations in less developed countries is one of the main reasons for this global aging trend. The number of persons over 60 years of age in less developed regions was 108 million, but this increased to 554 million in 2013 (UN, 2013). The number of retirees each year is sharply increasing, and eventually, this number will exceed the number of new labor market entrants (OECD, 2006). It is expected that this shift in the labor market will double the ratio of older inactive persons per worker, from 38% in OECD areas in 2000 to over 70% in 2050 (OECD, 2006). As recently as 1992, less than 3 percent of the American workforce consisted of people age 65 and over. Today that proportion has nearly doubled, according to the U.S. Bureau of Labor Statistics, and it's expected to reach 8.3 percent by 2022. Most of these 13.5 million older workers will be between 65 and 74, but nearly 2.6 million will be 75 and over (Anders, 2015)

The Fourth Industrial Revolution and aging in the 21st century are similar social transitions, which are historically unprecedented. Also, those changes are expected to cause

tremendous shifts in human's daily lives. Specifically, technological developments have been regarded as a fear to older workers. It is partially because of the perception that older workers are difficult to upgrade themselves with the technological advancement in workplace. However, Hobsbawm claimed "the industrial revolution is not merely an acceleration of economic growth, but an acceleration of growth because of, and through, economic and social transformation" (1968, p.12). Therefore, this study initially aims for understanding on the challenges, advantages, and strategies of older workers in labor market with the Fourth Industrial Revolution.

Grounded on the previous studies on technological developments and older workers in aging society, it is time to review the literatures related to technological challenges in the Fourth Industrial Revolution, aging, and adult education. Also, it is expected to find how adult education expands learning and working opportunities in this unprecedented technological development, specifically for helping aging people to be sustained as vigorous human resource in labor market with the lifelong learning.

Industrial Revolutions and Education

It has not been discussed much before, however, the past three Industrial Revolutions influenced shifts in the concept of education and educational system. The First Industrial Revolution, which is usually represented as steam power (Penprase, 2018), significantly changed the concept of manufacturing and production. The technological development in manufacturing and mass production led financial prosperous for employers and merchants, and this economic power arrangements led social and educational transformation (Hobsbawm, 1968).

Penprase (2018) explained the effects of past three Industrial Revolutions to modern education. After the First Industrial Revolution, new types of curriculums have been developed for offering more diverse degree options. This gradual shifts was continued toward more public and elective courses in college study in 19th century, even if the Yale Report of 1828 affirmed that the primary object of higher education is not offering vocational training and education, and emphasized Greek, Roman, and Latin as a core of education. The Second Industrial Revolution from 1860 to 1900 has electricity at its core. The new technologies based on electricity provoked "new economy" (Atkeson, 2007) increase in higher education access, and need for diverse forms of higher education (Penprase, 2018). There were also several private charities that founded several types of institutions such as Stanford University (1885), Pomona College (1887), or Throop College (1893), which is now Caltech (Penprase, 2018). This proliferation of new educational institutions and new curriculum after the first two Industrial Revolutions enabled the technical and managerial capacity to implement the massive expansion of the economy and manufacturing that arose in the 20th century.

The Third Industrial Revolution, which is mainly described with computerization and web-based interconnectivity in 1980s and 1990s (Penprase, 2018, p. 2). Also, at the time of globalization, the characteristics in internet access enabled online classes and diversities in campus (Penprase, 2018). For example, in 2012, MOOC (Massive Online Open Courses) emerged in the online movement in education to expand access to higher education to previously "unserved" (Penprase, 2018, p. 2) students all around the world. Online class enabled not only universities but also liberal art colleges or technical colleges to be available for the students and faculties with diverse backgrounds. The technical shifts led by Third Industrial Revolution also contributed to the brand-new pedagogies, which includes project-based team learning and cherishes collaborations in learning (Penprase, 2018).

The Fourth Industrial Revolution is a continuum of past three Industrial Revolutions and it specifically blurs the physical idea of "industry", which has been conceptualized as a big factory and large number of employees. In the Fourth Industrial Revolution, the invisible digital technologies such as computer storage power or cloud service are combined with the other technologies and develop multiple exponential technologies (Penprase, 2018).

Challenges of Aging Workers in the Fourth Industrial Revolution

A lot of studies and statistics reported the situation of aging workers in labor market. Starting in January of 2011, 10,000 people in United States are turning 65 every single day and this will continue through 2030. The baby boom generation in United States has been a large portion of the population and the labor force. The overall participation rate is declining as the boomers gradually aged and retired from the labor market. However, the population group aged 55 and over is the only one group that has increased in its participation rate in the labor market since 1994 (U.S. Bureau of Labor, 2015). The participation rate of this age group was 30.1 percent in 1994 and increased to 40% in 2014.

In 2015, the AWCS (American Working Conditions Survey) shows that more than two-thirds of older workers (age of 50 or above) reported that they felt satisfaction over work well done and felt that they were doing useful work—with no real differences between older men and women. Though existing research found that older workers want constructive work relationships, the AWCS found that older workers perceive that they have less support than younger workers do. Additionally, AWCS (2015) results that more than half of retirees would return to work under the right conditions, and numerous retirees already have. Maestas, Mullen, Powell, Wacher, and Wenger (2017) state that meaningful work is a key reason that leads older workers staying in labor market.

However, there are also reported challenges of aging workers specifically with developing technologies. Thompson and Mayhorn (2012) explained two different hurdles for aging workers towards technology: one is technical challenge and the other is attitudinal barrier. Technical challenges, such as small font size on webpages or small and simple design of digital devices, can cause design issue for the aged. Attitudinal barriers refer to the correlation between the reluctance to use technology and age (Thompson & Mayhorn, 2012). These challenges can direct the tension for confusion or conflict when older workers fail to adopt the information and to do the appropriate behavior which their younger colleagues anticipate them to follow. Schonfeld (2009) introduced a survey on the generation gap towards technology between baby boomers and the post generations, Generation X and Generation Y. The result is more obvious than expected: 69% of baby boomer respondents agree that "PDAs and mobile phones contribute to the decline of proper workplace etiquette," and 68% of them also found using a laptop or Blackberry during meeting is rude (Schonfeld, 2009). In short, this age-related difference in using technology in workplace may arouse intergenerational conflict (Thompson & Mayhorn, 2012).

The massive changes in technology can culminate with "technostress" (Thompson & Mayhorn, 2012). Thompson and Mayhorn (2012) introduced that older workers show less technostress than their younger colleagues, and argue that this result might imply that older workers react to these stressors by using their social and organization experiences. Additionally, failure to adopting information and technology can affect older workers' self-efficacy and proficiency in learning new technologies (Thompson & Mayhorn, 2012). There are a lot of literatures that claimed older workers also willing to learn and use new technologies, and the

positive attitudes can be enhanced by adequate training (Thompson & Mayhorn, 2012). Hence, those contradictory studies imply that older workers cannot be considered as technophobia (Thompson & Mayhorn, 2012). There are several factors to influence older workers' reluctant and objection to learn new technologies. Again, it is a matter of education and training to decline the intergenerational gap in technology.

Discussion and Conclusion: Aging Workers, Technologies, and Learning

Adaptability and self-directed learning and thinking are the most emphasized competences in the Fourth Industrial Revolution (Penprase, 2018). World Economic Forum (2016) reports that the Fourth Industrial Revolution requires reshaping the future of education, gender and work to diversify talents. To respond the shifts and developments in the Fourth Industrial Revolution, the way of accelerating workforce reskilling is emphasized, which includes: 1) rethinking education system, 2) incentivizing lifelong learning: wholesale reskilling of existing workforces, and 3) collaboration among educational institutes, government, and business levels to ensure that individuals have the time, motivation and means to seek retraining opportunities (WEF, 2016). Technological shifts such as the Fourth Industrial Revolution will require employees to have integrative skills combining technical, social, and analytic competences. Curriculums should be renovated for the future employees to have Humanities and Science on one hand, and applied and pure training on the other hand (WEF, 2016). Second, aging countries need to actively participate in the policy making for lifelong learning, which means a total reskilling according to the lengthened lifecycle. Third, the reskilling can be accomplished under the cross-industry and public-private collaborations (WEF, 2016).

As the previous three Industrial Revolutions do, Fourth Industrial Revolution calls for tremendous changes in every aspect of society and human beings. Specifically, the most implicative lesson from the past is redefining our environment, labor market, and social concepts on technology and aging (White Paper, 2018). Additionally, most of the research papers pointed out that the traditional type of higher education will face considerable challenges, since it needs to have diverse delivery system for education; such as "certificates, micro-credentials, badges, or training" (Whiter Paper, 2018, p. 9).

Mezirow's (1991) Transformative Learning Theory can be an implicative tool for discussing The Fourth Industrial Revolution, aging, and lifelong learning for older adults. People's diverse experiences are the primary medium of transformative learning (Taylor, 2009). Therefore, Transformative Learning Theory is applicable for helping older workers re-identify themselves and adapt to the shifts caused by the Fourth Industrial Revolution. Transformative Learning Theory can help older workers in rearranging their values, mindsets, or habits with the technologies and skills the Fourth Industrial Revolution will require, which can alter older workers' self-efficacy and attitude towards changes.

Also, the Fourth Industrial Revolution emphasizes adaptability and in self-directed learning and thinking. Within scientific and technical education, it needs to educate and re-educate students to help develop and shape the use of today's most rapidly emerging technologies. Pathways for students to come back their institutions after graduation will be essential, and it requires rapid expansion of existing initiatives for updating skills after graduation, and re-connecting within older workers in campus environments. Also, recent studies emphasize the necessity of lifelong learning, because the number of workers who participate in self-teaching will increase significantly to take the advantage of online learning opportunities (Rainie & Anderson, 2017). Also, the discussions from World Economic Forum (2016)

suggested to re-examine education system to incentivize lifelong learning as a wholesale reskilling of existing workforce throughout lifecycle. It is because no one can expect his/her skills to stay significant throughout whole career in this era of unpredictable change.

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