ESRI International Conference 2019
July 30, 2019, Tokyo

The Impact of Disruptive Technologies on Employment and Its Implications on an Aging Japan

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I. Introduction

- The common conception is that disruptive technologies in the 4th Industrial Revolution will transform our society, particularly employment, at a rapid pace.(Schwab 2016)
- Regarding the impact of disruptive technologies on employment we need to consider the changes in labor supply in relation to demographic change, namely population aging.
- This presentation will examine:

➢The direction of change in employment

➢The significance of disruptive technologies in a rapidly aging society

➢The role universities can play in times of great changes

II. How Disruptive Technologies Affect Employment

- Labor-saving technology may cause the loss of jobs.
- However, if productivity improves because of technological progress, causing prices of products to drop, the demand for the products will also become greater, which will also increase demand for employment.
- Examples of virtuous cycles from previous Industrial Revolutions in which improved productivity led to higher wages , stimulating domestic demand and creating more jobs.

➢ The Luddite movement in the early 19th century.(Ashton & Hudson 1997)

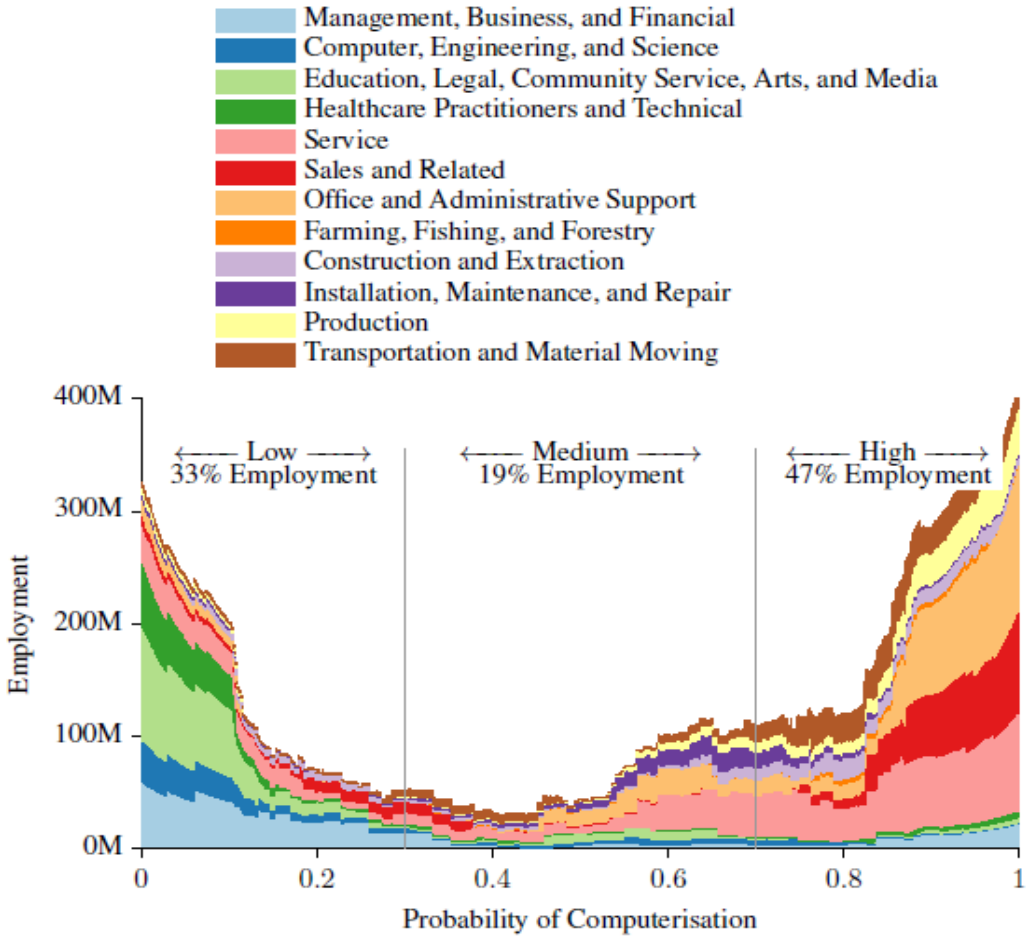
➢ Introduction of mass manufacturing technologies in the early 20th century.(Nevins & Hill 1954)

➢ Japan's postwar economic growth

III. Work that Only Humans Can Do - 1

- However it has significant impact on the quality and content of jobs and previous industrial revolutions affected mainly blue-collar jobs.
- The impact of disruptive technologies in the 4th Industrial Revolution will spread widely to white-collar professions.
- For example, Oxford researchers evaluated jobs at risk of computerization within the coming decades among 702 occupations in the US in 2010. (Frey & Osborne 2013)
- It was found that 47% of these occupations (especially in the “Office and Administrative Support,” “Sales and Related,” “Service” fields, etc.) are in the high risk category.(Figure 1)

〔Figure 1〕
The impact of disruptive technologies on the distribution of future employment according to a University of Oxford study



(Carl Benedikt Frey and Michael A. Osborne 2013)

III. Work that Only Humans Can Do - 2

- This trend will continue and workers will no longer be required to do work that can be done by AI and robots and they will be required to do what only human can do.（Brynjolfsson & McAfee 2014)

- So what are jobs that only humans can do in a society with advanced AI?

➢ Geeks and shrinks (Reich 2000)

- Geeks can create new things such as software, products, services, and know-how, or come up with new ideas.

- Shrinks can intuit what people want, especially those deepest yearnings and needs that even people themselves are not aware of.

➢ Craftspersons in the broadest sense and those that provide sophisticated services.

- Make-to-order production such as building custom made machines

- Services that respond to the individual needs and desires of the client in different and sometimes unexpected situations including medical services, Long-term care, Education, Tourism and so on.

III. Work that Only Humans Can Do - 3

- These jobs need wide knowledge and deep insight on people and events.
- They also need an intellectual ability to make the right judgments.
- Yukichi Fukuzawa, the founder of Keio University, emphasized the importance of public wisdom, which is “the ability to evaluate people and events, to give weightier and greater things priority, and to judge their proper times and places,” and this is exactly something that only humans can do (Fukuzawa1875).

IV. Big Hope in Disruptive Technologies to Cope with Population Aging - 1

- Japan's population aging is globally unprecedented in its level and depth.
- The proportion of older people aged 65 years old and over has now reached 28% of the total population of Japan making it already the largest proportion in the world, and it is expected to be 35% in 2040 and 40% in 2060.
- The depth of aging means that as Japan's baby boomers who were born between 1947 and 1949 reach the age of 75 by 2025, within the older population itself, the proportion of people aged 75 years and over is expected to increase rapidly.
- One significant impact of population aging, particularly in the coming decades is the rapid shrinking of the labor force.

〔Table 1〕
Projection of the Labor Force in Japan

(ten thousand)

Year	2017(actual number)	2025(projection)	2040(projection)
(Case I) Labor force participation rates remain constant			
Labor force	6720	6341	5460
Labor force participation rates (by Gender & Age Group)			
Female 30～34	75.2%	76.1%	76.1%
Female 35～39	73.4%	74.5%	74.7%
Male 60～64	81.7%	81.7%	81.7%
Male 65～69	56.5%	56.5%	56.5%
(Case II) Labor force Participation rates of women and older people will increase			
Labor force	6720	6673	6195
Labor force participation rates(by Gender & Age Group)			
Female 30～34	75.2%	81.5%	86.3%
Female 35～39	73.4%	83.5%	92.0%
Male 60～64	81.7%	85.0%	89.4%
Male 65～69	56.5%	62.7%	71.6%

(Source) The Study Group Report on Employment Policies (2019) Ministry of Health Labour and Welfare

IV. Big Hope in Disruptive Technologies to Cope with Population Aging - 2

- The labor force is projected to decrease from the present 67 million to 55 million in 2040. (Table 1)
- Increasing the labor force participation rate of women and older people will minimize the reduction of the current size of the labor force. (Table 1)
- In order to cope with a rapidly aging population, it is extremely important to promote employment of older people beyond the current retirement age. (Seike 2001) (Seike 2016b)
- This will substantially reduce the average per capita burden of social security and act as a driving force of economic growth in both the supply and demand side of the economy.

IV. Big Hope in Disruptive Technologies to Cope with Population Aging - 3

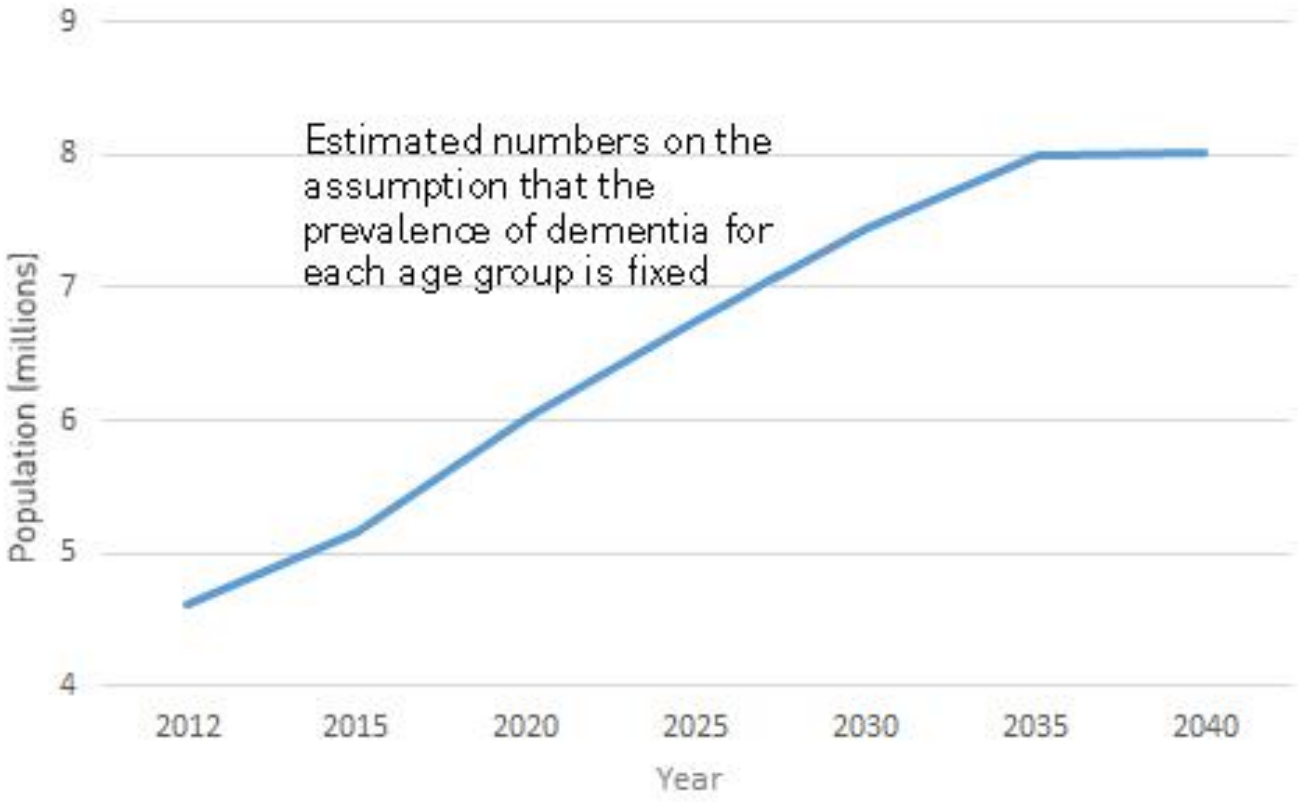
- The labor force participation rate of older people depends largely on their health conditions. (Table 2)
- Major progress in disruptive technologies in the field of medicine and the life sciences may play a major role to improve the health conditions of older people.
- Another problem is that many middle to older aged workers are leaving their job to take care for their older family members.
- The number of older people with Dementia in Japan is expected to grow from 5 million to 7 million within the next decade. (Figure 2)
- Disruptive technologies, namely advances in the field of medicine and the life sciences are expected to provide solutions for the prevention of cognitive decline and progression to dementia.
- The introduction of care-giving robots may eliminate the problem of the shortage of care workers, and reduce the number of middle- to older-aged workers and women leaving their job. (Ushiba *et al.* 2016) (Inamura *et al*.2016)

〔Table 2〕
Estimated results of labor supply of older people (2000, males aged 60 - 69)

Variables	Labor force participation function		Market wage function
	Probit coefficient	Coefficient on the probability at labor force	Regression coefficient
Age	0.067	0.027**	0.029**
Not in good health/ In poor health/ Having a tendency for poor health	0.814	0.316**	0.152
Graduate of high school/Junior College (twoyear college) or same level	0.053	0.021	0.184**
Graduate of university or same level	0.021	0.008	0.620**
Eligible to receive employee pension	0.327	0.127**	
Nonearned income excluding employee pension (×10,000yen)	0.011	0.004**	
Experience of mandatory retirement	0.462	0.180**	0.352**
Tokyo residence dummy	0.025	0.01	0.101*
Constant	5.305	**	8.897**
Lambda			0.323*
Wald test(X2)			926.0**
Sample size	4029		2212

(Source) Seike, A. and Yamada, A., 2004. The Economics of Older Workers (in Japanese). Tokyo: NihonKeizai Shinbunsha.

〔Figure 2〕
Population of Older People with Dementia



(Source)
Toshiharu Ninomiya et al., “Nihon ni okeru ninchishō no kōreishajinkō no shōraisuikei ni kansuru kenkyū (Research on estimates of the future population of elderly people with dementia in Japan),” FY 2014 Health and Labour Sciences Research Grants, Report, Ministry of Health, Labour and Welfare

V. The Role of Universities - 1

- Universities can play a major role in the era of disruptive technologies and an aging population. Their roles can be broadly divided into two areas. (Seike 2016a)

➢ Contribute to the sound development of new technologies and innovation by carrying out cutting-edge research that directly promotes technological innovation in the fields of natural sciences, life sciences, and technological sciences, as well as promote research in the social sciences and humanities to understand the conditions under which these technologies are accepted by society. (Kokuryo & Kaya 2017)

➢ Education is another important role of universities to cope with disruptive technologies.

V. The Role of Universities - 2

- There are two ways to make new technological innovation available to a wider public and redistribute the benefits thereof.
  - Redistribute the gains from increased productivity in the form of monetary redistribution.
  - Involve as many people as possible in improving productivity through technological innovation, so that they can directly have a share in the benefits.
- To achieve the second, people must be equipped with the work ability to adapt to new technologies.
- Universities can play a major role in helping them cultivate the necessary abilities to adapt to the technologies themselves, or through training received on the job.

V. The Role of Universities - 3

- One way to achieve this win-win situation is to strengthen life-long education (recurrent education program that allows students to catch up with the newest technology).
- Another necessary ability is being able to adapt to changes associated with the emergence of new technologies and markets.

➢ This is the ability to understand for themselves market and technology changes and respond appropriately based on this understanding.

➢ University students must engage themselves properly in the learning process of taking an unsolved problem as a research topic, constructing a hypothesis to explain the problem, and testing the hypothesis to reach a conclusion.

➢ They need to understand the meaning of learning through a liberal arts education, as well as by practicing the method of selecting a research topic and researching it in depth.

VI. Conclusion

- New technologies including AI will continue to make significant advances and the current pace is likely to get faster. It is important not to stop this process, but to adapt these technologies to improve the public welfare of society, which will allow more people to support technological innovation.
- To do so, we need to build a framework of distributing the benefits of new technologies to the people.
- In the long run, disruptive technologies have a huge potential to help improve the wellbeing of humanity, particularly in an aging society.
- Universities, too, can play a definitive role in assisting in the building of this win-win relationship between technological innovation and an aging society.

Reference-1

Ashton, T.S. and Pat Hudson (1997). *The Industrial Revolution 1760-1830*. Oxford: Oxford University Press.

Brynjolfsson, Erik and Andrew McAfee. (2014). *The Second Machine Age*. New York and London: W. W. Norton & Company.

Frey, Carl Benedikt and Michael A. Osborne. (2013). *The Future of Employment: How Susceptible are Jobs to Computerisation?* Oxford Martin School, University of Oxford, Oxford OX1 1PT, United Kingdom Department of Engineering Science, University of Oxford, Oxford OX1 3PJ, United Kingdom.

Fukuzawa, Yukichi. (1875). *An Outline of a Theory of Civilization*. Tokyo: Keio University Press.

Inamura, Haruhiko, Tsuyoshi Hamano, Takehiko Michikawa, Fujimi Takeda-Imai, Takahiro Nakamura, Toru Takebayashi and Yuji Nishiwaki. (2016). “Relationships of Community and Individual Level Social Capital with Activities of Daily Living and Death by Gender.” *International Journal of Environmental Research and Public Health*, 13.

Kokuryo, Jiro and Akiko Kaya. (2017). "The Human-AI Ecosystem: A Nonhuman-Centric Approach.” *Kindai Management Review*, Vol.5.

Reference-2

Nevins, Alan and Frank Ernest Hill. (1954*). Ford: Expansion and Challenge 1915–1933*. New York: Charles Scribner's Sons.

Reich, Robert. (2000). *The Future of Success*. New York: Vintage Books.

Schwab, Klaus. (2017). *The Fourth Industrial Revolution*. New York: Crown Business.

Seike, Atsushi. (2001). "Beyond Lifetime Employment." *The Geneva Papers*, Vol.26 No.4.

Seike, Atsushi. (2016a). "The Role of Universities and Social Needs in Times of Great Change." In Luc E. Weber and James J. Duderstadt eds*. University Priorities and Constraints*. London, Paris and Geneva: Economica.

Seike, Atsushi. (2016b). "Towards a Lifelong Active Society: Coping with Japan's Changing Population." *Asia and the Pacific Policy Studies*, Vol. 3, Issue 3.

Ushiba, J. and S.P. Soekadar. (2016). "Brain-Machine Interfaces for Rehabilitation of Poststroke: Hemiplegia." *Progress in Brain Research*, No.228.