Volume 22 Issue 41
Originally issued as A8



Global Journal of human-social science: A
Arts & Humanities - Psychology
Volume 22 Issue 8 Version 1.0 Year 2022
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-460X & Print ISSN: 0975-587X

Can the 4th Industrial Revolution be a Solution to the Challenges of Social Aging?

By Maciej Bazela

Abstract- This paper explores whether the fourth industrial revolution - robotization, automation, digitalization, and the Internet of Things - may mitigate the social, economic, and labor impacts of an aging society.

The increasing role of advanced technologies in economic and social life has fueled concerns about the risks of such technologies to human labor, social relations, and human dignity. These risks seem particularly tangible in advanced societies which face a shortage of skilled labor and increasing demand for social and care services. By reviewing a variety of business practices in several developed economies, this research seeks to build a case in favor of the use of advanced technologies in aging societies. Taking into account the scale of population aging and the limited effectiveness of social and fiscal reforms in favor of a demographic change, the fourth industrial revolution appears to be a useful tool to tackle social aging. Without dismissing the ethical, social, and other concerns related to the use of advanced technologies, the research shows a wide range of successful solutions and symbiotic collaboration between humans and advanced technologies in socially aging contexts.

Keywords: *technology, aging, labor, demographics.*

GJHSS-A Classification: *DDC Code: 301.243 LCC Code: HM101*



Strictly as per the compliance and regulations of:



© 2022. Maciej Bazela. This research/review article is distributed under the terms of the Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0). You must give appropriate credit to authors and reference this article if parts of the article are reproduced in any manner. Applicable licensing terms are at https://creativecommons.org/licenses/by-nc-nd/4.0/.

Can the 4th Industrial Revolution be a Solution to the Challenges of Social Aging?

Maciej Bazela

Abstract- This paper explores whether the fourth industrial revolution - robotization, automation, digitalization, and the Internet of Things - may mitigate the social, economic, and labor impacts ofan aging society.

The increasing role of advanced technologies in economic and social life has fueled concerns aboutthe risks of such technologies to human labor, social relations, and human dignity. These risks seem particularly tangible in advanced societies which face a shortage of skilled labor and increasing demand for social and care services. By reviewing a variety of business practices in several developed economies, this research seeks to build a case in favor of the use of advanced technologies in aging societies. Taking into account the scale of population aging and the limited effectiveness of social and fiscal reforms in favor of a demographic change, the fourth industrial revolution appears to be a useful tool to tackle social aging. Without dismissing the ethical, social, and other concerns related to the use of advanced technologies, the research shows a wide range of successful solutions and symbiotic collaboration between humans and advanced technologies in socially aging contexts. In that sense, the research seeks to offer practical elements that challenge the one-dimensional reading of technology as a threat to the human person and society.

The study follows the following structure. First, it describes the scale of aging in developed economies. Second, it provides a selection of examples showing how advanced technologies are used in different sectors to counter the impacts of aging. Third, the paper concludes by outlining certain ethical and political issues that need to be taken into account regarding the implementation of advanced technologies to address social aging.

Keywords: technology, aging, labor, demographics.

Introduction

Social aging has been a major concern for developed economies for quite some time. The 2019 G20 summit held in Fukuoka, Japan underlined that the combination of social aging, low birth rates, and rising life expectancy threatens the sustainability of labor markets, pension systems, and welfare policies. It may also hinder growth prospects, productivity, and competitiveness. Governments have been trying to counteract aging and its effects through various social and fiscal policies such as pro-family subsidies, vouchers, and tax breaks. Some governments have also sought to liberalize immigration policies to encourage demographic rejuvenation. However, the impact of these anti-aging measures has been rather limited so far. Demographic trends are especially worrying in Japan and across the European Union. Because of the limited effectiveness of conventional social policies, it becomes relevant to explore alternative solutions such as harnessing the tools of the fourth industrial revolution. Although advanced technologies alone cannot reverse demographic trends, it is pertinent to explore how such technologies may favor labor and economic inclusion of the elder; and also, how they may stimulate growth, productivity,and competitiveness despite shrinking labor force.

I. The Scale of Aging in the Developed World

The aging society is "the process by which older individuals become a proportionally larger share of the total population."[1] It is an umbrella term that reflects relative changes in the age distribution within a society which overall increases the share of older generations.[2] This process applies both to developing and developed economies. However, it is more prominent among the developed. According to the UN World Population Prospects, the number of people aged 60 or older is forecasted to double by 2050 and triple by 2100. That age group is projected rise to 2.1 billion in 2050 and 3.1 billion in 2100 worldwide.[3] That would imply that pensioners would represent almost one-third of the global population.[4]

Japan, which has the oldest society in the world, is a strong case in point. According to some estimates, a third of Japan's population will be at least sixty-five years old by 2040.[5] This implies that the labor

Author: IPADE Business School, Social & Political Environment Department. Mexico City, Mexico. e-mail: mbazela@ipade.mx

[1] *UN report on World Population Aging: 1950-2050.*

[2] *The Encyclopedia of Population, Paul Demeny and Geoffrey McNicoll (Eds.)*, New York, Macmillan Reference USA, 2003.

[3] https://www.un.org/en/development/desa/population/events/pdf/expert/29/session1/EGM_25Feb2019_S1_SergeiScherbov.pdf

[4] Adriana Scardino, Improvements in life expectancy and sustainability of social security schemes, report for the International Conference of Social Security Actuaries and Statisticians, Ottawa, Canada, 16-18 September 2009.

[5] "EMPLEO: Haciendo frente a los retos del future," Japan Fact Sheet, Ministry of Foreign Affairs of Japan, last modified 2020, https://web-japan.org/factsheet/es/pdf/es39_employment.pdf. ; Jacqueline Banas,

© 2022 Global Journals

force will have shrunk by 21%: from sixty-two to forty-nine million.[6] In 2018, Japan's total fertility rate was 1.42.[7] At the same time, Japan's average life expectancy at birth is 81.25 years for males and 87.32 years for females. If the trend continues, Japan risks having 1 child under 15 for 3 pensioners over 65 by 2050.

The situation is alike in the European Union. By 2070, 30% of people living in the EU-27 are projected to be aged 65. People aged 80 may represent 13% of the total population of the bloc. Themedian age is on the rise and is projected to reach 49 by 2070. The working-age population (20- 64) has been shrinking for years, and it is projected to represent 51% of the total population of the EU-27 by 2070. The EU-27 plus Switzerland and the UK are likely to lose 13.5 million working-age population by 2030.[8] In addition, the EU's-27 fertility rate, which has oscillated between 1.25and 1.55 in the last few decades, remains far below the 2.1 threshold to keep the population size constant. Except for very few local regions and municipalities in France and other member states, all EU-27 member states have been shrinking demographically.[9] By 2070 the EU's share in the world's population is projected to decrease to 4% from 12% in 1960, making it the second-smallestslice of the world's population after Oceania, followed by Northern America in the third place.[10]

Although longer life expectancy is a good thing in itself, it has far-reaching implications for the sustainability of public finance, growth prospects, productivity, and intergenerational equity.[11] According to an OECD report, older adults *consume* around 40-50% of the health budget, and the average health care cost per capita for older adults is 3 times higher than for the working population.[12] Before the pandemic of Covid-19, the EU-27 was projected to dedicate 26.6% of its GDP by 2070 to attend to the needs of the 65+ age group.[13]

As the proportion of people over 65 in a society increases, people of productive age (14-64) facegreater fiscal burden and social obligations, which is known as the old-age dependency ratio. "Old- age dependency ratios will rise in all G20 members in the next decades, although at different paces. Japan is experiencing the fastest aging of its population, with 47 people older than 65 per 100 working-age adults in 2015, up from 19 in 1990, and rising to 80 by 2060. Among advanced G20 countries, Italy, Germany, and Korea will also face some of the most significant challenges from aging."[14] This burden can be further aggravated by early retirement, increasing expenditure in the medical sector related to geriatric care, palliative care, and chronic conditions. Additionally, the risks of old-age poverty and inadequate care for persons with disabilities may increase as well.[15]

To address the trilemma of longer life expectancy – rising social spending – shrinking demographics, governments in developed countries have considered a broad variety of measures ranging from raising the retirement age and introducing co-payments for some medical services tore-incorporating retirees into the labor market on a part-time basis; reconciling work and family life; increasing employment opportunity for women; improving labor qualifications of

"The Socio-Cultural Implications of the Aging Population in Japan," *Capstone Projects and Master's Theses*, May, 2018, https://digitalcommons.csumb.edu/cgi/viewcontent.cgi?article=1289&context=caps_thes_all.;Tami Saito et al., "Population aging in local areas and subjective well-being of older adults: Findings from two studies in Japan," *BioScience Trends* 10, no. 2 (2016): 103-112, http://doi.org/10.5582/bst.2015.01174.

[6] Claudia Irigoyen, "Tackling the Declining Birth Rate in Japan," *Centre for Public Impact*, last modified April 7, 2020, https://www.centreforpublicimpact.org/case-study/tackling-declining-birth-rate-japan/.

[7] Claudia Irigoyen, "Tackling the Declining Birth Rate in Japan," *Centre for Public Impact*, last modified April 7, 2020, https://www.centreforpublicimpact.org/case-study/tackling-declining-birth-rate-japan/.

[8] The future of work in Europe https://www.mckinsey.com/~/media/mckinsey/featured%20insights/future%20of%20organizations/the%20future%20of%20work%20in%20europe/mgi-the-future-of-work-in-europe-discussion-paper.pdf

[9] https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf; Ageing Europe - statistics on population developments https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_-_statistics_on_population_developments#:~:text=In%202019%2C%20there%20were%2090.4,22.1%20%25%20in%20predominantly%20rural%20regions; Ageing workforce: https://www.eurofound.europa.eu/topic/ageing-workforce; Population structure and ageing EUROSTAT https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Population_structure_and_ageing; Population: demography, population projections, census, asylum & migration https://ec.europa.eu/eurostat/web/population/overview.

[10] https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf; Population pyramids, EU-27, 2019 and 2050 (% share of total population) https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Population_pyramids,_EU-27,_2019_and_2050_(%25_share_of_total_population)_AE2020.png.

[11] https://www.oecd.org/economy/ageing-inclusive-growth/.

[12] Dang T., Antolin P., Oxley H., Fiscal implications of ageing: projections of age-related spending, OECD Economics Department Working Paper, OECD, 2001.

[13] https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf

[14] https://www.oecd.org/economy/ageing-inclusive-growth/

[15] Ageing Europe looking at the lives of older people in THE EU 2020 https://ec.europa.eu/eurostat/documents/3217494/11478057/KS-02-20-655-EN-N.pdf/9b09606c-d4e8-4c33-63d2-3b20d5c19c91?t=1604055531000

© 2022 Global Journals

people withlow education level; enhancing the design of public pension schemes, and encouraging personal savings.[16] Nevertheless, there has been little progress in implementing these measures, for they challenge the fundamentals of the intergenerational social contract and call into question the acquired social guarantees. As the options for reform in labor and social policy seem rather limited, it may be relevant to look for alternatives that are more politically and socially viable. One such alternative might be the use of advanced technology to mitigate the costs associated with population aging.[17] According to the EU's New Industrial Strategy for Europe, the combination of the digital economy and green economy may be a trigger of new business models, working schemes, and productivity.[18] It may also help modernize health care, social services, transportation; improve productivity; and offer new products and services for the aging society. Section 2.0. will look at some business practices in that regard.

II. Technology as a Mitigating Measure of Social Aging

a) Nursing, preventive, rehabilitative, and assistance services

Health care is one of the sectors most affected by social aging. Not only is the public healthcare expenditure destined to grow, but also the demand for different healthcare services - from specialist consultations to daycare services for the elder population is projected to expand. According to research by Eurofound (European Foundation for the Improvement of Living and Working Conditions), personal care workers are the second most demanded occupation next to information and communication technology (ICT) professionals in the EU. Nevertheless, the study also pointsout that personal care jobs "are not yet strongly impacted by new technology and are not offshorable. They are in the lowest or second-lowest wage quintile."[19]

For example, Germany has around 13,600 home centers for elder citizens which employ around 1million caregivers. However, there still is a shortage of 15,000 geriatric nurses and around 8,500 auxiliary personnel. Although the number of foreign nurses, especially from Asia, has almost doubled for the last decade, qualifying nursing candidates to cover only 1/5 of the demand.[20] It becomes reasonable to ask whether this growing demand for personal care services may be supplemented by advanced technologies considering the shortage of personnel.

Some encouraging examples come from nursing houses in Japan. More than twenty different types of robots—humanoid and non-humanoid—are already used to provide care for the elderly in Japan.[21] SHIN-TOMI Nursing Home is at the forefront of aid robotics, a market that may represent a $3.8 billion opportunity by 2035 in Japan.[22] Among them, there are humanoid robots that lead physical exercises, conversation partners, and even robotic pets.[23] In addition to humanoid robots such as SoftBank's Pepper, nursing homes in Japan use a variety of robotic devices to assist human caregivers. For example, RESYONE is an automated bed that transforms into a wheelchair. TREEis a grab-hold device used in walking rehabilitation. A hybrid Assistive Limb is a robotic lever tohelp caregivers lift patients. In a sector where 80% of caregivers experience back problems, such robotic exoskeletons that can lift and move around patients help to reduce physical strain and injuries among staff.[24]

Sohgo Security Services, known as ALSOK, created thumb-sized electronic devices that can help track dementia patients who are likely to wander from their homes or care facilities.[25] But though robotic

[16] https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf; https://www.oecd.org/economy/ageing-inclusive- growth/; https://www.eurofound.europa.eu/publications/report/2017/working-conditions-of-workers-of-different-ages

[17] https://www.ilo.org/global/WCM_041965/lang--en/index.htm#P27_5453

[18] https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf

[19] https://www.eurofound.europa.eu/publications/blog/current-changes-to-the-labour-market-may-well-define-the-future-of-europe

[20] https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_710863.pdf, pp. 46-48

[21] Malcom Foster, "Aging Japan: Robots may have role in future of elder care," *Reuters,* March 27, 2018,https://www.reuters.com/article/us-japan-ageing-robots-widerimage/aging-japan-robots-may-have-role-in-future-of-elder-care-idUSKBN1H33AB.

[22] Malcom Foster, "How robots could help care for Japan's ageing population," *The Independent,* April 9, 2018, https://www.independent.co.uk/arts-entertainment/photography/japan-robot-elderly-care-ageing-population-exercises-movement-a8295706.html; Don Lee, "Desperate for workers, aging Japan turns to robots for healthcare," *Los Angeles Times,* July 25, 2019, https://www.latimes.com/world-nation/story/2019-07-25/desperate-for-workers-aging-japan-turns-to-robots-for-healthcare; Al Jazeera, "Innovative Japanese projects help seniors with dementia," YouTube, September 18, 2017, https://www.youtube.com/watch?v=es1p16FIM-U.

[23] Jun Wu, "Robots, Aging Population and Pets: A story of shifting demographics, aging population and robots," *Towards data science,* April 22, 2019, https://towardsdatascience.com/robots-aging-population-and-pets-c84cdd5214cb.

[24] Bryan Lufkin, "What the world canlearn from Japan's robots," *BBC,* February 6, 2020,https://www.bbc.com/worklife/article/20200205-what-the-world-can-learn-from-japans-robots.

[25] Justin McCurry, "Japan's dementia crisis hits record levels as thousands go missing," *The Guardian,* June 16, 2016, https://www.theguardian.com/world/2016/jun/16/record-12208-people-with-dementia-reported-missing-in-japan;

© 2022 Global Journals

nursing solutions are effective, they are not easy to afford without government subsidies; the cost per unit may vary between $4,000 and $9,000, not including maintenance, training, and assistance.

In addition to nursing services, advanced technologies play an important role in preventive and rehabilitative medicine ranging from retinal disease to Alzheimer's predictions, to advanced dentistry, nanorobotic surgeries, and psychological illness risk assessment[26]. Preventive and regenerative solutions based on advanced technology are a subset of a broader universe of services called telecare which "includes technical devices and assistive technology as well as professional health care services to assist, monitor and care for people from a distance. Telecare includes a variety of services such as communication, monitoring, consultation, diagnostics, and training."[27]

Studies show that thanks to telecare elderly people can preserve their autonomy and active life for longer, which has a positive impact on the economy and frees up resources dedicated to social spending. Telecare also helps to reduce the number of injuries, accidents, and hospital admissions.[28] They can also help the elderly avoid the risk of social isolation, especially in the case of people who, due to illness, lack of family members, or natural aging, cannot easily leave their home or residence.[29]

No-Isolation is a Norwegian startup that specializes in developing communication devices easy-to-use for older generations. The company came up with KOMP a device that shares photos, messages and makes video calls. It does not require previous digital skills. The company recognizes that conventional tablets and smartphones are not easy to use for everyone. KOMP features high contrast screens, enhanced audio, and a one-button interface.[30] The diffusion of telecare is closely linked to the development of smart homes and residences equipped with the internet of things, home health monitoring technologies for older adults, personalized interior design, and customized healthcare.

Another interesting example comes from Cyberdyne Inc. a company that specializes in *cybernetics*, which is applied technology solutions at the intersection of human anatomy, robotics,and information technology. The company has developed treatment devices that help regenerate neuro-physical functions. It also manufacturers rescue devices, heavy labor devices, and entertainment equipment. Among its flagship products, there is hybrid assistive limb (HAL), "the world's first cyborg-type robot,"[31] which stimulates brain functions. Cybernic treatments, which rely on HAL, recognize that a healthy nervous system is fundamental to maintain or regain kinetic capabilities. What HAL adds to conventional physiotherapy is the emphasis on regaining the connection loop between the human brain, the nerve system, and muscles. Not only can HAL be used in post-traumatic treatments (i.e., spinal cord injuries), but also in cerebrovascular conditions, degenerative conditions, and even non-medical well-being-oriented treatments oriented towards preserving the autonomy of movement. In addition, the company offers services such as NeuroHealthFit, which are guided rehab sessions with the use of HAL equipment to improve the nerve and muscular functions.[32] Cyberdyne's products and services aim to build a *brighter future* in which the elderly and the disabled can live active lives thanks to *techno-peer support*.[33]

b) Public transport and mobility services

Whill, Inc. provides advanced mobility services for last-mile transportation. The company seeks to fill the void regarding near-home mobility for the disabled. While wheelchair-friendly infrastructure is commonplace at airports and railway stations around the globe, people inwheelchairs still tend to face steep mobility challenges running local daily errands. To increase mobility independence within a one-mile radius of the residences of the wheelchair-bound, WhillInc. commercializes highly

[26] Using AI to predict retinal disease progression https://deepmind.com/blog/article/Using_ai_to_predict_retinal_disease_progression; Robot jaws shows medicated chewing gum could be the future https://www.sciencedaily.com/releases/2020/07/200714101226.htm; Artificial intelligence predicts Alzheimer's years before diagnosis https://www.sciencedaily.com/releases/2018/11/181106104249.htm; https://www.deutschland.de/en/topic/business/medicine-for-the-future-research-in-robotics-and-ai

[27] http://wp6.pacitaproject.eu/wp-content/uploads/2014/02/Telecare-description-web.pdf

[28] Teleassistance and future ageing http://wp6.pacitaproject.eu/technology-description/ ; How smart monitoring technologies and AI optimise patient safety https://www.healtheuropa.eu/how-smart-monitoring-technologies-and-ai-optimise-patient-safety/107790/;The Future of Remote Patient Monitoring is in Artificial Intelligence https://meddevops.blog/2019/10/09/the-future-of-remote-patient-monitoring-is-in-artificial-intelligence/ ; Transforming healthcare with AI https://eithealth.eu/wp-content/uploads/2020/03/EIT-Health-and-McKinsey_Transforming-Healthcare-with-AI.pdf.

[29] https://www.noisolation.com/global/research/what-is-social-isolation/

[30] https://www.noisolation.com/global/komp/#header

[31] "What is HAL? The world's first cyborg-type robot," Cyberdyne Japan, last modified 2020, https://www.cyberdyne.jp/english/products/HAL/index.html.

[32] "Cybernic Treatment," Japan Gov, last modified September, 2019, https://www.japan.go.jp/technology/innovation/cybernictreatment.html; "What is HAL? the world's first cyborg-type robot," Cyberdyne Japan, last modified 2020, https://www.cyberdyne.jp/english/products/HAL/index.html.

[33] "Corporate Identification," Corporate Identification, Cyberdyne, last modified 2020, https://www.cyberdyne.jp/english/company/index.html.

© 2022 Global Journals

advanced mobility vehicles equipped with autonomous driving functions and light batteries, among other features. The company has also focused on aesthetics to create a new image for wheelchair mobility.[34] Whill's autonomous vehicles have also been tested at airport terminals in Japan to improve the quality of service to passengers without adding labor costs.[35]

To provide the possibility of an autonomous and mobile life for elderly citizens, public-private projects are run to implement self-driving cars on a mass scale. There is a special need for autonomous vehicles in remote towns and rural regions where public transportation options are limited. For example, in the town of Suzu, at the tip of the Noto Peninsula, the rail station has beenshut down and there are no more than a few bus links during the day.[36] Consequently, elderly citizens rely on private vehicles to get to medical appointments and other obligations. However, older motorists are twice as likely to cause fatal accidents in Japan. According to one study, "drivers and motorcycle riders aged seventy-five or older caused 8.2 fatal accidents per 100,000 licensed road users in 2018, about 2.4 times the number caused by those aged seventy-fours or younger. The number of accidents resulting in death by drivers aged seventy-five and over totaled 460."[37] This is not a minor issue for towns such as Suzu, where over 50% of the 15,000 local population is over sixty-five years old, with many of that number being bus drivers.

c) Industrial robotics

Although industrial robotization may look distant from the issues of aging and shrinking labor markets, it has the potential to improve productivity where a skilled labor force is ever- harder to come by. It may decouple economic growth and productivity from demographic trends. Despite shrinking labor markets, companies could stay competitive, generating revenues and tax income which may be used to address the problem of aging. Additionally, advanced technologies may transform various heavy industrial jobs into safer and less arduous work. It would make possible to postpone retirement.

A good example of this comes from a mineral mine in Garpenberg, Sweden which applies 440 persons, 18% of them are women. The mine is of the most technologically advanced in the world. Among other equipment, it deploys perforating machines which are remotely controlled from a monitor room as well as autonomous vehicles to transport the ore from the mine.[38]

While traditional industrial robots used to be programmed meticulously to carry out strictly limitedtasks and movements, the latest generation of industrial robots is versatile and adaptative in terms of movement and tasks.[39] Mira Robotics specializes in patrolling robots that can perform routine surveillance tasks at corporate buildings.[40] They can send voice and image reports to police officers and security guards, becoming a handy substitute for human guards and watchmen. In particular, there has been significant progress in the robotization of repetitive tasks such as product picking, sorting, and palletizing.[41] Thanks to the development of intelligent robot controllers such as Mujin, industrial robots have acquired much greater autonomy.[42]

[34] "Advanced Mobility Service for Last Mile Transportation," Innovation Japan, The Government of Japan, last modified 2020, https://www.japan.go.jp/technology/innovation/personalmobility.html; Uesugi Tsukasa, "Next-generation wheelchair," *NHK World Japan*, March 3, 2019, https://www3.nhk.or.jp/nhkworld/en/news/backstories/390/.

[35] Michael Gillan, "Self-driving wheelchairs tested at Haneda Airport," *The Japan Times,* December 5, 2019, https://www.japantimes.co.jp/news/2019/12/02/national/self-driving-wheelchairs-tested-haneda-airport/#.XrB8pC_MzOR; "WHILL Autonomous Driving Trial for Personal Mobility Devices to be held at Haneda Airport," Press Release, Japan Airlines, last modified October 28, 2019, https://press.jal.co.jp/en/release/201910/005362.html; "Japan Airlines to trial WHILL autonomouswheelchairs at Haneda Airport," Airport Technology, last modified October 29, 2019, https://www.airport-technology.com/news/whill-autonomous-wheelchair-haneda-airport/.

[36] Mike Ramsey et al., "Japan Road Tests Self-Driving Cars to Keep Aging Motorists Mobile," *The Wall Street Journal,* last modified January 21, 2016, https://www.wsj.com/articles/japan-road-tests-self-driving-cars-to-keep-aging-motorists-mobile-1453357504.

[37] Jiji Kyodo, "The Japan Times, Older drivers in Japan cause fatal accidents at twice the rate of under 75s, report shows," *The japan times,* June 21, 2019, https://www.japantimes.co.jp/news/2019/06/21/national/75s-cause-fatal-traffic-accidents-twice-rate-younger-drivers-white-paper-shows/#.XrB_Hi_MzOT; "Over-75 drivers cause Japan road deaths at twice rate of younger set," *Nikkei Asian Review*, last modified June 21, 2019, https://asia.nikkei.com/Economy/Over-75-drivers-cause-Japan-road-deaths-at-twice-rate-of-younger-set.

[38] https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_710863.pdf, 29-33

[39] Mujin Video, "Depalletizing robotoperation," You Tube, October 9, 2018, https://www.youtube.com/watch?v=th93jxqRm8U&feature=emb_logo; Mujin Video, "MUJIN Customer Case," YouTube,October 15, 2018, https://www.youtube.com/watch?v=LIY4pEqNWAY&feature=emb_logo; Prime Minister´s Office of Japan, "Innovation Japan: Making Industrial Robots Intelligent to Improve Productivity," YouTube, April 1, 2019, https://www.youtube.com/watch?v= IWzEO2r69BU.

[40] Bryan Lufkin, "What the world can learn from Japan's robots," *BBC,* Last modified February 6, 2020, https://www.bbc.com/worklife/article/20200205-what-the-world-can-learn-from-japans-robots.

[41] "Mujin's picking solutions accelerate factory automation for customers," MUJN, accessed 2020, https://www.mujin.co.jp/en/solution/fa/picking/; "Depalletizing," MUJIN, accessed 2020, https://www.mujin.co.jp/en/solution/distribution/depalletize/; "Insertion into sorters," MUJIN, accessed 2020, https://www.mujin.co.jp/en/solution/distribution/sorter/; "Palletizing, "MUJIN, accessed 2020, https://www.mujin.co.jp/en/solution/distribution/palletize/.

[42] "What is the MUJIN Controller?," MUJIN, accessed 2020, https://www.mujin.co.jp/en/product/controller/.

© 2022 Global Journals

III. Conclusions: Ethical, Political, and Social Challenges

Advanced technologies rather than being a threat can expand the possibilities for attractive and well-paid jobs in high-skilled sectors. In the context of demographic decline and population aging, the service economy cannot be labor-intensive. This applies in particular to health services and social services in advanced economies where the demand for healthcare services is on the rise while the pool of the healthcare workforce is shrinking.[43]

Contrary to widespread concerns about the fourth industrial revolution stifling human labor, there is little evidence among the workforce in Japan and the EU-27 to see technology as direct competition. As a technologically advanced economy, the labor force seems to be more at ease working alongside humanoid and non-humanoid robots and other technologies. On the other hand,further research is needed to examine the reactions of labor unions, consumer associations, families, and society at large. Little evidence exists so far regarding the psychological, sociological, and spiritual responses of advanced societies to the adoption of advanced technologies in different aspects of life, especially among the elderly and the retired.

The deployment of humanoid and non-humanoid robots in nursing homes is a pragmatic response to a shortfall of specialized caregivers which cannot be easily filled by immigrant workers. Although it takes some time to get used to working with and be attended by a robot assistant, robotics in nursing homes has many advantages. Unlike human caregivers, android nurses are consistently patient and well-tempered, which is extremely important in assisting patients with dementia or other degenerative conditions. They are good at memorizing names, dates, and prescription details. Moreover, they are not a source of health risks since they do not get sick.[44]

The mini-cases presented in this paper show that advanced technologies are used to improve the daily freedom of the elderly and to provide assistance when human-mediated care is scarce. However, the study found little evidence of using technology to re-incorporate the elderly into the workforce. A demographic decline as sharp as the one experienced by Japan and the EU-27 may fuel greater interests in substitutive rather than complementary technologies. Thus one may ask whether a stronger effort is needed to come up with complementary technologies to keep the elderly active in the labor force.

Culture seems to play an important role in the public and private management of aging. Because of language and customs barriers, many advanced economies have attracted very few immigrants to fill the growing void of nurses, caregivers, and other professional positions needed in an aging society. Although one could wish for a more human-centric approach, the technological approach may be more attractive for highly homogenous societies where cultural barriers to immigration are high. On the other hand, the technological approach may fall short of fulfilling the human need for meaningful connections and genuine interpersonal relations.

While advanced technologies may help retirees lead more active and independent lives, they can also fuel further social polarization. The cost of high-tech solutions and the skills needed to use them may pose new social barriers. Hence, the use of advanced technologies to manage demographic decline presupposes a substantive agreement between the government, companies, pension funds, and other actors on how to cover costs and train retirees to use those technologies. The technological training of retirees could be a new challenge for corporate social responsibility.

Although several studies show an upward trend in the use of telecare and other advanced technologies, their widespread application in society implies a new agreement between governments, insurers, service providers, and users regarding cost coverage. The large-scale application of telecare also has important implications in terms of continuous training of the personnel involved, technological support, and systemic changes in the structure of the health and welfare system. In addition, there is the challenge of ensuring the security of sensitive personal data, such as patient medical records. In a highly technological environment, there is a risk of a lack of proper safekeeping where data circulates between different devices, clouds, and servers. There is also the challenge of ensuring equitable access so that telecare is not a luxury service forsome.[45]

All in all, the introduction of advanced technologies to mitigate the employment impacts of aging, especially in the health sector, presents benefits,

[43] https://www.mckinsey.com/~/media/mckinsey/featured%20insights/future%20of%20organizations/the%20future%20of%20work%20in%20europe/mgi-the-future-of-work-in-europe-discussion-paper.pdf; https://futureworkforce.economist.com/modern- times;

[44] Bryan Lufkin, "What the world can learn from Japan's robots," *BBC,* February 6, 2020, https://www.bbc.com/worklife/article/20200205-what-the-world-can-learn-from-japans-robots.

[45] Parliaments and civil society in Technology Assessment http://www.pacitaproject.eu/; European Stakeholder involvement in Ageing society http://www.pacitaproject.eu/ageing-society/ ; Telecare Technology for an Ageing Society Europe http://www.pacitaproject.eu/wp-content/uploads/2012/11/Telecare-description-web.pdf; https://deepmind.com/safety-and-ethics

© 2022 Global Journals

but also challenges and public policy dilemmas.[46] What technological solutions should be prioritized? To what extent should technologies be used without depersonalizing services? What is the ethical boundary of what is permissible in terms of the technologization of services? How to cover the costs related to the use of advanced technologies in the health and social services sector? How to avoid the risk of exacerbated social polarization and differences in the quality of service? What roles should technology in the design of public spaces, housing, transportation, and services? How to mitigate the risk of the loss of personal autonomy in a technology-saturated setting?

References Références Referencias

1. Airport Technology.2019. Japan Airlines to trial WHILL autonomous wheelchairs at Haneda Airport. https://www.airport-technology.com/news/whill-autonomous-wheelchair- haneda-airport/. Accessed May 2021.
2. Al Jazeera, Innovative Japanese projects help seniors with dementia. YouTube. https://www.youtube.com/watch?v=es1p16FIM-U. Accessed May 2021.
3. Banas, Jaqueline. 2018. The Socio-Cultural Implications of the Aging Population in Japan. California State University, Global studies department. https://digitalcommons.csumb.edu/cgi/viewcontent.cgi?article=1289&context=caps_thes_all. Accessed April 2021.
4. Bausch, Jonas, Seydina Alioune Diallo, Alejandro Iturrizaga, Jean-Luc Martinage, Asmaa Rezk, Minette Rimando and Hans von Rohland. 2019. 100 años de la OIT: promoción de la paz yde la justicia social. *Revista del Trabajo*. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_710863.pdf. Accessed May 2021.
5. Corselli-Nordblad, Louise and Helene Strandell. 2020. Ageing Europe looking at the lives of older people in the EU. Publications Office of the European Union. https://ec.europa.eu/eurostat/documents/3217494/11478057/KS-02-20-655-EN-N.pdf/9b09606c-d4e8-4c33-63d2-3b20d5c19c91?t=1604055531000. Accessed. April 2021.
6. Cyberdyne. 2020. Corporate Identification: Message. Cyberdyne. https://www.cyberdyne.jp/english/company/index.html. Accessed May 2021.
7. Cyberdyne. 2020. What is HAL? The world's first cyborg-type robot. Cyberdyne Japan. https://www.cyberdyne.jp/english/products/HAL/index.html. Accessed May 2021.
8. Dang Thai-Thanh, Pablo Antolin, and Howard Oxley. 2001. Fiscal implications of aging: projections of age-related spending, *OECD Economics Department Working Paper*. https://doi.org/10.1787/503643006287
9. DeepMind. 2020. Safety and Ethics. Deep Mind. https://deepmind.com/safety-and-ethics. Accessed May 2021.
10. DeepMind. 2020. Using AI to predict retinal disease progression. https://deepmind.com/blog/article/Using_ai_to_predict_retinal_disease_progression. Accessed May 2021.
11. Demeny, Paul and McNicoll, G. 2003. *The Encyclopedia of Population.* New York: Macmillan.
12. EIT Health and McKinsey Company. Transforming healthcare with AI: The impact on the workforce and organizations. EIT Health and McKinsey Company. https://eithealth.eu/wp-content/uploads/2020/03/EIT-Health-and-McKinsey_ Transforming-Healthcare-with- AI.pdf. Accessed May 2021.
13. Eurofound. 2021. Aging workforce. Eurofound data. https://www.eurofound.europa.eu/topic/ageing-workforce. Accessed May 2021.
14. European Commission. 2020. the Impact of Demographic Change.EC. https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf. Accessed May 2021.
15. Eurostat. 2020. Ageing Europe-statistics on population developments. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_-_statistics_on_population_developments. Accessed May 2021.
16. Eurostat. 2021. Population: demography, population projections, census, asylum & migration. Eurostat database. https://ec.europa.eu/eurostat/web/population/overview. Accessed May 2021.
17. Eurostat. 2020. Population pyramids, EU-27, 2019 and 2050. Eurostat file. https://ec.europa.eu/info/sites/default/files/demography_report_2020_n.pdf. Accessed May 2021.
18. Eurostat. 2020. Population structure and aging. Eurostat data base. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Population_structure_and_ageing .Accessed March 2021.
19. Foster, Malcom, 2018. Aging Japan: Robots may have a role in future of elder care, Reuters, https://www.reuters.com/article/us-japan-ageing-robots-widerimage/aging-japan-robots-may-have-role-in-future-of-elder-care-idUSKBN1H33AB. Accessed May 2021.
20. Foster, Malcom. 2018. How robots could help care for Japan's aging population. The Independent. https://www.independent.co.uk/arts-entertainment/photography/japan-robot-elderly-care-ageing-population-exercises-movement-a8295706.html. Accessed May 2021.

[46] https://ec.europa.eu/eip/ageing/events/future-ageing-technology-innovation-and-organisation-european-health-care_en.html; https://ec.europa.eu/jrc/communities/sites/jrccties/files/eedfee77-en.pdf.

© 2022 Global Journals

21. Gillan, Michael. 2019. Self-driving wheelchairs tested at Haneda Airport. The Japan Times. https://www.japantimes.co.jp/news/2019/12/02/national/self-driving-wheelchairs-tested-haneda-airport/#.XrB8pC_MzOR .Accessed May 2021.
22. Health Europa.2021. How smart monitoring technologies and AI optimize patient safety. *Health Europa*. https://www.healtheuropa.eu/how-smart-monitoring-technologies-and-ai-optimise-patient-safety/107790/. Accessed May 2021.
23. International Labour Organization. 2009. Aging societies: The benefits, and the costs, of living longer. *Magazine World of Work*. https://www.ilo.org/global/WCM_041965/lang--en/index.htm#P27_5453. Accessed May 2021.
24. Irigoyen, Claudia. 2017. Tackling the Declining Birth Rate in Japan. Centre for Public Impact BCG Foundation. https://www.centreforpublicimpact.org/case-study/tackling-declining-birth-rate-japan/. Accessed April 2021.
25. Irigoyen, Claudia. 2020. Tackling the Declining Birth Rate in Japan. Centre for Public Impact. https://www.centreforpublicimpact.org/case-study/tackling-declining-birth-rate-japan/. Accessed April 2021.
26. Japan Airlines. 2019. WHILL Autonomous Driving Trial for Personal Mobility Devices to be held at Haneda Airport. Press Release, Japan Airlines. https://press.jal.co.jp/en/release/201910/005362.html. Accessed April 2021.
27. JapanGov. 2020. Advanced Mobility Service for Last-Mile Transportation. Innovation Japan-The Government of Japan. https://www.japan.go.jp/technology/innovation/personalmobility.html. Accessed May 2021.
28. JapanGov. 2020. Cybernic Treatment: Recovering lost bodilyfunctions. JapanGov. https://www. japan.go.jp/technology/innovation/cybernictreatment.html. Accessed May 2021.
29. Koskimies, Oskari. 2019. The Future of Remote Patient Monitoring is in Artificial Intelligence. *MEDDEVOPS*. https://meddevops.blog/2019/10/09/the-future-of-remote-patient-monitoring-is-in-artificial-intelligence/. Accessed May 2021.
30. Kyodo, Jiji. 2019. The Japan Times, Older drivers in Japan cause fatal accidents at twice the rate of under 75s, report shows. The japan times. https://www.japantimes.co.jp/news/2019/06/21/national/75s-cause-fatal-traffic-accidents-twice-rate-younger-drivers-white-paper-shows/#.XrB_Hi_MzOT. Accessed May 2021.
31. Lee, Don. 2019. Desperate for workers, aging Japan turns to robots for healthcare, Los Angeles Times. https://www.latimes.com/world-nation/story/2019-07-25/desperate-for-workers-aging-japan-turns-to-robots-for-healthcare. Accessed May 2021
32. Lüber, Klaus. 2020. Medical innovations from Germany. Deutschland Government. https://www.deutschland.de/en/topic/business/medicine-for-the-future-research-in-robotics-and-ai. Accessed May 2021.
33. Lufkin, Bryan. 2020. What the world can learn from Japan's robots. BBC. https://www.bbc.com/worklife/article/20200205-what-the-world-can-learn-from-japans-robots. Accessed May 2021.
34. Lufkin, Bryan. 2020. What the world can learn from Japan's robots. BBC. https://www.bbc.com/worklife/article/20200205-what-the-world-can-learn-from-japans-robots. Accessed May 2021.
35. McCurry, Justin. 2016. Japan's dementia crisis hits record levels as thousands go missing, The Guardian. https://www.theguardian.com/world/2016/jun/16/record-12208-people-with-dementia-reported-missing-in-japan. Accessed May 2021.
36. Meidert, Ursula; Sina Früh and Heidrun Becke. 2013. Telecare Technology for an Ageing Society In Europe. Centre for Technology Assessment. http://wp6.pacitaproject.eu/wp-content/uploads/2014/02/Telecare-description-web.pdf. Accessed May 2021.
37. Menéndez-Valdés, Juan. 2016. Current changes to the labor market may well define the future of Europe.Eurofound documents. https://www.eurofound.europa.eu/publications/blog/current-changes-to-the-labour-market-may-well-define-the-future-of-europe. Accessed May 2021.
38. Ministry of Foreign Affairs of Japan. 2021. EMPLEO: Haciendo frente a los retos del futuro. https://web-japan.org/factsheet/es/pdf/es39_employment.pdf. Accessed May 2021.
39. Mujin Video, 2018. Depalletizing robot operation. YouTube. https://www.youtube.com/watch?v=th93jxqRm8U&feature=emb_logo. Accessed May 2021.
40. Mujin Video. 2018. MUJIN Customer Case.YouTube. https://www.youtube.com/watch?v=LIY4pEqNWAY&feature=emb_logo. Accessed May 2021.
41. MUJIN. 2020. Depalletizing. MUJIN. https://www.mujin.co.jp/en/solution/distribution/depalletize/. Accessed May 2021.
42. MUJIN. 2020. Insertion into sorters. MUJIN. https://www.mujin.co.jp/en/solution/distribution/sorter/. Accessed May 2021.
43. MUJIN. 2020. Mujin's picking solutions accelerate factory automation for customers. MUJIN. https://www.mujin.co.jp/en/solution/fa/picking/. Accessed May 2021.
44. MUJIN. 2020. Palletizing. MUJIN. https://www.mujin.co.jp/en/solution/distribution/palletize/. Accessed May 2021.
45. MUJIN. 2020. What is the MUJIN Controller? MUJIN. https://www.mujin.co.jp/en/product/controller/. Accessed May 2021.
46. Nikkei Asian Review. 2019. Over-75 drivers cause Japan road deaths at twice the rate of younger set. Nikkei Asian Review. https://asia.nikkei.com/Eco

© 2022 Global Journals

nomy/Over-75-drivers-cause-Japan-road-deaths-at-twice-rate-of-younger-set. Accessed May 2021.
47. No Insolation. 2020. Revolutionary technology. For those who didn't grow up with it. No Insolation. https://www.noisolation.com/global/komp/#header. Accessed May 2021.
48. No Insolation. 2020. What is social isolation? No Insolation. https://www.noisolation.com/global/research/what-is-social-isolation/. Accessed May 2021.
49. OECD. 2019, Artificial Intelligence in Society. *OECD Publishing, Paris.* https://doi.org/10.1787/eedfee77-en. Accessed May 2021.
50. PACITA. 2020. Broadening the knowledge base in policy making. PACITA project. http://www.pacitaproject.eu/. Accessed May 2021.
51. PACITA. 2020. European Stakeholder involvement in Ageing society. PACITA project. http://www.pacitaproject.eu/ageing-society/. Accessed May 2021.
52. PACITA. 2020. The Future of Ageing. Technology, Innovation, and Organisation in European Health Care. European Innovations Partnership. https://ec.europa.eu/eip/ageing/events/future-ageing-technology-innovation-and-organisation-european-health-care_en.html. Accessed May 2021.
53. Population pyramids, EU-27, 2019 and 2050 (% share of the total population) https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Population_pyramids,_EU-27,_2019_and_2050_(%25_share_of_total_population)_AE2020.png. Accessed May 2021.
54. Prime Minister´s Office of Japan. 2019. Innovation Japan: Making Industrial Robots Intelligent to Improve Productivity. Prime Minister´s Office of Japan- YouTube. https://www.youtube.com/watch?v=IWzEO2r69BU. Accessed May 2021.
55. Radiological Society of North America. 2018. Artificial intelligence predicts Alzheimer's years before diagnosis. *Science Daily*. https://www.sciencedaily.com/releases/2018/11/181106104249.htm. Accessed May 2021.
56. Ramsey, Mike; Miho Inada and Yoko Kubota. 2016. Japan Road Tests Self-Driving Cars to Keep Aging Motorists Mobile. The Wall Street Journal. https://www.wsj.com/articles/japan-road-tests-self-driving-cars-to-keep-aging-motorists-mobile-1453357504. Accessed May 2021.
57. Rouzet, Dorothée, Aida Caldera Sánchez, Theodore Renault and Oliver Roehn.2019. Fiscal challenges and inclusive growth in aging societies. OECD Publishing. https://doi.org/10.1787/c553d8d2-en
58. Saito, Tami et al. Population aging in local areas and subjective well-being of older adults: Findings from two studies in Japan. *BioScience Trends*. http://doi.org/10.5582/bst.2015.01174. Accessed May 2021.
59. Scardino, A. 2009. Improvements in life expectancy and sustainability of social security schemes. International Conference of Social Security Actuaries and Statisticians archive. http://www.actuaries.org/PBSS/Documents/0910-Report_ISSA_Ottawa.pdf. Accessed May 2021.
60. Scherbov, Sergei and Warren Sanderson. 2019. New Measures of Population Ageing. International Institute for Applied System Analysis. https://www.un.org/en/development/desa/population/events/pdf/expert/29/session1/EGM_25Feb2019_S1_Sergei Scherbov.pdf. Accessed May 2021.
61. Smit, Sven; Tilman Tacke; Susan Lund; James Manyika and Lea Thiel. Mckinsey Global Institute. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/future%20of%20organizations/the%20future%20of%20work%20in%20europe/mgi-the-future-of-work-in-europe-discussion-paper.pdf. Accessed May 2021.
62. Smith, Svean, et al. 2020. The future of work in Europe: Automation, workforce transitions, and the shifting geography of employment. McKinsey Global Institute. https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-in- europe. Accessed May 2021.
63. Takada, Hidetoshi.2017. In tests across Japan, new tech allows speedy tracking of lost dementia patients, The Japan Times. https://www.japantimes.co.jp/news/2017/05/03/national/social-issues/in-tests-across-japan-new-tech-allows-speedy-tracking-of-lost-dementia-patients/#.Xlf0f6hKjIU Accessed April 2021.
64. The Economist. 2020. Future X: The future of work. The Economist. https://futureworkforce.economist.com/modern-times. Accessed May 2021.
65. Tsukasa, Uesugi. 2019. Next-generation wheelchair. NHK World Japan. https://www3.nhk.or.jp/nhkworld/en/news/backstories/390/. Accessed April 2021.
66. United Nations. 2015. World Population Ageing. UN archive. https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2015_Report.pdf. Accessed May 2021.
67. University of Bristol. 2020. Robot jaws show medicated chewing gum could be the future. *Science Daily*. https://www.sciencedaily.com/releases/2020/07/200714101226.htm. Accessed May 2021.
68. Vargas Llave, Oscar, Mathijn, Wilkens and Jack Mullan.2017. Working conditions of workers of different ages Publications Office of the European Union. https://www.eurofound.europa.eu/publications/report/2017/working-conditions-of-workers-of-different-ages. Accessed May 2021.
69. Wu, Jun.2019. Robots, Aging Population, and Pets: A story of shifting demographics, aging population, and robots. Towards data science. https://towardsdatascience.com/robots-aging-population-and-pets-c84cdd5214cb. Accessed April 2021.

© 2022 Global Journals