Part 3

AI and Employment Overseas, and in Development, Utilization and Management of Human Resources

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[Overview]

Part 2 focused on AI users, mainly experts in several areas and domains in Japan, and provided an overview of the situation surrounding AI, robotics, employment, and labor, from legal, social, ethical, and technological perspectives. Experts in each domain use AI and robotics as one of the means to achieve their objectives; in other words, "using AI and robotics" is not their goal. Further, AI and robotics do not stand alone. They require infrastructure, such as communication networks and hardware. Also they function as one of the elements of a system consisting of existing environments, institutions, the economy, people's literacy, human values, and organizational culture.

Interactions between technology and society vary not only by field but also by country and region. Therefore, the first half of Part 3 reviews what kind of discussions are held policy-wise about the influence of AI and robotics on employment and labor in the US, EU, Germany, France, and China.

AI and robotics are positioned as one of the pillars of economic growth and industrial development in various countries and regions. Development and recruitment of AI-related human resources is also one of the issues discussed. The second half of Part 3 discusses what kind of employment and personnel management systems businesses in Japan and overseas countries are employing. In addition, the report introduces how Japanese are working on human resources development to address changes in the work styles and work environments engendered by AI and robotics while introducing the status of legal systems.

I Employment Policy Trends in the US

1. Introduction

Employment (labor demand) is derived from the demand of economic activities. In general, the "labor market" is a market where employers or recruiters looking to hire workers, and job seekers looking to be employed make deals regarding labor. In this market, the demand and supply for labor are coordinated when prices are determined. Thus, the labor market fulfills the function of optimally allocating resources called labor.[1] Directions of economic activities, such as industrial trends and progresses of technology development, must be understood when it comes to employment policies and labor market laws that are designed as policy interventions with employment systems aiming to establish the foundation for the labor

* The last date of access to the internet information in this paper is May 1, 2018.

[1] Soichi Ota & Toshiaki Tachibanaki, An Introduction to Labor Economics, Yuhikaku, 2004, pp.4, 23-41 (in Japanese).

market and to maximize its function. Hereinafter, this chapter will overview employment policies in relation to artificial intelligence (AI) / robotics and also introduce industrial policies.

Traditionally, it is said that there are two types of stances in policy interventions on the labor market: a passive stance (less regulation) and an aggressive stance (more regulation). The US has been considered a typical example of the passive stance.[2] In other words, the US respects the essential function of the market itself, and the federal government is reserved in implementing regulations and interventions (for example, legal regulations on dismissal).[3] US employment policies have put priority on improving the rate of unemployment and maintaining the average wage level under relaxed regulations on employment but have had to live with a large income gap in exchange.[4] As discussed later, this stance has not changed when it comes to AI and robotics

President Donald Trump assumed the presidency in January 2017, but one year into his presidency, he has not clearly presented policies regarding AI/robotics and labor/employment. Therefore, this chapter will also explain the policy documents released during the former President Barack Obama administration.

2. Policy documents regarding AI, robotics, and employment during the Obama administration

Recently, the possibility of jobs being replaced due to automation and digitalization, such as the use of AI and robotics, has been a hot topic around the globe. Some note that 47% of US workers have professions that are more likely to be replaced by AI within 10 to 20 years.[5] It is said that nonroutine tasks, which have not been considered be likely to be replaced by machines, will also be performed by machines due to advancements in big data and AI. As seen in *Race against the machine*,[6] which has attracted much attention, some say that people are losing jobs because people or society cannot fully handle technology, as technologies, not just AI and robotics, are progressing rapidly. The US is concerned that labor demand may change owing to the automation of production activities, which may have a negative impact on employment and labor.

In October 2016, the National Science and Technology Council (NSTC) and the Office of Science and Technology Policy (OSTP), which are organizations for gathering information on the science and technology policies of various departments and agencies and for ensuring coordination among them, published a report entitled "Preparing for the Future of Artificial Intelligence."[7] This report presents the social impacts of AI and a framework for designing institutional arrangements. It is important to understand this report together with the "National Artificial Intelligence Research and Development

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[2] Yasuo Suwa, *Employment Policies and the Rights to Career: Exploring Career Law*, Koubundou, 2017, pp.19-20 (in Japanese).
[3] In most cases, this works closely with the principles of control and intervention in the economy in general. Same as above.
[4] Akihisa Adachi, "International comparison of employment protection regulations (Volume 1): Protection regulations in 23 major OECD member countries and quantitative analysis of socio-economic factors," *Journal of Faculty of Business Administration, Tokoha University* Vol.4 No. 2, 2017.2, p.1 (in Japanese). <https://tokoha-u.repo.nii.ac.jp/?action=repository_uri&item_id=1272&file_id=22&file_no=1>.
[5] Carl B. Frey and Michael A. Osborne, "The future of employment: how susceptible are jobs to computerization?" *Technological Forecasting and Social Change*, Vol.114, 2017.1, pp.254-280.
[6] Erik Brynjolfsson and Andrew McAfee, *Race against the machine: How the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy*, 2011.
[7] National Science and Technology Council et al., "Preparing for the Future of Artificial Intelligence," 2016.10. Obama White House Website <https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf>.

Strategic Plan"[8] formulated at the same time. Social issues were explored in "Preparing for the Future of Artificial Intelligence" in alignment with the exploration of industrial policies and R&D strategies in the "National Artificial Intelligence Research and Development Strategic Plan," and as one of the social issues, employment policies in relation to AI were analyzed. Therefore, the report "Preparing for the Future of Artificial Intelligence" highlights social issues arising from the advancement of AI and its use and dissemination, but it also anticipates benefits engendered by AI. While promoting R&D in the field of AI, it maintains a consistent perspective when it comes to how to control these social issues, exhibiting an optimistic tone overall.[9] The report makes 23 recommendations, including the promotion of innovation, support for basic research, monitoring of safety and equality, use of AI by the government, international collaboration, and implementation of cyber security. There was also a recommendation for compiling a follow-on report by the end of 2016 regarding the impact on the economy and employment.

In response to this, the Executive Office of the President released a report entitled "Artificial Intelligence, Automation, and the Economy"[10] in December 2016. The report said that improvements in labor productivity and GDP growth could be expected from AI and automation. It presents a vision that there will be both creation and loss of jobs, but there will not be a significant change in the rate of unemployment as a result.[11] On the other hand, it notes that AI and automation may lead to economic inequality and widened economic gaps because the skills required in the labor market will change, and in particular, the jobs of workers with low wages, low skills, and low education will be threatened.[12] It suggests that the US should undertake long-term policy interventions, namely, (1) investing in R&D of AI, (2) investing in education and training, and (3) establishing and reinforcing safety nets, such as unemployment insurance and support for re-employment.

3. Innovation and employment trends

There is a reason for the optimism seen in "Artificial Intelligence, Automation, and the Economy." What has significantly contributed to growth in real GDP since 2000 is total factor productivity (TFP),

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[8] National Science and Technology Council et al., "The National Artificial Intelligence Research and Development Strategic Plan," 2016.10. Obama White House Website <https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/national_ai_rd_strategic_plan.pdf>.

[9] Chris O'Brien, "White House: 'A.I. holds the potential to be a major driver of economic growth and social progress'," *VentureBeat*, 2016.10.12. <https://venturebeat.com/2016/10/12/white-house-a-i-holds-the-potential-to-be-a-major-driver-of-economic-growth-and-social-progress/>.

[10] Executive Office of the President, "Artificial Intelligence, Automation, and the Economy," 2016.12. Obama White House Website <https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF>.

[11] Other studies also predict that there will not be much of a decrease in the number of jobs. For example, previous research notes that jobs will consist of various tasks and that over 70% of tasks can be automated in only 9% of professions, under the assumption that the possibilities of mechanization should be estimated by task, not profession. Melanie Arntz et al., "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis," *OECD Social, Employment, and Migration Working Papers*, No.189, 2016, pp.47-54. <http://dx.doi.org/10.1787/5jlz9h56dvq7-en>; previous research also suggests that there will not be a significance decrease in jobs through automation and that the content of tasks is highly likely to change. OECD, "Automation and Independent Work in a Digital Economy," 2016.5, OECD Website <https://www.oecd.org/els/emp/Policy%20brief%20-%20Automation%20and%20Independent%20Work%20in%20a%20Digital%20Economy.pdf>.

[12] During technological innovation in the 19th century, highly skilled workers (experienced craft workers) were replaced both by low skilled workers and machines, but during technical innovation in the latter half of the 20th century, routine tasks were replaced, and the demand for highly skilled workers increased, which is consistent with history. Executive office of the President, *op.cit.*(10), p.11.

which indicates the increase in productivity irrelevant of the increase in capital and labor, and "innovation"[13] is what has driven the increase in TFP.[14] There are information and communication giants, such as Google, Apple, Facebook, and Amazon, in the US, and their innovations have contributed to the growth in real GDP. Yet, the number of employees working in the information and communication industry is only 2,720,000 (as of November 2017), which accounts for only about 2.1% of all workers.[15]

On the other hand, if we look at robot-related manufacturing businesses, the number of employees working in the manufacturing industry is about 12,510,000 (as of November 2017), but this figure has been on the decline since the 2000s; the share of employees on nonfarm payrolls has dropped to 8.5% of all workers.[16] This is mainly because import competition with China has negatively affected employment.[17] In other words, one of the reasons for this is the increased globalization of corporate activities, such as "offshoring," which is the practice of transferring relatively low priority jobs to overseas countries and concentrating on relatively high priority jobs within the country. A similar situation with respect to the international division of labor and decrease in domestic employment seen with "offshoring" in the manufacturing industry can also occur with AI and robotics-based automation.

4. Trends seen in the Trump administration

President Trump was elected because he recognized the downfall of manufacturing businesses in areas surrounding the Great Lakes called the "Rust Belt" as a problem,[18] and he publicly promised to create 25,000,000 jobs within 10 years by reviewing tax cuts, investment in infrastructure, and trade relations.[19]

However, for example, Secretary of the Treasury Steven Mnuchin said in March 2017 that jobs of American people will not be taken away through AI and robotics-based automation until 50 or 100 years from now.[20] Thus, insufficient attention has been devoted to the issues presented in "Artificial Intelligence, Automation, and the Economy" released during the Obama administration. This statement by

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[13] OECD and European Communities, *Oslo Manual: Guidelines for Collecting and Interpreting Technological Innovation Data, 3rd Edition*, Paris: OECD Publishing, 2005, p.46. <http://dx.doi.org/10.1787/9789264013100-en>. This includes not only technological innovation but also on-technological innovation, such as the improvement of promotion methods and renewal of management strategies, in innovation. In other words, creating new value by improving work efficiency through organizational reforms and applying existing technologies that have been disseminated widely and that have become reasonable in other areas can lead to an increase in TFP and eventually to economic growth.

[14] Ministry of Health, Labour and Welfare, "2017 Analysis of the labor economy: Challenges for Promoting Innovations and Realizing Work-Life Balance, Overview" 2017. < http://www.mhlw.go.jp/english/wp/l-economy/2017/summary.pdf >.

[15] "Industries at a Glance: Information: NAICS 51." U.S. Bureau of Labor Statistics Website <https://www.bls.gov/iag/tgs/iag51.htm>,

[16] "The Employment Situation - November 2017," 2017.12.8. U.S. Bureau of Labor Statistics Website <https://www.bls.gov/news.release/archives/empsit_12082017.htm>. The number of employees on nonfarm payrolls (seasonally adjusted) is about 147,240,000 (as of November 2017).

[17] Daron Acemoglu et al., "Import competition and the great US employment sag of the 2000s," *Journal of Labor Economics*, Vol.34 No.S1, 2016.1, pp.S141-S198; Cabinet Office, *Trend of World Economy 2017 I: Globalization, economic growth, and employment*, 2017.7, p.36. <http://www5.cao.go.jp/j-j/sekai_chouryuu/sh17-01/pdf/s1-17-1-3.pdf> (in Japanese).

[18] The decline of the employment situation in the Rust Best is considered to be caused by the unique circumstances of the area; for example, high wage levels were maintained due to the existence of strong labor unions, and structural adjustment was not successfully completed. Simeon Alder et al., "Labor Market Conflict and the Decline of the Rust Belt," Manuscript, University of California, San Diego, 2017.2.4. <https://sites.google.com/site/davidlagakos/home/research/rustbeltrevision_submit.pdf>.

[19] "New US administration taking tough stance toward employment expansion, using return of the manufacturing industry as the driving force to overcome invisible low growth," *Nihon Keizai Shimbun*, 2017.1.21, p.2 (in Japanese).

[20] Chris Weller, "Trump's Treasury secretary revises claim the prospect of robots displacing humans," 2017.5.25. Business Insider Website <http://www.businessinsider.com/trump-administration-robot-automation-2017-5>.

the Secretary of the Treasury was corrected in May 2017. Yet, no policies regarding AI/robotics and employment/labor have been presented during the first year of Trump's presidency.

5. Introduction of AI in employment and recruitment and the use of personal data

"HR Tech (Human Resource Technology)" has been attracting attention recently. This involves the use of information technology to improve tasks in the domain of personnel affairs. However, some are concerned about "profiling" during the recruitment process,[21] which is a problem where unexpected stigma may be placed on competence of workers if companies use AI to have it analyze information on job applicants, their circle of friends, and their action history publicly available on social network services (SNS) so that companies can hire people based on a probabilistic certainty.

A report released by the Federal Trade Commission (FTC) in January 2016 entitled "Big Data: A tool for inclusion or exclusion?"[22] and a report released by the Executive Office of the President in May 2016 entitled "Big Data: A Report on Algorithmic Systems, Opportunity, and Civil Rights"[23] express concern that the use of big data and AI may lead to the elimination and discrimination of job applicants. For example, the FTC's report notes that if past results regarding personnel management and evaluation are used to develop AI for helping determine good candidates and if such results contain biases with respect to race, gender, or academic background, such biases will be reproduced, and discrimination may inherently result.[24]

The private sector has also raised issues and has been exploring solutions. The Institute of Electrical and Electronics Engineers (IEEE), a society of electrical and electronic engineering in charge of setting standards and standardization, launched a program called the "IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems" in April 2016.[25] The institute released its first report, entitled "Ethically Aligned Design: A Vision For Prioritizing Wellbeing With Artificial Intelligence And Autonomous Systems," in December 2016.[26] This report addresses issues related to the use of personal data, which is not only information on individuals but also information that cannot be used for personal identification, such as device information and location information. Therefore, standards such as the "Standard for Transparent Employer Data Governance" are now being discussed.[27]

In January 2017, the Future of Life Institute (FLI), an organization supporting efforts toward the effective use of new technologies such as AI, held a five-day international conference in Asilomar,

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[21] Tatsuhiko Yamamoto, "AI and 'Respect for Individuals'," Masaki Fukuda et al. (eds.), *Society Connected by AI: Laws and policies in the era of AI network*, Koubundou, 2017, pp.320-343 (in Japanese).

[22] Edith Ramirez et al., "Big Data: A Tool for Inclusion or Exclusion?" *FTC Report*, 2016.1. Federal Trade Commission Website <https://www.ftc.gov/system/files/documents/reports/big-data-tool-inclusion-or-exclusion-understanding-issues/160106big-data-rpt.pdf>.

[23] Executive Office of the President, "Big Data: A Report on Algorithmic Systems, Opportunity, and Civil Rights," May 2016. Obama White House Website <https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/2016_0504_data_discrimination.pdf>.

[24] Edith Ramirez et al., *op.cit.*(22), pp.28-29.

[25] "The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems." IEEE Standards Association Website <http://standards.ieee.org/develop/indconn/ec/autonomous_systems.html>.

[26] IEEE, "Ethically Aligned Design: A Vision for Prioritizing Human Wellbeing with Artificial Intelligence and Autonomous Systems, Version 1 – For Public Discussion," 2016.12.13. <http://standards.ieee.org/develop/indconn/ec/ead_v1.pdf>.

[27] "7005 - Standard for Transparent Employer Data Governance." IEEE Standards Association Website <https://standards.ieee.org/develop/project/7005.html>.

California,[28] to discuss the direction of AI studies, ethics and values, and future issues while referring to various discussions held in the past, principles, and guidelines. The institute released the outcome of the conference in the report "Asilomar AI Principles."[29] Among them, the following three principles are based on problems related to the use of personal data and respect for individuals.

- Human Values: AI systems should be designed and operated so as to be compatible with ideals of human dignity, rights, freedoms, and cultural diversity.
- Personal Privacy: People should have the right to access, manage, and control the data they generate, given AI systems' power to analyze and utilize that data.
- Liberty and Privacy: The application of AI to personal data must not unreasonably curtail people's real or perceived liberty.

6. Summary

In the US, AI and robotics are expected to drive economic growth. At least during the Obama administration, policies to promote innovation were discussed. Points of argument related to social issues raised by AI were summarized, and the issue of employment and labor was discussed by the Executive Office of the President. Back in 2016, the Executive Office of the President determined that the loss of jobs due to AI and robotics would be compensated for by the level of job creation and that the unemployment rate would change significantly. It also suggested establishing safety nets in this respect, such as investing in education and training, reinforcing unemployment insurance, and supporting re-employment, because the skills required in the labor market would likely change. However, since Trump's inauguration, policies regarding AI/robotics and employment/labor have not been presented.

During the Obama administration, the Executive Office of the President and FTC put together a report summarizing the points of argument regarding the introduction of AI and the use of personal data during the processes of employment and recruitment. Discussions are also being held in the private sector; for example, the IEEE is considering standards to realize the equal, fair, and transparent use of data.

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II Employment Policy Trends in the EU and Germany

1. Introduction

This chapter will overview the employment policy trends in the European Union (EU). As discussed in the previous chapter, the US has taken a passive stance (less regulation), but it is said that continental European countries (e.g., Germany, Northern Europe, and France) are taking an aggressive stance (more regulation).[30] In other words, on the lookout for the "failure of the market," they are proactive in preparing sufficient safety nets (e.g., unemployment insurance system, job training system) and introducing

[28] "Beneficial AI 2017." Future of Life Institute Website <https://futureoflife.org/bai-2017/>.
[29] "Asilomar AI Principles." Future of Life Institute Website <https://futureoflife.org/ai-principles-japanese/>.
[30] Suwa, *op.cit.* (2), pp.19-20.

regulations related to social and labor law (e.g., employment control, maintenance of individual employment, legal regulation on dismissal). Moreover, generally, continental European countries have adopted stringent regulations on employment protection while putting priority on reducing the income gap and raising the average wage. In exchange for this, they have had to live with a high rate of unemployment.[31] In addition to employment policy trends in EU, we will also introduce industrial policies and employment policies in Germany, a representative country with an aggressive stance.

As discussed later, regarding the relationship between AI/robotics and employment/labor, the EU sees that jobs will increase in the future from the use of AI/robotics. To address the possibility that there may be changes in the demand for occupational skills and job content, the EU is discussing policies related to the development of occupational skills aligned with social security systems and group labor relations law (laws pertaining to labor unions and labor relations coordination).

2. Policy trends in the EU pertaining to AI, robotics, and employment

In January 2015, the "Working Group on Robotics and Artificial Intelligence" was established within the European Parliament's Committee on Legal Affairs.[32] In June 2016, the office of Science and Technology Options Assessment (STOA) of the European Parliamentary Research Service (EPRS) released a report[33] analyzing the risks posed by the advancement of robot technology so that it could contribute to the discussions of the working group. The discussions continued based on this report. In January 2017, the Committee on Legal Affairs put together a report with "Recommendations to the Commission on Civil Law Rules on Robotics."[34] The report notes that it is important to ensure legal stability to develop AI and robotics-related businesses, with the conclusion that it is necessary to introduce uniform civil law regulations within the EU to ensure safety.[35] The report also refers to various risks, including the loss of jobs, widening of gaps, decrease in tax revenue, and damage to social security systems. If the number of human jobs will decrease along with the spread of robotics, social security premiums and tax revenues will go down, and there will be a greater need again to invest in education and training for unemployed people. Therefore, the report suggests that the European Commission should consider

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[31] Adachi, *op.cit.* (4), p.1 (in Japanese).

[32] "Subject files: Working Group on Robotics and Artificial Intelligence," 2016.11.18. European Parliament Website <http://www.europarl.europa.eu/committees/en/juri/subject-files.html?id=20150504CDT00301>.

[33] Scientific Foresight Unit (STOA), European Parliamentary Research Service, "Scientific Foresight study: Ethical Aspects of Cyber-Physical Systems," PE 563.501, 2016.6. <http://www.europarl.europa.eu/RegData/etudes/STUD/2016/563501/EPRS_STU(2016)563501_EN.pdf>.

[34] Committee on Legal Affairs, *Report with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL))*, PE582.443v03-00, European Parliament, 2017.1.27. <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A8-2017-0005+0+DOC+PDF+V0//EN>. The Committee usually appoints a "Rapporteur" for each case, and the Rapporteur puts together a report to be submitted to the plenary session. The Rapporteur of this case was Mady Delvaux, a member of the Parliament from Luxembourg, who belongs to the Progressive Alliance of Socialists and Democrats (S&D), a left-center party and the second party of the European Parliament.

[35] Recommendations pertaining to civil law regulations are diverse; the report not only includes a "Charter on Robotics" defining robot development principles and usage guidelines but also defines and classifies autonomous robots, clarifies liability for damage caused by autonomous robots and a compulsory insurance scheme for autonomous vehicles, introduces a robot and AI registration system to ensure traceability, and establishes an institution dedicated to providing advice on technological, ethical, and legal problems pertaining to robots. The report also mentions the possibility of giving a specific legal status to robots, namely, the status of "electronic person," for some autonomous robots in the future so that they will be responsible for any damage they may cause. Ikuko Kudo, "Advent of the Concept 'Electric Person' Next to Natural Person and Legal Person," *Bijinesu Homu*, Vol.18 No.2, 2018.2, pp.4-5 (in Japanese).

introducing a "robot tax," by mandating that companies that own robots register AI-equipped robots and pay part of the revenues obtained through the use of robotics as a tax and that it should offer "basic income" to realize sustainable taxation systems and social security systems.

However, following the release of the report, the International Federation of Robotics, to which robot manufacturers around the world belong, as well as the Mechanical Engineering Industry Association (Verband Deutscher Maschinen- und Anlagenbau – VDMA), an organization for machine and plant manufacturers in Germany, expressed opposition to the introduction of a robot tax, asserting that there is a positive correlation between "robot density," which refers to the number of robots per 10,000 workers in one country, and the number of employees, according to statistics from the automotive industry and the like.[36] At the plenary session of the European Parliament, some insisted that levying a robot tax may hamper the dissemination of robots and may lower the competitiveness of EU and its member nations, which would result in a loss of human jobs. Therefore, all descriptions related to a robot tax were erased from the modified report adopted during the plenary session held in February 2017.[37]

As for industrial policies in the EU, the European Commission released the new "Industrial Policy Strategy" in September 2017.[38] The report says that the European Commission will seek to play a leading role in the fields of innovation, digitalization, and decarbonization internationally while emphasizing the necessity to maintain and reinforce industrial competitiveness. Other the other hand, it also says that the commission should pay close attention to how new technologies and new business models would affect labor and employment.

3. Industrial policies in Germany

Manufacturing businesses account for about 20% of GDP in Germany. The contributions from businesses such as transport machinery, general machinery, and electronic and electric equipment to economic growth are very high. Germany thus has an industrial structure with strong manufacturing capabilities. It is said that the manufacturing industry in Germany successfully increased value added to the amount of sales by transferring labor-intensive production processes to Eastern European countries, leaving high-value added production processes in the country, and it worked on branding of high-quality models.[39]

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[36] "European parliament calls for robot law, rejects robot tax," *Reuters*, 2017.2.17. Website <https://www.reuters.com/article/us-europe-robots-lawmaking/european-parliament-calls-for-robot-law-rejects-robot-tax-idUSKBN15V2KM>.

[37] European Parliament, *Civil Law Rules on Robotics: European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL))*, P8_TA(2017)0051, European Parliament, 2017.2.16. <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2017-0051+0+DOC+PDF+V0//EN>. The report says that close attention should be paid to the medium- to long-term effects of AI and robotics on employment and labor. Resolutions of the European Parliament (adoption of reports) are not legally binding. Therefore, the European Commission, the only EU agency that has the right to submit law and bills, is not obliged to follow them. The European Commission has started working on setting rules pertaining to the ethical aspect of AI and is planning to present directions to its member nations in the spring of 2018. However, the establishment of regulations will probably be shelved. "AI 'Rules, EU leads' 'personality' 'taxation' Hope for discussions among the members of the parliament," Mainichi Shimbun, 2018.2.8, p.8 (in Japanese).

[38] European Commission, *Investing in a smart, innovative and sustainable Industry A renewed EU Industrial Policy Strategy*, COM(2017) 479 final, 2017.9.13.

[39] Martin Krzywdzinski, "How the EU's Eastern Enlargement Changed the German Productive Model. The Case of the Automotive Industry," *Revue de la régulation*, 15, Spring 2014. <http://regulation.revues.org/10663>.

To further promote such efforts of the industrial arena and maintain and reinforce its international superiority as an exporter, the German federal government also sets a goal for the overall optimization of development, manufacturing, and distribution processes through digitalization in the "High-Tech Strategy 2020 Action Plan"[40] put together in November 2011. This German strategy promoting the digitalization of industries, mainly the manufacturing industry, is widely known as "Industry 4.0 (Industrie 4.0)."[41] "Digital Strategy 2025 (Digitale Strategie 2025),"[42] formulated by the Federal Ministry for Economic Affairs and Energy in March 2016, addresses support for the digitalization of small and medium-sized companies called "mittelstand," which have supported the economic growth of Germany, as one of the ten measures recommended for promoting digitalization.[43] In response to "Digital Strategy 2025," a leading business software company headquartered in Germany, SAP SE, now plays the role of communicant to small- and medium-sized companies in "Industry 4.0" through enterprise resource planning (ERP) systems and consulting services, for example.[44] In other words, Germany is facilitating the digitalization of mittelstand not only by coordinating ERP systems, which are the core systems of such companies, with electronic commerce (EC) and allowing them to adjust production according to the sales order status, but also by facilitating horizontal integration through the integration of systems among companies.

4. Work 4.0 and issues pertaining to occupational skills development in Germany

It has been noted that Germany succeeded in increasing its international competitiveness thanks to the flexible labor market formed by the employment policy turnaround in the 2000s[45] and the low unit labor cost.[46] Because the increase of labor productivity exceeds the rise of wages, Germany kept labor's share of profits (proportion of labor cost in added value) low and established an environment where labor movement among companies or among divisions is easy, which apparently contributed to increasing German companies' competitiveness.

In November 2016, the Federal Ministry for Labour and Social Affairs released a white paper entitled "Work 4.0 (Arbeiten 4.0)."[47] This contains the results of broad discussions among labor relations

[40] Federal Ministry of Education and Research, "The new High-Tech Strategy 2020 Innovation for Germany," 2014.8. <https://www.bmbf.de/pub/HTS_Broschuere_eng.pdf>.

[41] Plattform Industrie 4.0 Website <http://www.plattform-i40.de/I40/Navigation/DE/Home/home.html>.

[42] Federal Ministry for Economic Affairs and Energy, Digital Strategy 2025, 2016.4. <https://www.de.digital/DIGITAL/Redaktion/EN/Publikation/digital-strategy-2025.pdf?__blob=publicationFile&v=8>.

[43] Ministry of Internal Affairs and Communications (ed.), *Information and Communications in Japan*, 2017. < http://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2017/2017-index.html >.

[44] Japan Machinery Federation, "2014 research of responses to paradigm shift of the global manufacturing industry," 2015.3, pp.112-113. <http://www.jmf.or.jp/content/files/houkokusho/26nendo/26jigyo_08.pdf> (in Japanese).

[45] During the Gerhard Schröder administration, Germany attempted to change the direction of labor policies from unemployment compensation to employment promotion and worked on making the labor market flexible and diverse, under the basic principle to "stimulate and guarantee self-reliant efforts." Cabinet Office, "Trend of World Economy 2016 II: Low interest rate and low inflation in advanced countries, regional gap in China," 2017.1, pp.114-130 (in Japanese). <http://www5.cao.go.jp/j-j/sekai_chouryuu/sa16-02/index-pdf.html>; Japan Institute for Labour Policy and Training, "Labor and employment policies and social security in Germany and France," *JILPT Report*, No.84, 2007.4, pp.11-36 (in Japanese). <http://www.jil.go.jp/institute/reports/2007/documents/084.pdf>.

[46] Bennet Berger and Guntram Wolff, "The global decline in the labour income share: is capital the answer to Germany's current account surplus?" *Policy Contribution*, Issue 12, 2017.4. <http://bruegel.org/wp-content/uploads/2017/04/PC-12-2017-1.pdf>; Cabinet Office, *op.cit.* (45), pp.121, 129.

[47] Bundesministerium für Arbeit und Soziales, *Weissbuch Arbeiten 4.0*, 2017.3. <http://www.bmas.de/SharedDocs/Downloads/DE/PDF-Publikationen/a883-weissbuch.pdf?__blob=publicationFile&v=9> (in German). The following sources were referred to for "Work 4.0" in this chapter: Kenji Takahashi, "Employment policies over IoT and AI in Germany: New debate related to German labor law over Work 4.0," *DIO RengoSouken Report*, No.329, 2017.9,

organizations, intellectuals, and citizens, which began in April 2015,[48] to consider future employment policies in view of "Industry 4.0," as is evident from its title.

"Work 4.0" and "German Labour Market 2030," [49] a survey report put together prior to it, both expect economic growth and an increase in jobs in the labor market, if Germany promotes "Industry 4.0" and focuses on digitalization utilizing AI and robotics (digitalization promotion scenario).[50] Specifically, both argue that although about 750,000 jobs will be lost in 27 areas (e.g., retail, papermaking, printing, public services), about 1 million jobs will be created in 13 areas (e.g., electronic optical machinery, IT, R&D), and there will be an increase of about 250,000 jobs compared to 2014.[51]

Both high-skilled jobs and low-skilled jobs increased from 2002 to 2014 in the EU, Japan, and the US, whereas middle routine jobs, which are jobs for routine tasks decreased, already resulting in bipolarization.[52] "Work 4.0" explains that such bipolarization has not been seen in Germany to this point.[53] However, it shows strong concern over the possibility of job bipolarization and widened gaps among workers in the future.

Bering this forecast in mind, to realize "good-quality jobs" (Gute Arbeit) in the future, "Work 4.0" presents five policy goals, such as maintaining employability over the entire career of each person, even if digitalization changes the labor market and society. As one of the concrete policy challenges, "Work 4.0" cites the improvement of continuous education and training called "Weiterbildung" so that employed workers can maintain and acquire the necessary knowledge and skills according to changes in the external environment. Weiterbildung are currently provided by occupational schools, technical schools, universities, and private organizations such as labor unions, and they are not necessarily appropriate programs. Therefore, "Work 4.0" suggests formulating comprehensive strategies at national-level conferences where the government, labor unions, and companies participate to reconstruct the overall Weiterbildung system. It also suggests covering the cost of education and training with unemployment insurance, stating "from unemployment insurance to insurance for labor."

"Work 4.0" also cites the reinforcement of the labor relations system so that representatives of workers can participate in the processes and procedures for changing work styles and corporate organizations, as an important policy goal to realize "good-quality jobs."

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pp.26-29. <http://www.rengo-soken.or.jp/dio/pdf/dio329.pdf> (in Japanese); Yota Yamamoto, "Changes in work styles caused by the fourth industrial revolution and issues surrounding labor law policy: What German "Work 4.0" white paper proposes," *Business Labor Trend*, 2017.8 & 9, pp.46-53. <http://www.jil.go.jp/kokunai/blt/backnumber/2017/0809/046-053.pdf> (in Japanese).

48 "Weißbuch Arbeiten 4.0 - Diskussionsentwurf." Arbeiten 4.0 Website (Bundesministerium für Arbeit und Soziales) <http://www.arbeitenviernull.de/dialogprozess/weissbuch.html> (in German).

49 Kurt Vogler-Ludwig et al., *Arbeitsmarkt 2030 - Digitalisierung der Arbeitswelt: Fachexpertisen zur Prognose 2016*, Economix Research & Consulting, 2016. (Im Auftrag des BMAS) <https://doi.org/10.3278/6004559w> (in German). As explanatory mateiral in Japanaese, refer to "Prediction of 2030 labor market: Report commissioned by Federal Ministry for Labour and Social Affairs," 2016.11. Japan Institute for Labour Policy and Training Website <http://www.jil.go.jp/foreign/jihou/2016/11/germany_01.html> (in Japanese).

50 In terms of the labor market prediction, the "base scenario," which is focused on the supply of labor by immigrants against the background of the declining birthrate and aging population, and "digitalization promotion scenario," which is focused on the promotion of digitalization, are analyzed.

51 Bundesministerium für Arbeit und Soziales, *op.cit.*(47), p.48 (in German).

52 OECD, *op.cit.*(11), p.1.

53 Bundesministerium für Arbeit und Soziales, *op.cit.*(47), p.53 (in German).

5. Summary

In Europe, industrial digitalization utilizing AI and robotics is anticipated to drive economic growth. The EU and the German government position this area as one of the pillars of their industrial policies. In terms of the relationship between AI/robotics and employment/labor, the EU presumes that jobs will increase through the promotion of digitalization, and detailed discussions are being held pertaining to social security systems and group labor relations systems so that people can development occupational skills that can adapt to job bipolarization.

Fumiko Kudo, Makaira KK

III AI and Employment Issues in France

1. Occupational consciousness and employment status in France

Occupational consciousness in France is very different from that in Japan. As a national trait of French people, they put great value on leisure and vacation. In France, people do not associate much with their peers after work or on weekends and have a low sense of belonging to their workplace (group).[54] The current French labor law sets working hours at 35 hours per week (1607 hours per year) and maximum 10 hours per day.[55] The law also sets paid vacation time for 2.5 days a month (30 days per year) irrespective of the employment pattern (nonfixed-term employment contract, fixed-term employment contract, temporary employment).[56] The average total working hours per year per French person is low by international standards, and the number of days off per year is high.[57]

They are very conscious about becoming pensioners after retirement, and the employment rate of the elderly is low among major nations.[58]

Regarding the employment status of France, we can see that France has been faced with mass unemployment for the past 30 years.[59] France constantly shows a higher unemployment rate[60] than Japan; the rate was 6.4% in 1980 (2.0% in Japan in the same year), 8.4% in 1990 (2.1% in Japan), 9.2% in 2000 (4.7% in Japan), and 9.3% in 2010 (5.1% in Japan).[61] The overall unemployment rate was 9.3% in the

[54] "Worker consciousness: France, Occupational consciousness of French people," 2005.4. Japan Institute for Labour Policy and Training Website <http://www.jil.go.jp/foreign/labor_system/2005_4/france_01.html>. (in Japanese)

[55] "Durée de travail du salarié à temps plein," 2016.10.28. Service-Public.fr Website <https://www.service-public.fr/particuliers/vosdroits/F1911>. According to Code du travail, L.3121-18, L.3121-27, and L.3121-41. (in French)

[56] "Congés payés," 2017.12.4. Service-Public.fr Website <https://www.service-public.fr/particuliers/vosdroits/F2258>. According to Code du travail, L.3141-3. (in French)

[57] Japan Institute for Labour Policy and Training (ed.), *Data Book: International Labor Comparison 2017*, Japan Institute for Labour Policy and Training, pp.201-202.
<http://www.jil.go.jp/kokunai/statistics/databook/2017/documents/Databook2017.pdf>. (in Japanese)

[58] Same as above, pp.78-81.

[59] Marine Rabreau, "Qui sont les chômeurs en France?" *Le Figaro*, 2015.12.16. <http://www.lefigaro.fr/economie/le-scan-eco/decryptage/2015/12/16/29002-20151216ARTFIG00013-qui-sont-les-chomeurs-en-france.php>. (in Japanese)

[60] This refers to the proportion of unemployed people among the labor force population.

[61] "World Economic Outlook Databases (October 2017 Edition)," 2017.10.10. International Monetary Fund Website <http://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx>.

first quarter of 2017 (2.9% in Japan), and the unemployment rate among young people (aged 15-24) is even higher than that among other age groups, at 21.8%.[62]

2. French government initiatives pertaining to employment and AI

A report published in January 2017 by the Employment Advisory Council (Conseil d'orientation pour l'emploi: COE), which consists of intellectuals, labor relations representatives, representatives of government agencies, and members of parliament under the control of the Prime Minister. The report discusses employment issues in general, presented the council's perception of employment and AI in France as follows.[63]

- Less than 10% of existing jobs are vulnerable to extinction due to AI.
- The contents of half of the current jobs may change significantly due to automation and digitalization.
- Technology progress would continue to favor skilled and highly qualified employment.

Based on this perception, the French Minister for the Digital Sector and Innovation and Minister of Higher Education and Research initiated an activity called "France AI (France IA) in January 2017." In addition to government officials and researchers, representatives of the private sector participated in discussions regarding the (1) status of AI-based innovation, (2) impact on society and the economy, and (3) ways to perform job training and research in the future.[64] A report put together in March 2017 entitled "France IA" states that AI will no doubt significantly change current jobs and economic activities, whereas there is an expectation of employment creation by AI.[65] The report also suggests enriching job training for workers after being employed and creating a society where people can change jobs flexibly.

The report also recommends that France not only develops the use of AI within the country but also takes a leadership role within the EU, and for this purpose it is necessary to build an attractive environment for overseas researchers, investors, and entrepreneurs. In particular, it is aiming for the creation and cultivation of AI-related start-ups (ventures).

At about the same time as "France AI," the Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques (OPECST), which was established within parliament to evaluate science and technology activities and relevant policies, composed by senators and deputies, published a report

[62] The National Institute of Statistics and Economic Studies, ,"The unemployment rate decreased by 0.4 points in Q1", Informations Rapides, No.131, 2017.5.18. <https://www.insee.fr/en/statistiques/2851778>

[63] Conseil d'orientation pour l'emploi, *Automatisation, numérisation et emploi Tome 1: les impacts sur le volume, la structure et la localisation de l'emploi (Synthèse)*, 2017.1, pp.2-3, 7. <http://www.coe.gouv.fr/IMG/pdf/COE_170110_Synthese_du_rapport_Automatisation_numerisation_et_emploi_Tome_1.pdf>. (in French)

[64] "Lancement de France I.A., stratégie nationale en intelligence artificielle," 2017.1.23. Ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation (Website) <http://www.enseignementsup-recherche.gouv.fr/cid112129/lancement-de-france-i.a.-strategie-nationale-en-intelligence-artificielle.html>. (in French)

[65] Ministère de l'économie et des finances et al., *France Intelligence Artificielle - Rapport de synthèse*, Ministère de l'éducation nationale, de l'enseignement supérieur et de la recherche, 2017.3, p.16. <https://www.economie.gouv.fr/files/files/PDF/2017/Rapport_synthese_France_IA_.pdf>. (in French)

containing recommendations similar to "France AI," such as the creation of European Champions and enrichment of education and job training.[66]

3. Supports for start-ups in France

It is said that there are over 280 start-ups utilizing AI in France at the moment.[67] In addition, there have been quite a few start-ups that have continued to succeed and grow in the area of IT in recent years both in France and overseas, such as BlablaCar providing ride-share services (established in 2006), Drivy providing car-sharing services among individuals (established in 2010), and Criteo handling digital ads (established in 2005).

Considering the current situation that these IT-related growth industries and new companies are producing half of new jobs, the French government places great expectations on start-ups and thus launched a support program.[68] Specifically, the initiative "French Tech (La French Tech)" initiated by the French government was launched to facilitate the creation and growth of start-ups in November 2013.[69] French Tech is a collective term for a series of activities where entrepreneurs, investors, financial institutions, research institutions, and government agencies cooperate with each other. It is designed to (1) build a network related to start-ups mainly in major cities, (2) promote the growth of start-ups, and (3) encourage globalization. Concrete activities include "Pass French Tech"[70] for accrediting high-growth businesses and providing prioritized support from participating institutions, "French Tech Visa"[71] for simplifying and expediting visa (entry permit) application procedures for excellent foreign human resources and investors, and "French Tech Hub,"[72] which is an overseas base for supporting the overseas expansion of start-ups. In France, 13 cities where there are very active start-up activities are labeled as "Métropole French Tech."[73] In one of them, La French Tech Rennes St-Malo, the number of new employees in IT-related businesses in 2016 was 950, for example.[74] Moreover, 66 businesses were supported by Pass French Tech between 2015 and 2016, and the number of new employees in 2015 was

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66 Claude De Ganay and Dominique Gillot, *Pour une intelligence artificielle maîtrisée, utile et démystifiée - Tome I*, L'Office parlementaire d'évaluation des choix scientifiques et technologiques, 2017.3.15, pp.121, 209-210. <http://www.senat.fr/rap/r16-464-1/r16-464-11.pdf>. For the summarized version of this report in English, see Claude De Ganay and Dominique Gillot, *Toward a Controlled, Useful and Demystified Artificial Intelligence*, L'Office parlementaire d'évaluation des choix scientifiques et technologiques, 2017.4. <http://www.senat.fr/rap/r16-464-1/r16-464-1-syn-en.pdf>.

67 "Discover 250+ French startups leveraging AI in a variety of applications." France is AI (Website) <http://franceisai.com/startups/>.

68 Shigeo Okamoto, "French government focusing on start-ups," *Telecommunication*, 2016.11, p.64. National Institute of Information and Communications Technology Website <https://www.nict.go.jp/global/pdf/TC201611.pdf>. (in Japanese)

69 "La French Tech: une ambition collective pour les start-up françaises," 2017.5.15. (Last Update) Gouvernement.fr Website <http://www.gouvernement.fr/action/la-french-tech-une-ambition-collective-pour-les-start-up-francaises>. (in French)

70 "Pass French Tech." La French Tech (Website) <http://www.lafrenchtech.com/en-action/pass-french-tech>. (in French)

71 "What is French Tech Visa?" French Embassy in Japan Website <https://jp.ambafrance.org/article11805>; French Tech Visa Website < https://visa.lafrenchtech.com/>.

72 "Les Hubs French Tech à l'international," La French Tech Website <http://www.lafrenchtech.com/en-action/les-french-tech-hubs-linternational>. (in French)

73 "Les Métropoles French Tech" La French Tech Website <http://www.lafrenchtech.com/en-action/le-label-metropoles-french-tech>. (in French)

74 "French Tech Rennes: 950 emplois créés dans le numérique en 2016," *La Tribune*, 2017.4.15. <https://www.latribune.fr/regions/bretagne/french-tech-rennes-950-emplois-crees-dans-le-numerique-en-2016-685922.html>. (in French)

1,123.[75] The number of new start-ups increased by 30% to 9,400 between 2012 and 2015 (the increase in general new companies was 3% during the same period).[76]

Further, Xavier Niel, who is a founder of a leading communication company in France called Iliad, invested 250 million euro (about 33.3 billion yen[77]) of his own money and started the world-largest incubation facility with a 3,000-seat office space called "Station F" in June 2017.[78]

As a result of these public-private initiatives, the total amount invested in ventures in France doubled from 1 billion euro (about 133 billion yen) in 2014 to 2.4 billion euro (about 319 billion yen), and young people are more motivated to start new companies, which resulted in over 10,000 start-ups.[79]

4. Empirical experiment of a new economic system

In addition to efforts to create new businesses like French Tech and to promote industrial digitalization, France is working on an experiment of a new economic model to address changes in society and the economy caused by AI. For example, in Seine-Saint-Denis department, a suburb of Paris, an empirical experiment is being conducted to assess a new system called "le revenu contributif," which replaces conventional salary as a payment for labor performed.[80] This is modeled after a freelance system called "régime d'intermittent du spectacle."[81] Here, individuals' activities that benefit the community, such as volunteer activities or participation in social activities (e.g., road construction), are calculated as activity hours to receive benefits (e.g., vacation, unemployment allowance, job training, pension) of social rights (droit social).[82]

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IV AI, Robotics, and labor in the Chinese Workplace

1. The IT and Internet Industries Create New Employment Trends in China

In 2017, the Chinese government announced a registered unemployment rate of 3.95% in Chinese cities. It is the lowest one in years. Accounting for the decrease is the creation of 7.35 million new jobs in the first half of 2017, an increase of 180,000 jobs compared to the first half of 2016. Despite these

[75] Rapport d'activité 2015-2016, L'agence du numérique Website <https://agencedunumerique.gouv.fr/wp-content/uploads/2017/03/20170321_Rapport-dactivite-Agence-du-Numerique.compressed-2.pdf>. (in French)
[76] *Ibid.*
[77] Converted at 1 euro = 133 yen (Ministerial ordinance rate for December 2017). The same applies hereinafter.
[78] Station F (Website) <https://stationf.co/>; "Counter attack of the French digital industry: Volume 2, World largest VB base about to become reality, connecting entrepreneurs and investors," Nikkei Sangyo Shimbun, 2017.6.21, p.7. (in Japanese)
[79] French Tech Visa Website *op.cit.*(71)
[80] "Plaine commune veut tester le revenu contributif," 2017.1.11. Le Parisien Website <http://www.leparisien.fr/villetaneuse-93430/plaine-commune-veut-tester-le-revenu-contributif-11-01-2017-6554634.php>.
[81] In régime d'intermittent du spectacle, actors, dancers, musicians, technicians, and so forth working in the entertainment industry can receive support and unemployment allowances from the government if they work 507 hours per year. They can receive the benefits for 12 months from the day of the termination of their contract in principle, but this varies a little by job type. The amount of compensation varies according to the work hours and the wages received during employment. "Indemnisation chômage des intermittents du spectacle: conditions à remplir," 2017.5.12. Service-Public-Pro.fr Website <https://www.service-public.fr/professionnels-entreprises/vosdroits/F14098>. (in French)
[82] "Revenu de base et revenu contributif, deux projets complémentaires," 2016.1.9. Mouvement Français Pour un Revenu de Base Website <http://revenudebase.info/2016/01/09/9294/>. (in French)

improvement, the Chinese government is still concerned with: 1) the lack of skilled labor, and 2) the re-employment of laid-off workers.[83]

These concerns are further echoed by 97% of Chinese employers surveyed by Hays, a global recruitment firm, noting their struggle to find skilled workers and predicted the situation will likely worsen[84]. Perhaps accounting for the difficulty in attracting skilled labor, is a large wages gap between the real increase in wage and workers' growing wage expectations outside of competitive industries.[85] Looking at the average salary by industry in 2016, it appears that the IT industry now exceeds the financial industry, which is the highest paying among all industries. Other industries do not appear to be offering similar increases, making other industries less competitive for skilled workers.[86] And yet, the IT industry in China is still unable to fill its ranks with local workers. Despite offering competitive salaries and lucrative positions, it faces a shortage of suitable candidates.

The concerns expressed by both government officials and surveyed employers about the acute shortage in skilled labor can be attributed to the meteoric rise of labor demand in the IT and Internet sectors, which still exceed skilled labor supply. In the second quarter (Q2) of 2017, a survey conducted by the China Institute for Employment Research at Renmin University and Zhaopin limited, a Chinese career platform, concluded that Chinese labor demands exceed labor supply across numerous industries. The "Internet and e-commerce" sectors top that list, as labor demand in the IT and Internet sectors increased by 36% in Q2 of 2017, as compared to Q2 of 2016.[87]

Aware of this occupational predicament, the Chinese university system has already began preparing the next generation of skilled workers for a hi-tech career. A survey by Universum Global, an international human resource consulting company, shows that the most popular industries for Chinese graduate students in 2017 were the IT and Internet sectors, which include e-commerce and social media platforms, among other lucrative businesses. Following the same trend, the survey showed that the popularity of the information and communication technology (ICT), and software industries is also increasing.[88]

In line with China's growing labor market needs, the Chinese Premier, Li Keqiang, declared a boost for "mass entrepreneurship and innovation", and both central and local the Chinese governments have announced several venture support measures, including the establishment of a large fund for venture investments.[89] As aid to manual industrial production decreases with growing automation, local

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[83] "China reports lowest urban unemployment rate in recent years," Xinhuanet, 2017.7.28. <http://news.xinhuanet.com/english/2017-07/28/c_136480724.htm>

[84] Maggie Zhang, "Hays survey expects more, better paid Chinese jobs in 2017," South China Morning Post, 2017.2.17. <http://www.scmp.com/business/china-business/article/2071805/hays-survey-expects-more-better-paid-chinese-jobs-2017>

[85] *ibid.*

[86] Eva Li, "It's official: China's highest-paying jobs have shifted to tech from finance," South China Morning Post, 2017.5.31. <http://www.scmp.com/news/china/economy/article/2096312/its-official-chinas-highest-paying-jobs-have-shifted-tech-finance>

[87] Zhaopin Limited, "China labor market continued to improve in the second quarter of 2017," 2017.7.20. PR Newswire Website <https://www.prnewswire.com/news-releases/china-labor-market-continued-to-improve-in-the-second-quarter-of-2017-300491357.html>

[88] Universum, *China's Most Attractive Employers 2017*, 2017, p.9. <http://universumglobal.com/rankings/china>

[89] "China to further promote innovation and entrepreneurship," 2017.7.12. The People's Republic of China The State Council Website <http://english.gov.cn/premier/news/2017/07/12/content_281475723086902.htm>; 国务院「国务院关于大力推进

governments are also instructed to create funds to support graduate students in opening independent businesses and offer single grants to job seekers who demonstrate difficulties in finding employment. In addition, local governments will be extending internship subsidiaries to students in secondary occupational schools, distant and poverty-stricken areas, and old industrial centers outmatched by automation.[90]

2. Concerns about Job Loss and Automation

The Chinese Manufacturing Promotion Plan, "Made in China 2025",[91] is aiming at creating an innovative manufacturing industry by utilizing China's growing IT industry to improve the efficiency, product quality, and volume of Chinese manufacturing and production. This plan is more essential for the Chinese economy than meets the eye. While the hi-tech industry has many jobs and not enough qualified employees, the manufacturing industry is also struggling with many jobs and fewer candidates. But this shared struggle is caused by the opposite reason, an increase in over-skilled workers with higher salary expectations. As such, automation is crucial for Chinse industrial productivity.

A survey led by Wuhan University found that increasing salaries and labor mobility rates make it impossible for Chinese factories to stay profitable, with many going out of business. In response, 40% of surveyed employers have turned to automated manufacturing and production.[92] Overall, reports show that over 600 companies are looking to automate their factories in China to reduce costs and increase efficiency. This will further exacerbate China's unemployment problem, as robots purchasing rates continue to rise among Chinese companies.[93] IT research company IDC predicts the industrial robots market worth will reach almost 60 billion USD by 2020, with China accounting for 30% of the global market.[94] This makes China the world's largest country in terms of automation demand and consumption.[95]

A report by the German Mercator Institute for China Studies addresses the implications of such massive job loss to automation, and claims that the Chinese government is not yet ready to integrate

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大众创业万众创新若干政策措施的意见」（国发〔2015〕32 号）2015.6.16. <http://www.gov.cn/zhengce/content/2015-06/16/content_9855.htm>

[90] "More job assistance to focus on vital areas," 2017.4.9. The People's Republic of China The State Council Website <http://english.gov.cn/premier/news/2017/04/06/content_281475618173320.htm>

[91] 国务院「国务院关于印发《中国制造 2025》的通知」（国发〔2015〕28 号）2015.5.8. <http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm>, Scott Kennedy, "Made in China 2025," 2015.6.1. Center for Strategic and International Studies Website <https://www.csis.org/analysis/made-china-2025>

[92] "China Employer-Employee Survey Releases First Report," 2017.6.20. Hong Kong University of Science and Technology Institute for Emerging Market Studies Website <http://iems.ust.hk/updates/press-release/china-employer-employee-survey-releases-first-report>

[93] Mandy Zuo, "Rise of the robots: 60,000 workers culled from just one factory as China's struggling electronics hub turns to artificial intelligence," *South China Morning Post*, 2016.5.21. <http://www.scmp.com/news/china/economy/article/1949918/rise-robots-60000-workers-culled-just-one-factory-chinas>

[94] Bien Perez, "Manufacturing automation to drive China's robotics spending to US$59b by 2020, says IDC," 2017.4.4. South China morning Post <http://www.scmp.com/tech/china-tech/article/2084740/manufacturing-automation-drive-chinas-robotics-spending-us59b-2020>

[95] International Federation of Robotics, Executive Summary World Robotics 2017 Industrial Robots, 2017, p.23. <https://ifr.org/downloads/press/Executive_Summary_WR_2017_Industrial_Robots.pdf> However, the number of industrial robots operated per 10,000 workers (referred to as "robot density") is about the same as 66 units in the year 2016, and there are considerable differences from 66 units in the world, Korea (No. 1 in the world), 631 units in Germany, 309 units in Germany (third largest in the world), and 303 units in Japan (fourth largest in the world). 「外经济学家：中国机器人出货量猛增 将对全球经济造成威胁」2017. 8. 24. 中国机器人产业联盟 <http://cria.mei.net.cn/news.asp?vid=3680>

unskilled workers back into the workforce after losing their now automated jobs. This is due to lacking, but much needed, mid-career training schemes. The authors also question the ability of the technology to produce as many jobs as it takes in the short run. This leaves many unskilled workers with employment insecurity, and will likely burden the Chinese government and its plans to achieve smart automation by 2025.[96]

3. China's Plans to Become an AI-Enhanced Nation

Investments in AI in China continue to increase.[97] The State Council of the People's Republic of China has released its new "Next Generation of AI development plan"[98] on July 20th, 2017. The plan is set to address three key aspects of cultivating a robust Chinese AI market: 1) allocating resources to basic research and development, 2) investing in key AI applications for private and public products, and 3) supporting the growth of a robust AI industry through positive regulation and financial means. This plan also looks to attract new talent from overseas, synergize China's commercial and military AI applications, and invest in education and training to enhance the quality and quantity of Chinese talent.

With labor demand already far exceeding supply in the Chinese AI market, companies are showing notable global expansion with many opening AI labs overseas and bringing foreign AI experts to China. Many Chinese companies are rapidly diversifying their business by utilizing AI, and are therefore investing heavily into dominating the field at home and abroad by competing for talent and product development.[99] In addition, China is now ranked second in the world in the number of patent applications related to artificial intelligence. The country is experiencing a meteoric rise in AI development due to the abundance of data available from an estimate of 1.4 billion citizens, collected and analyzed by AI-oriented local IT and Internet companies.[100] China is catching up on basic AI research as well. In 2016, it surpassed the US and became the world's largest producer of academic papers mentioning 'deep learning',[101] and more fundamental research on AI is starting to take place at a growing number of Chinese universities.[102]

Further supporting China's emphasis on basic research, the Chinese minister of Science and Technology announced that a special government fund to promote fundamental research and support the

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96 Jost Wübbeke et al., "Made in China 2025: The making of a high-tech superpower and consequences for industrial countries," *MERICS Papers on China*, No.2, 2016.12, p.8. <https://www.merics.org/sites/default/files/2017-09/MPOC_No.2_MadeinChina2025.pdf>

97 Mark Bergen and David Ramli, "China's plan for world domination in AI isn't so crazy after all," Bloomberg Technology, 2017.8.15. <https://www.bloomberg.com/news/articles/2017-08-14/china-s-plan-for-world-domination-in-ai-isn-t-so-crazy-after-all>

98 国务院「新一代人工智能发展规划的通知」2017.7.20. <http://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm>

99 Meng Jing, "Chinese firms fight to lure top artificial intelligence talent from Silicon Valley," *South China Morning Post*, 2017.4.2. <http://www.scmp.com/tech/china-tech/article/2084171/chinese-firms-fight-lure-top-artificial-intelligence-talent-silicon>

100 "China may match or beat America in AI," *Economist*, 2017.15. <https://www.economist.com/news/business/21725018-its-deep-pool-data-may-let-it-lead-artificial-intelligence-china-may-match-or-beat-america>

101 Brian Fung, "China has now eclipsed us in AI research," Washington Post, 2016.10.13. <https://www.washingtonpost.com/news/the-switch/wp/2016/10/13/china-has-now-eclipsed-us-in-ai-research/>

102 Sarah Zhang, "China's artificial intelligence boom," Atlantic, 2017.2.16. <https://www.theatlantic.com/technology/archive/2017/02/china-artificial-intelligence/516615/>

"Next Generation of AI development plan" will be established.[103] Alongside strong government support for basic research, China's industry is also taking initiative in this area alongside universities. A case in point of this trend in academic – industrial collaboration is the establishment of China's first national lab for brain-like artificial intelligence at the China University of Science and Technology. This lab was established in collaboration with Fudan University, the Shenyang Institute of Automation at the Chinese Academy of Science, and Baidu, one of China's largest Internet companies and AI leader.[104]

4. The Ethical Discussion of AI in China

The "Next Generation of AI development plan" calls to "launch research on AI behavior science and ethics and other issues, establish an ethical and moral multi-level judgement structure and human-computer collaboration ethical framework." It also calls to "develop an ethical code of conduct and R&D design for AI products, strengthen the assessment of the potential hazards and benefits of AI, and build solutions for emergencies in complex AI scenarios."

However, the ethical discussion of AI technologies in China is still in early stages, and is in the process of assuming a Chinese identity according to social needs and government planning. Since the publishing of the plan, the Tencent Research Institute has launched the "AI for Social Good",[105] and a number of local Chinese conferences have hosted speeches and panels about the topic in recent months.[106] More debates are starting to emerge in private Chinese circles with growing interest in the field.

Finally, it is important to note that the plan also stresses the need to develop AI in a controllable manner to ensure safety and minimize potential risks. This implies that in the future, discussions on AI ethics and regulation, applied to Chinese ethical thought and governance frameworks, will become more common and robust in China.

Danit Gal, Keio University

V Technological Innovation and Employment

In this and next few chapters, we will overview arguments regarding the cultivation, use, and management of human resources. We will describe what kind of personnel affairs, employment, and management systems today's businesses employ to use and manage human resources with respect to changes caused by AI in work styles and work environments, and we will introduce cases both in Japan and overseas. We will also discuss the statuses of support and regulations from the legal and institutional perspective.

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[103] Meng Jing, "Beijing to release national artificial intelligence development plan," South China Morning Post, 2017.3.12. <http://www.scmp.com/tech/article/2078209/beijing-release-national-artificial-intelligence-development-plan>

[104] "China sets up national lab developing brain-like AI technology," Xinhuanet, 2017.5.14. <http://news.xinhuanet.com/english/2017-05/14/c_136282675.htm>

[105] 「Tech for Social Good 科技向善 | T 项目发布」2018. 1. 10. 腾讯研究院 <https://mp.weixin.qq.com/s/7fYPb6394zC4GHN9ILA51Q>

[106] The 2017 Global Festival for A.Ideas Website <http://aideas.toutiao.com/index.html>

1. Influence of technological innovation

Since the advent of industrial society brought about by the Industrial Revolution, which took place in the UK, technological innovations have been constantly seen in the industrial arena. Technological innovations can sometimes lead to the elimination of jobs, but the influence of unemployment can be curbed if the number of jobs created by new technologies exceeds the number of jobs lost and labor movement is achieved. Indeed, during the Industrial Revolution, the number of jobs for craft workers in the textile industry decreased dramatically, but the heavy demand for workers in factories absorbed the loss (reallocation of human resources among industries and among businesses). On the other hand, if we look at post-war Japanese companies, they have maintained the long-term employment of regular employees (so-called permanent employment), which is considered an employment system unique to Japan, by addressing the needs for new skills brought about by technological innovations with personnel-related measures, such as job training and reallocation within the company.

Thus, the influence of technological innovations on employment is substantially affected by the liquidity of the labor market in each country (easiness of labor movement) and the employment system of each company (personnel system). Among them, the Japanese-style employment system has high adaptability to external environment changes, including technological innovation, and its structure did not easily lead to unemployment.

2. Influence of advanced technologies, including AI

In general, technological innovation affects the streamlining of tasks, but if it progresses further, jobs will be replaced by machines. This applies to today's advanced technologies, including AI. For example, tasks in which it is clear what is right can easily be replaced by AI, as long as we can input an abundance of "right data" because AI can perform the tasks more efficiently.[107] The tasks that Japanese white-collar workers perform are considered highly likely to be replaced by AI. According to a study, nearly 100% of jobs centered around routine desk work can be replaced.[108]

If the tasks that people perform will be limited due to advancements in AI and the like, the ability to reallocate personnel within a company will be limited, and the Japanese-style employment system, mentioned above, will be difficult to maintain. As today's technological innovations, mainly AI, progress rapidly, skills are likely to become outdated instantly even if companies have their employees learn the skills through on-the-job training. Thus, businesses may decide not to invest in such training, which will raise a question of who will perform human resources development.[109]

3. Influence of the advancement of information and communication technology

Owing to the advancement of information and communication technology (ICT), an environment where people can work anywhere by accessing information at any time and from anywhere is becoming a

[107] Noriyuki Yanagawa, et al., "Advantages of humans and management in the era of AI," *NIRA Opinion Paper*, No.25, 2016.11, pp.5-6. <http://www.nira.or.jp/pdf/opinion25.pdf>. (in Japanese)
[108] Tomota Terada et al., *Who supports the labor force in Japan?* Toyo Keizai, Inc., 2017, Appendix pp.2-18. (in Japanese)
[109] Shinya Ouchi, Work style and law: Looking into the labor law in 2035, Koubundou, 2017, pp.105-108. (in Japanese)

reality. This style of work will lower the need to go to the office and allow for telework (e.g., working at home, mobile work).[110] People will be able to run a business using information devices, such as smartphones, without having a special means of production, which will lower the hurdles to working without being employed and starting a new business.[111]

These phenomena are already spreading overseas. For example, in Europe, a fact-finding survey revealed that there are diverse new forms of employment, as shown in Table 1.

Table 1. New forms of employment in Europe

Forms of employment	Description
Employee sharing	Sharing of employees among multiple employers
Job sharing	Sharing of one post among multiple employees
Voucher-based work	To pay part of the salary with vouchers purchased from the government and the like
Interim management	Workers with specialized skills are hired for a fixed period and engage in a certain project
Casual work	Companies summon people and hire them when necessary
ICT-based mobile work	Teleworker
Crowd employment	Self-employment type of work using crowd sourcing
Portfolio work	Self-employed people provide services to multiple clients
Collaborative employment	Self-employed people provide services in collaboration with each other

(Source) Created by the author based on Eurofound, *New forms of employment*, Luxembourg: Publications Office of the European Union, 2015.
<https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1461en.pdf>.

4. Necessity of new legal rules

Japanese companies have emphasized employing regular employees; thus, they have not been active in the use of new technologies or new forms of employment. As discussed above, however, the Japanese-style employment system characterized by stable employment of regular employees and cultivation of human resources is now becoming difficult to maintain in the face of rapid technological innovations. Now, Japanese companies are required to use various human resources in various ways. Perhaps because of this background, the government has called for diversification of work styles and has encouraged businesses to reconsider prior work practices.[112]

Especially when new technologies, such as AI, replace human tasks, people who can generate added value by using their intellectual creativity, which cannot be done by machines, are desired. However, these people would probably prefer independent work styles, instead of being hired by companies and bound by labor regulations (e.g., work hour regulations).[113] What is now attracting attention from this perspective

[110] According to a survey conducted by the Ministry of Internal Affairs and Communications, 16.6% of companies have already adopted or are planning to adopt telework (2016). Ministry of Internal Affairs and Communications, "Results of the 2016 Communications Usage Trend Survey (Summary)," 2017.6.8, p.16. <http://www.soumu.go.jp/main_content/000489195.pdf>. (in Japanese)

[111] These visions are summarized in "Future of Work: 2035: For Everyone to Shine" Panel "Future of Work: 2035: For Everyone to Shine," 2016.8. Ministry of Health, Labour and Welfare Website <http://www.mhlw.go.jp/file/05-Shingikai-12601000-Seisakutoukatsukan-Sanjikanshitsu_Shakaihoshoutantou/0000132302.pdf>. (in Japanese)

[112] Referenced websites include "Action Plan for the Realization of Work Style Reform" (Decided at the meeting of the Council for the Realization of Work Style Reform on March 28, 2017) Office of Prime Minister Website <https://www.kantei.go.jp/jp/headline/pdf/20170328/01.pdf>. (in Japanese)

[113] Ouchi, *op.cit.* (109), pp.144-145.

is a self-employment type of work style (not employed). Indeed, cases of asking crowd workers, who are individual self-employed workers, to do tasks (crowd sourcing) are also increasing in Japan.[114]

Thus far, self-employed workers have been less protected than unemployed workers. They are not covered by labor law, and they are not covered by employment insurance or workers' accident compensation insurance in terms of social security. In addition, they cannot enroll in employee pension or health insurance programs, where business owners need to pay part of the insurance premiums. People in Europe see that some sort of legal intervention is necessary for the self-employment type of work style at least if it involves an economic dependence, and they have begun discussing whether the protection of workers should be extended to self-employed workers and whether an intermediate legal status between workers and self-employed workers should be acknowledged.[115]

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VI Human Resources and Labor Management by ICT and Its Regulation: Japan and Overseas

1. Introduction

Even before the spread of ICT, employee monitoring was done via supervisor's through visual judgments, daily reports, and the like in order to facilitate the smooth and proper implementation of tasks and maintain corporate order. In labor using ICT, ICT is a tool for labor, but at the same time it can also be a tool for monitoring and record keeping. Such data are used to understand the attendance and working situation of employees for labor control purposes, such as motivation and productivity enhancement, and the results of analyzing such data are also used for personnel evaluation. In this section, we will discuss the use of ICT in employee monitoring and personnel evaluation and the related issues and legal regulations.

2. Use of ICT in employee management and personnel management

According to the Institute of Labor Administration, Japan, 57.7% of surveyed Japanese companies said that they monitor employees' internet connection status, sent and received emails, and operations of devices that they provide to their employees.[116] They can thoroughly monitor and keep records of the activities of employees working away from their office through smartphones and special wearable devices. A Canadian company, Vandrico Solutions, which supplies software for management of workers equipped with wearable devices, sells a system equipped with GPS and integrated with wearable devices that

[114] Ministry of Internal Affairs and Communications (ed.), *2015 White Paper on Information and Communications*, 2015, pp.215-216. <http://www.soumu.go.jp/johotsusintokei/whitepaper/ja/h27/pdf/n4300000.pdf>.

[115] Alain Supiot, *Au-delà de l'emploi*, Nouvelle Édition, Paris: Flammarion, 2016, pp.45-83. Similar discussions are also being held in Japan. "Committee for investigating work forms similar to employment" Ministry of Health, Labour and Welfare Website <http://www.mhlw.go.jp/stf/shingi/other-kintou.html?tid=488802>; Study group of "employment-free work styles," "Report of the study group of 'employment-free work styles'," 2017.3. Ministry of Economy, Trade and Industry Website <http://www.meti.go.jp/report/whitepaper/data/pdf/20170330001-2.pdf>.

[116] Institute of Labour Administration, "Survey of the use of IT devices at work," 2017.8.31, p.3. <https://www.rosei.or.jp/research/pdf/000071316.pdf>. (in Japanese).

monitors the locations and health conditions of employees engaging in dangerous tasks in mineral mines and the like.[117] In addition, dynamic management and dispatching of taxis, sales vehicles, and company cars using GPS are now widely used. A sales assist system is also sold for managing the locations of employees engaging in sales activities using GPS information from their smartphones.

ICT used in the field of personnel management is called "HR Tech (Human Resources Technology)." HR Tech may range from a personnel management tool for coordinating hiring schedules and managing attendance and background information to services and software for analyzing and evaluating personnel records, including attendance management and performance evaluation, supposedly using deep learning and automatically judging the most appropriate types of work or job positions.[118]

Several companies launched wearable devices and its applications which are intended to improve the quality of tasks performed by employees. For example, a system using wearable sensors has been suggested to record the activities of employees, predict interactions among employees and the activeness of the organization, and enhance employees' motivation.[119] There is also an eye-glass-type wearable device that can measure the degree of concentration of employees based on the number of times they blink to support work.[120]

3. Issues and problems

Employees are obligated to provide labor, concentrate on their duties, maintain corporate order, and respect employers' facility management rights through the employment contract between employee and employer. Therefore, employee monitoring can be legally and ethically justified. However, there is a court ruling that if monitoring and record keeping are comprehensive and detailed, then they will put strong psychological pressure on employees, and they should be an invasion of personal rights when there is no consent.[121] The obligation to concentrate on duties is an obligation to sincerely perform tasks based on a labor contract. However, actions that do not actually disturb the tasks allocated by the employer are not necessarily violation of the obligation to concentrate on duties, even during work hours.[122] This is because employees' private sphere, from their private life to their mind, should not be monitored and controlled by the employer.

On the other hand, personnel evaluations using AI, such as deep learning, can be problematic in terms of the biases in the judgments and the fair consideration of individual circumstances. Judgments by machines tend to be regarded as fair, and they can easily hide the biases of designers and operators[123]. By too rigorously following machine judgements, circumstances or elements that need to be considered

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117 Geof Wheelwright, "IoT-linked wearables will help workers stay safe," *Financial Times*, 2017.10.11.

118 Shota Uehara, "With AI, no need for human resources division? Bizreach and Yahoo, optimal allocation using data," Nihon Keizai Shimbun, 2016.6.15, p.11; "Less recruitment tasks using IT, human resources-related companies support streamlining using cloud," Nihon Keizai Shimbun, 2017.8.24, p.14. (in Japanese).

119 Kazuo Yano, Invisible hands of data: Laws of human, organization and society revealed by wearable sensors, Soshisha, 2014, pp.133-175. (in Japanese).

120 「JINS MEME ES」 JINS MEME Website <https://jins-meme.com/ja/products/es/>. (in Japanese).

121 Decision of Tokushima District Court, November 17, 1986, Roudo Hanrei, No. 488, p.46. (in Japanese)

122 Decision of the Third Petty Bench of the Supreme Court, April 13, 1982, Supporting opinion by Judge Masami Ito, Supreme Court Reports (criminal cases), Volume 36, No. 4, p.659. (in Japanese)

123 Batya Friedman and Helen Nissenbaum, "Bias in Computer Systems," ACM Transactions on Information Systems, July 1996, pp.330-347.

individually may be ignored. AI's judgment is derived from correlations, not from cause-and-effect relationships. Therefore, when making personnel evaluations and personnel allocation by using AI, we cannot often present reasonable grounds for the judgment. However, legal issues pertaining to personnel evaluations using AI, including deep learning, have not come to the surface at this point, and no legal regulations have been established[124]. Therefore, we will discuss legal regulations on employee monitoring using ICT hereinafter.

4. Regulations on ICT monitoring of employees in Japan

The Personal Information Protection Commission (Kojin Joho Hogo Iinkai), an independent agency for Japanese government, which supervise and settling dispute over personal information, says that in terms of ICT monitoring of employees in general in relation to tasks involving the handling of personal data, there should be restrictions on the purpose and personnel authorized to perform monitoring, as well as advance notice to and discussions with labor unions, clear definitions in working regulations, and auditing.[125] In light of the intent of the "Act on the Protection of Personal Information" (Act No. 57 of 2003, "Kojin Joho no Hogo ni kansuru Horitsu, " hereinafter "Personal Information Protection Law (Kojin Joho Hogo Ho)"), this prescription applies not only to the monitoring of tasks involving the handling of personal data but also to the monitoring of other tasks.[126] In companies or other institutions, phone numbers, device identification numbers, and IP addresses of employees' smartphones can be easily cross-checked with other information to identify individuals. Therefore, they falls under the "individual identification codes" in Section 2, Article 2 of the Personal Information Protection Law.[127] Therefore, monitoring using the location information services of mobile devices or wearable devises should be treated the same as the monitoring of the above tasks.

We will introduce two of the key court decisions related to this issue, especially on the monitoring of employees' use of emails, although they are given before the Personal Information Protection Law was enacted and lower court decisions..

(1) Monitoring of the use of emails can be permitted in light of employers' facility management rights. Compared with the use of telephones, the scope of privacy protection in emails is significantly reduced. On the other hand, private emails can be permitted within the scope reasonably necessary if they do not interfere with duties and put only a little financial burden on the employer.[128]

(2) To decide whether monitoring of the use of emails is an invasion of employees' privacy, we consider the purpose of monitoring and the appropriateness of its method as well as other aspects (e.g., whether it is monitoring as a duty of a person authorized to supervise employees) in a comprehensive manner.[129]

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[124] Daniel Keats Citron and Frank A. Pasquale, "The Scored Society: Due Process for Automated Predictions," *Washington Law Review*, Vol. 89, 2014, pp. 1-34; Frank A. Pasquale. The Black Box Society, Harvard University Press, 2015.

[125] Personal Information Protection Commission, "Q & A about "Guidelines on the law pertaining to the protection of personal information)" and "About responses in the event of personal data breach," 2017.2.16 (updated on 2017.5.3), p.23 <https://www.ppc.go.jp/files/pdf/kojouhouQA.pdf>. See the section "Supervising of employees" (Q4-6). (in Japanese)

[126] Same as above, pp.4-5. See the section "Personal information" (Q1-17). (in Japanese)

[127] Same as above, p.6. See the section "Personal identification code" (Q1-22). (in Japanese)

[128] Decision of Tokyo District Court, December 3, 2001, Roudo Hanrei, No. 826, p.76. (in Japanese).

[129] Same as above; Decision of Tokyo District Court, February 26, 2002, Roudo Hanrei, No. 825, p.50 (in Japanese).

Similarly, another lower court decision states that monitoring of employees using the location information function of smartphones is illegal except "during working hours when employees are obligated to provide labor," also before the Personal Information Protection Law was enacted.[130]

5. Regulations on ICT monitoring of employees overseas

(1) United States of America

The US has federal laws called "Electronic Communications Privacy Act of 1986 (ECPA)"[131] and "Stored Communications Act (SCA),"[132] which is a part of ECPA. These laws control interceptions of communications in general and do not directly regulate monitoring of employees' communications. Employers must notify employees in advance to monitor their emails in the states of Connecticut and Delaware.[133]According to court rulings, monitoring of emails and web browsing at work is permitted without prior notification to employees when there is due cause, in light of the employers' facility management rights, except in these two states. However, it is illegal to view and save information on employees' private accounts stored on servers owned by a third party outside the workplace without employees' consent.[134]

In addition to these, as state law-based regulations, it is considered illegal in several states (e.g., California, Illinois) for employers to request disclosure of user IDs and passwords that employees use on social media. States such as Missouri and North Dakota have a state law explicitly prohibiting monitoring by implanting radio frequency identification (RFID) tags in employees' bodies.

(2) Canada

The Personal Information Protection and Electronic Documents Act (S.C.2000, c.5) in Canada applies only to federally regulated companies (e.g., airlines, financial institutions). Yet, there is a judgement of the Supreme Court of Canada that employers' monitoring of web browsing is illegal because employees' browsing history contains secrets of the mind when computers at work are allowed or because it is rationally expected to be used for private purposes.[135]

(3) EU

The Article 88 of the General Data Protection Regulation (GDPR),[136] which was applied in May 2018, says to "include suitable and specific measures to safeguard the data subject's human dignity,

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130 Decision of Tokyo District Court, May 31, 2012, Roudo Hanrei, No. 1056, p.19. (in Japanese).

131 Electronic Communications Privacy Act of 1986 (P.L. 99-508)

132 Stored Communication Act (18 USC §§2701-12). This was enacted as part of ECPA (Title II).

133 Brenda R. Sharton and Karen L. Neuman, "The Legal Risks of Monitoring Employees Online," *Harvard Business Review*, 2017.12.4. <https://hbr.org/2017/12/the-legal-risks-of-monitoring-employees-online>.

134 V. John Ella, "Employee Monitoring and Workplace Privacy Law," National Symposium on Technology in Labor & Employment Law, Washington, D.C., April 6,7 and 8, 2016, p.8. <https://www.americanbar.org/content/dam/aba/events/labor_law/2016/04/tech/papers/monitoring_ella.authcheckdam.pdf>.

135 R. v. Cole, 2012 SCC 53, 2012.10.19. Supreme Court Judgments Website <https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/12615/index.do>.

136 "REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)," Official Journal of the Europea

legitimate interests and fundamental rights, with particular regard to the transparency of processing, the transfer of personal data within a group of undertakings, or a group of enterprises engaged in a joint economic activity and monitoring systems at the work place." The GDPR also requires clear "consent" of the data subject when collecting personal data (Article 4 (11) and imposes a severe fine in the event of a violation (Article 83). Thus, in EU countries, employers will be required to adopt the principle of obtaining consent when monitoring employers. Adding to that, according to the survey conducted by an NPO that provides legal information to employees, the consent of employees alone is insufficient because the employer-employee power balance is asymmetrical, a Belgian employment and labor lawyer pointed out.[137]

In September 2017, the European Court of Human Rights gave a ruling that companies must give prior notice to employees when they are going to monitor employees' email accounts.[138]

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VII Development and Recruitment of AI-related Human Resources

1. Current situation surrounding AI-related human resources

(1) Japan

Along with the increase in computing abilities and speed and advancements in cloud and storage technologies, new products and services are being created one after another. The use of big data, IoT, and AI is expected to become increasingly more sophisticated and diversified in the future. As these changes occur, the inability to supply sufficient IT-ready human resources who have advanced skills in IT has become a problem.

The number of IT human resources (human resources belonging to IT vendors, web-related businesses, or the information system department of IT user companies) is expected to take a downward turn in 2019. The aging of such human resources is also expected,[139] which suggests that it is highly likely that the shortage of human resources will become more serious. In particular, there was a shortage of about 15,000 people in terms of advanced IT human resources (those engaging in big data, IoT, and AI) in 2016, and it is estimated that there will be a shortage of about 32,000 people in 2018 and 48,000 people in 2020 (Figure 1).

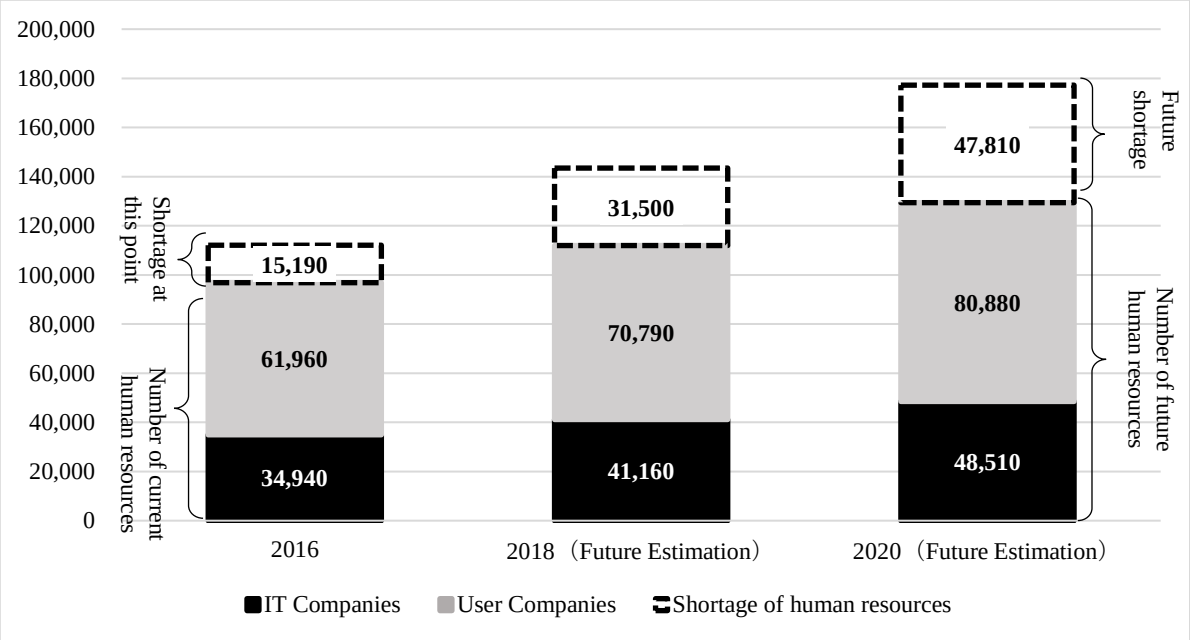
n Union, L119, 2016.5.4, pp.1-88. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679&from=EN>.

137 Employment Law Alliance, "Employee Data Privacy in Europe: The Essentials for Multinational Employers," 2016, p.12. <http://www.employmentlawalliance.com/Templates/media/files/Misc%20Documents/EU-Data-Privacy2016.pdf>.

138 *Judgment: Case of Bărbulescu v. Romania*, European Court of Human Rights, 2017.9.5. <http://hudoc.echr.coe.int/eng?i=001-177082>.

139 Mizuho Information and Research Institute, "Model project for cultivating and securing human resources to promote innovation by IT ventures, etc. Project Report Part 2: Building an estimation model of future demand and supply of IT human resources," 2016.3, pp.30-31. Ministry of Economy, Trade and Industry Website <http://www.meti.go.jp/policy/it_policy/jinzai/27FY/ITjinzai_fullreport.pdf>. (in Japanese).

Figure 1. Shortage of advanced IT human resources and future estimations



(Note) The shortage figure in 2016 was estimated based on web-based questionnaire surveys and hearing surveys, and the shortage figures in 2018 and 2020 are differences between the future human resources demand estimated based on the market growth rate and web-based questionnaire surveys and the future human resources supply estimated based on demographics, the hiring rate, and the turnover rate.

(Source) Created based on Mizuho Information and Research Institute, "Model project for cultivating and securing human resources to promote innovation by IT ventures, etc. Project Report Part 2: Building an estimation model of future demand and supply of IT human resources," 2016.3, p.218. Ministry of Economy, Trade and Industry Website <http://www.meti.go.jp/policy/it_policy/jinzai/27FY/ITjinzai_fullreport.pdf> (in Japanese)

(2) Overseas

There is also a shortage of advanced IT human resources overseas. In the US, AI-related offers are drastically increasing. Of them, 40% are from leading IT companies such as Amazon, Google, Microsoft, IBM, and the Chinese company Huawei.[140] These IT companies and manufacturing businesses such as General Electric (GE), Samsung, and Ford are acquiring venture companies that have AI technology. There is also fierce international competition over AI human resources. For instance, an eminent AI researcher at Google began working for the Recruit Institute of Technology in Japan,[141] while Google announced that the company would begin hiring AI human resources in China.[142] Leading IT companies in China, such as Baidu, Tencent, and Alibaba, are also recruiting top-level AI human resources in Silicon Valley in the US. Moreover, the level of wages for AI human resources is skyrocketing in the US. Wages offered to AI engineers (about 15 million yen) are more than double the wages offered to AI human resources in Japan (about 6.5 million yen).[143]

[140] Stacy Jones, "Automation Jobs Will Put 10,000 Humans to Work, Study Says," *Fortune*, 2107.5.1. <http://fortune.com/2017/05/01/automation-jobs-will-put-10000-humans-to-work-study-says/>.

[141] "Recruit hunts the brain of Google," Nihon Keizai Shimbun, 2017.6.16, p.1. (in Japanese).

[142] "US Google, hiring AI human resources in China to complement task in US," Nihon Keizai Shimbun, 2017.5.25, p.15. (in Japanese).

[143] Information-technology Promotion Agency, White Paper on AI Editorial Committee (ed.), *White Paper on AI 2017: Technological innovation and social changes brought by artificial intelligence*, Kadokawa Ascii Research Laboratories, 2017, p.215. (in Japanese).

The AI industry is also active in hiring people from academia. For example, there are many people with skills related to machine learning technologies and with astrophysics backgrounds at an American machine learning venture called Wise.io.[144] Uber Technologies, an American company providing dispatch services, hired researchers who used to work at the National Robotics Engineering Center (NREC) for its autonomous vehicle research division.[145] Because of these outflows of researchers to the industrial world, there are concerns regarding a shortage of human resources who can promote research and engage in education.[146]

2. Skills required of AI-related human resources

Because people can now obtain much more data (big data) than they were able to in the past, researchers today in the area of AI mainly study "machine learning," which obtains knowledge from big data, and "deep learning," which extracts feature quantities. However, in addition to intelligent informatics, which deals with machine learning and the like, there are various relevant research fields, such as computer science (e.g., algorithm, network), robotics, ontology,[147] cognitive science, and neuroscience.

On the other hand, to use AI in business, abilities to sort out and solve issues are also necessary. The Information-technology Promotion Agency (IPA) has presented the skills required of IT human resources as skill standards for IT professionals "ITSS+." These standards show that skills in "business," "data engineering," and "data science" are necessary in the field of data science where people create value from data using machine learning and deep learning (Table 2). In addition to skills, concrete tasks are also addressed in the skill standards for IT professionals "ITSS+."[148]

Table 2. Skills required in the field of data science

Skill category	Description
Business	Sorting out and solving business issues after understanding the background of the issues
Data science	Understanding and utilizing knowledge of information science, such as information processing, AI, and statistics.
Data engineering	Making data science useful and meaningful to implement and operate it.

(Source) "ITSS+ Data science domain, skill domain, and skill category" (updated on February 1, 2018) Information-technology Promotion Agency Website <https://www.ipa.go.jp/files/000063897.xlsx> (in Japanese)

3. Cultivation and recruitment of AI-related human resources in Japan

As AI businesses are expected to grow, companies in Japan are becoming active in cultivating human resources and hiring new people. For instance, Fujitsu and NEC reeducated their system engineers as AI human resources. Fujitsu is looking to increase its current number of AI human resources by 3.5 times by

144 Wise.io was acquired by GE in 2016. Cade Metz, "Giant Corporations Are Hoarding the World's AI Talent," *WIRED*, 2017.1.3. <https://www.wired.com/2016/11/giant-corporations-hoarding-worlds-ai-talent/>.

145 Anne Steel, "Carnegie Mellon Reels After Uber Lures Away Researchers," *Wall Street Journal*, 2015.6.1. < http://jp.wsj.com/articles/SB12759595096617873597504581020681775312842>.

146 Lauren Dixon, "How Brain Drain from Academia Could Impact the AI Talent Pool," January 11, 2017. Talent Economy Website <http://www.talenteconomy.io/2017/01/11/brain-drain-academia-impact-ai-talent-pool/>.

147 Ontology refers to vocabulary or the basic concept for describing knowledge or the structural relationship for knowledge processing of expert systems and the like.

148 "ITSS+ Data science domain, task" (updated on February 1, 2018), Information-technology Promotion Agency Website <https://www.ipa.go.jp/files/000063897.xlsx>. (in Japanese)

the end of fiscal 2018, while NEC is looking to increase its number of such resources to over 1,000 by 2020.[149] To secure AI human resources that are running short, companies such as Sony, Toyota Motor Corporation, and Hitachi are working on hiring new people not just in Japan but also overseas.[150] On one hand, there are concerns regarding the overflow of domestic AI human resources to overseas companies that have abundant budgets.

There are many systems and courses that help working people and students acquire the appropriate skills. In 2017, the Ministry of Economy, Trade and Industry launched the "System for certifying skill acquisition courses for the fourth industrial revolution," which certifies education and training courses for working people in the areas expected to grow in the future, such as AI, IoT, data science, and cloud computing.[151] In addition, in 2017, the Ministry of Education, Culture, Sports, Science and Technology began the "Data-related human resources development program" to promote the cultivation of human resources who use data-related technologies (e.g., AI, IoT big data, security), targeting students in doctoral courses and those with doctoral degrees.[152]

In terms of universities, Shiga University newly established the Faculty of Data Science in 2017, and Yokohama City University, Hiroshima University, and Kyoto Sangyo University have announced that they will to newly establish a data science-related faculty (course) in 2018.[153] Academia-industry efforts include the Chair for Frontier AI Education of the University of Tokyo (donated by 8 companies) and an AI course jointly provided by Osaka University and Panasonic to cultivate human resources.[154] There are also a variety of efforts in the private sector, such as seminar-type courses provided by ALBERT and BrainPad,[155] a course provided through online movies on the online learning platform called Udemy,[156] and a machine learning study group[157] held by TeamAI, a community for AI engineers.

As future issues related to the cultivation of AI human resources, awareness toward the risks of AI and motivation for the use of AI must be heightened. Compared with other countries, motivation for AI human resources development is low in Japan. According to a questionnaire survey, only 19.4% of companies in Japan are cooperating with external organizations, such as universities and external institutions, to cultivate their own human resources, which is less than half of the share, 41.1%, in the US (Figure 2). According to a survey that asked respondents what kind of AI skills they want to acquire or

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149 "Fujitsu and NEC find talent among SE, reeducating their own IT people for cyber defense and AI reinforcement," *Nihon Keizai Shimbun*, 2017.8.14, p.5. (in Japanese)

150 Information-technology Promotion Agency, White Paper on AI Editorial Committee (ed.), *op.cit.* (143). (in Japanese)

151 Ministry of Economy, Trade and Industry, "METI to Establish a New Program for Certifying Courses on IT-Skill Training to Meet the Era of the Fourth Industrial Revolution" 2017.8.7. <http://www.meti.go.jp/english/press/2017/0807_002.html>

152 Ministry of Education, Culture, Sports, Science and Technology, "Doctoral program for Data-Related InnoVation Expert(D-DRIVE) Data-related human resources development program," 2017.4. <http://www.mext.go.jp/a_menu/jinzai/data/index.htm>. (in Japanese)

153 Yokohama City Policy Bureau, "About the establishment of the faculty of data science at Yokohama City University," 2017.5.29. < http://www.city.yokohama.lg.jp/shikai/pdf/siryo/j1-20170529-ss-11.pdf> (in Japanese); Hiroshima University, "Establishing "<Faculty of Information Sciences> and <Department of Integrated Global Studies> in 2018," 2017.8. <https://www.hiroshima-u.ac.jp/news/38756> (in Japanese); Kyoto Sangyo University, "Faculty of Information Science and Engineering is coming!!" 2017.7.11. <https://www.kyoto-su.ac.jp/news/20170711_195_ise.html>.

154 University of Tokyo, "University of Tokyo establishes Chair for Frontier AI Education," 2016.5.30. <http://www.isi.imi.i.u-tokyo.ac.jp/pdf/IST_Press>; Osaka University, Osaka University and Panasonic to Begin Joint Collaborative Course in Artificial Intelligence," 2016.6.22. < http://www.osaka-u.ac.jp/en/news/topics/2016/06/20160622_01>.

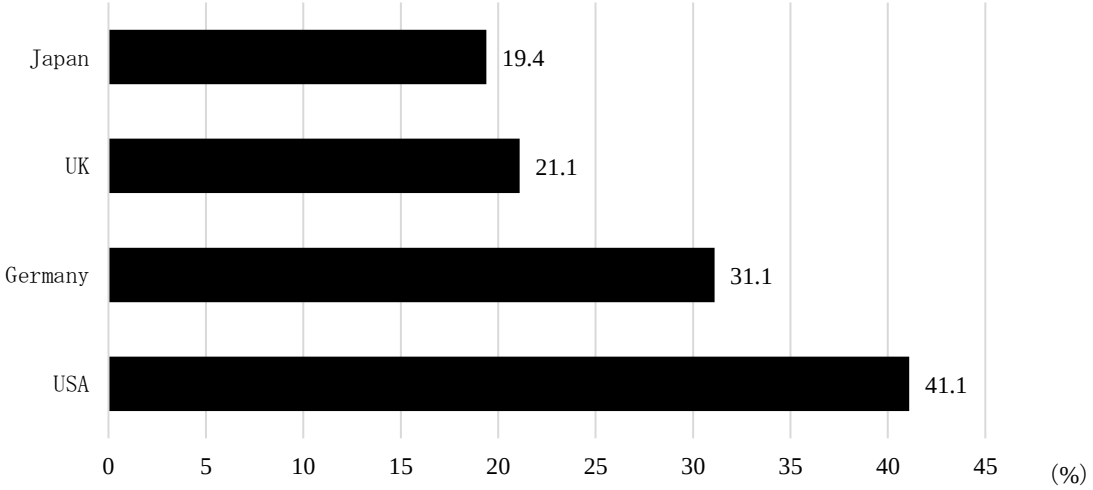
155 "Data Scientist Training Course" ALBERT Website <https://www.albert2005.co.jp/DST/> (in Japanese); "BrainPad Education Course" BrainPad Website <http://school.brainpad.co.jp/> (in Japanese).

156 "Data Scientist Training Course" Udemy Website <http://www.benesse.co.jp/udemy/datascientist/> (in Japanese).

157 TeamAI Website <https://www.team-ai.com/> (in Japanese).

have their children acquire, people in Japan were less motivated to acquire technological competence for using AI, programming skills, implementation skills, creativity, design competence, and engineering capabilities than people in the US. Thus, there is a concern that Japan will miss out on the global wave of the introduction and use of AI and that the gap between Japan and the US will widen, from the perspective of human resources development.[158]

Figure 2. Share of companies cooperating with external organizations to cultivate their employees



(Note) The shares of the UK, Germany, and the US are calculated based on web-based questionnaire surveys conducted with people at the management level, not questionnaire surveys conducted with individual companies.
(Source) Created by the author based on Information-technology Promotion Agency, White Paper on AI Editorial Committee (ed.), *White Paper on AI 2017: Technological innovation and social changes brought by artificial intelligence*, Kadokawa Ascii Research Laboratories, 2017, p.220, 343-344. (in Japanese)

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[158] Ministry of Internal Affairs and Communications (ed.), *2016 White Paper on Information and Communications*, 2017, p.258. <http://www.soumu.go.jp/johotsusintokei/whitepaper/ja/h28/pdf/n4400000.pdf> (in Japanese).