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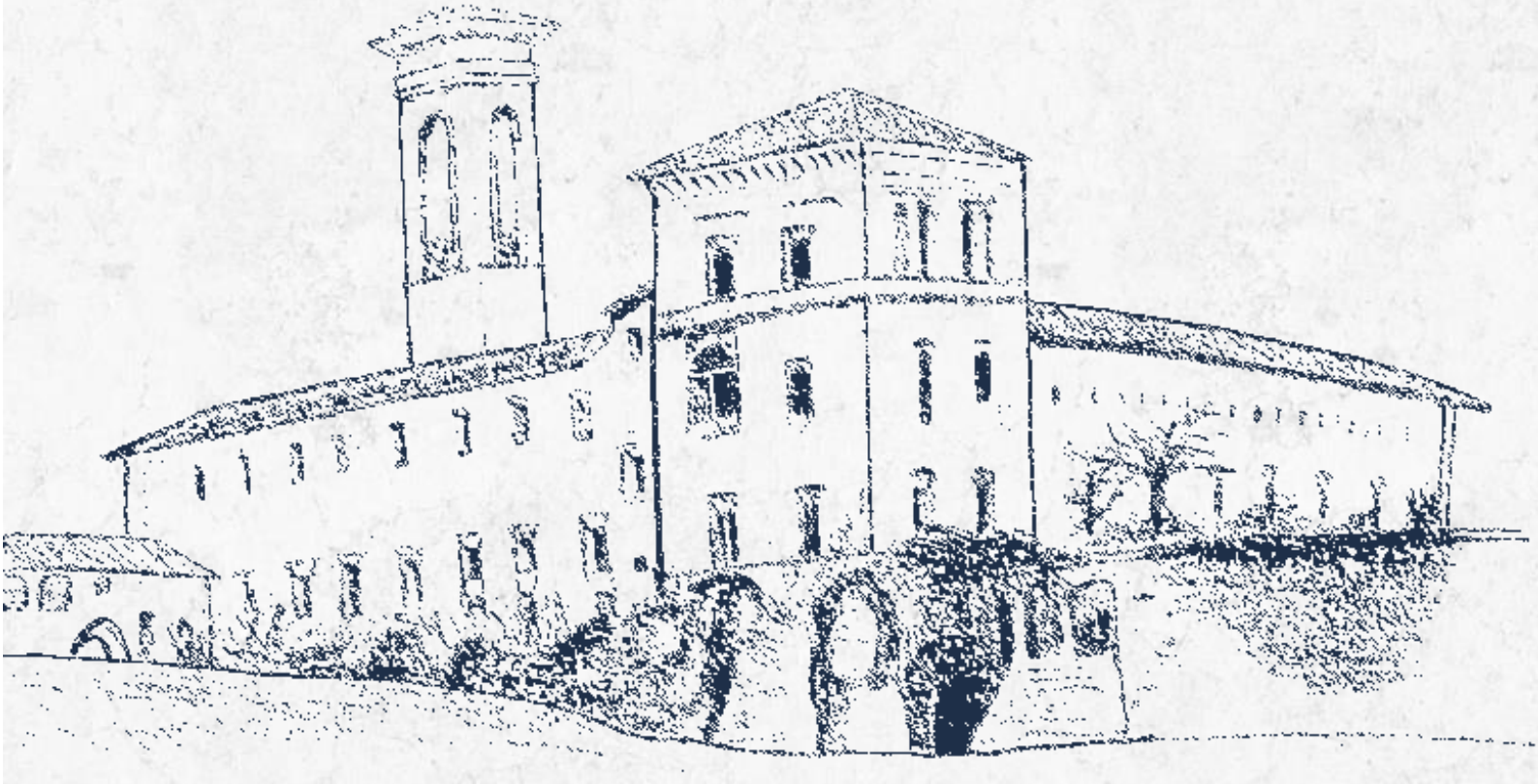

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Industry 4.0 and Human Resources Development: A View from Japan

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Abstract

Purpose. The paper aims at analyzing the approach of the Japanese Government towards the impacts of the fourth industrial revolution.

Design/methodology/approach. The paper discusses the application of the Frey and Osborne model to the Japanese labor market as a way to analyze the repercussions of computerization. Furthermore, it provides an overview on the most recent policies devised by the Japanese Government in order to prepare the society for the change, with a specific focus on strategic planning for human resources development.

Findings. In the case of Japan, there is a lack of official data that can be used to apply the Frey and Osborne model. The plans of the Japanese Government are ambitious and comprehensive, but do not seem to be based on a full feasibility analysis tailored on the current situation of the Japanese labor market.

Research limitations/implications. The research draws its conclusions from previous contributions in order to broaden the dialogue on the fourth industrial revolution outside of the US and EU.

Originality/value. The paper adds to the debate on the way in which national governments could deal with the fourth industrial revolution.

Paper type. Issues paper.

Keywords: *Computerization, Employability, Industry 4.0, Japan, Society 5.0, Labour Law, Labour market, Productivity*

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1. Introduction

Industry 4.0 is a term that gained much attention in the European Union with reference to the most recent developments in the manufacturing industry. It was coined in Germany as *Industrie 4.0*,[2] but it has a close connection with similar concepts that are used in other countries, such as smart factories or internet of things. The model is aimed at integrating some of the latest technological advancements – for instance, information and communication technology (ICT), or big data analysis – into the industry. The number four, instead, is a reference to the fact that it is supposed to represent the fourth industrial revolution, although it is an on-going process and its disruptive effects, if any, are yet to be seen.[3] In a recent briefing by the European Parliament Research Service,[4] the four fundamental transitions that affected European industries to a great degree in the last three centuries were summarized as follows:[5]

[2] It might be worth noting that in Japanese the term Industry 4.0 (pronounced half in English and half in Japanese: *indasutorii yon ten zero*) is used solely with reference to the German model. See, only in Japanese: https://dictionary.goo.ne.jp/jn/278685/meaning/m0u/ (accessed November 25, 2017).

[3] F. Seghezzi, *La nuova grande trasformazione: lavoro e persona nella quarta rivoluzione industriale*, ADAPT University Press, Milano, 2017, pp. 151-177.

[4] R. Davies, *Industry 4.0: Digitalisation for Productivity and Growth*, European Union, Brussels, 2015, http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI(2015)568337_EN.pdf (accessed November 25, 2017).

[5] It must be noted, however, that there is no consensus among scholars with reference to the third and fourth revolutions (for example, they could be grouped in a single computer revolution).

Table 1: Industrial revolutions

Time periods	Technologies and capabilities
First: 1784-Middle 19th century	Water- and steam-powered mechanical manufacturing
Second: Late 19th century-1970s	Electric-powered mass production based on the division of labor (assembly line)
Third: 1970s-Today	Electronics and information technology drives new levels of automation of complex tasks
Fourth: Today-	Sensor technology, interconnectivity and data analysis allow mass customization, integration of value chains and greater efficiency

Source: European Union, 2015

As pointed out in Table 1, the advantages deriving from the fourth and most recent phase of European industrial development are supposed to be many: improvements in speed, quality and flexibility of the production are just a few examples. However, at the same time, a number of challenges can be foreseen. Among them, without doubt, there is the issue of future employability of workers, and, consequently, of how to develop the professional profiles that will be needed from now on. Indeed, since many low-skilled employees are likely to be replaced by machines in a decade or two, there seems to be the concrete risk of generating a mass of unemployed or underemployed people, if no specific action is taken. Yet, on the other hand, if the transition goes well, workers might benefit from a reduced burden of menial work and might be able to focus on more fulfilling tasks.[6]

In the European Union, the Federal Ministry of Labor and Social Affairs of Germany has discussed many of the abovementioned challenges in detail in its "Work 4.0" White Paper,[7] a document that the Ministry has elaborated through a public dialogue based on a previously published

[6] R. Davies, *Industry 4.0: Digitalisation for Productivity and Growth*, cit., pp. 6-7.

[7] Federal Ministry of Labour and Social Affairs, *White Paper: Work 4.0*, Berlin, 2017, http://www.bmas.de/EN/Services/Publications/a883-white-paper.html (accessed November 25, 2017).

Green Paper.[8] In terms of maintaining individual employability over time, for example, the White Paper contains some useful policy recommendations, including actively supporting the main transitions in each worker's life, monitoring future skilled-labor needs and providing continuous education and training for long-term skills development.[9] However, there is at least another country not located in Europe that is well-known for its technological advancement: Japan. In the following sections, the Japanese situation will be analyzed, in an attempt to broaden the dialogue on employability to a more global scale.

2. Previous research and its reception in Japan

Albeit being geographically distant, Japan, as an active member of the international community, is usually observing what happens in the so-called West[10] quite attentively. That is why a 2013 working paper on the occupations that are most likely to be replaced by machines in the near future written by two British scholars, C. Frey and M. Osborne, in the framework of the Oxford Martin Programme on the Impact of Future Technology,[11] had much resonance also in Japan.[12] In their research, Frey and Osborne tried to analyze how computerization – defined as "job automation by means of computer-controlled equipment" – might affect 702 occupations. They also referred to previous research according to which the job market is gradually polarizing, in the sense that the demand is increasing for "high-income cognitive jobs and low-income manual occupations," whereas it is decreasing for "middle-income routine jobs."[13] One of the most interesting aspects of Frey and Osborne's research is that they focused on the content of each occupation – *i.e.* the tasks performed

[8] Federal Ministry of Labour and Social Affairs, *Green Paper: Work 4.0*, Berlin, 2015, http://www.bmas.de/EN/Services/Publications/arbeiten-4-0-greenpaper-work-4-0.html (accessed November 25, 2017).

[9] Federal Ministry of Labour and Social Affairs, *White Paper: Work 4.0*, cit., pp. 100-114.

[10] In Japanese, the less relative but equally broad term *ōbei*, meaning Europe and North America, is used.

[11] Later published as C. Frey and M. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?*, in *Technological Forecasting and Social Change*, 2017, vol. 114, issue C, 254-280.

[12] S. Matsumoto, *Toward a New Dawn – The Importance and Potential of Quantifying Occupational Information*, in *JILPT Research Eye*, July 20, 2016, http://www.jil.go.jp/english/researcheye/bn/RE014.html (accessed November 25, 2017).

[13] C. Frey and M. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?*, cit., p. 258.

by each worker – and classified them according to their susceptibility to computerization. Such an analysis was made possible thanks to the existence of the Occupational Information Network Service O*NET OnLine,[14] sponsored by the United States Department of Labor. As noted also by Japanese scholars,[15] the very existence of this kind of "occupational information" is of key importance for researchers. Also in Japan there are similar examples,[16] although the relevant data was not gathered directly by the Ministry of Health, Labor and Welfare, but by the Japan Institute for Labor Policy and Training (JILPT) through on-line surveys, and they represent only a limited part of the Japanese labor market.

Frey and Osborne based their work on two pairs of opposite concepts: routine/non-routine tasks and manual/cognitive tasks. Routine tasks are rule-based activities that can be performed by machines, whereas cognitive tasks relate to knowledge work, although they also noted that the extent of what they called routine tasks could be expanded through technological advancement in the future – *i.e.* former non-routine tasks might become routine tasks over time, for example driving.[17] In order for machines to be able to carry out what were originally non-routine tasks, it is indispensable to collect big amounts of data that can be used to check the performance of technological substitutes in comparison with humans – and nowadays such big data exists, to some extent. Moreover, it is well-known that computers can perform better when processing batch activities and can ensure unbiased decision-making, therefore their introduction in originally non-routine tasks might even be beneficial, in some cases. Finally, robots and similar could free the human workforce from the less satisfying jobs.

What Frey and Osborne's research revealed is that around 47% of the total number of US workers might be substituted by machines relatively soon, and such percentage might even increase depending on the technological advancement that takes place in the meantime. This high-risk group includes transportation and logistics, office and administrative

[14] https://www.onetonline.org/ (accessed November 25, 2017).

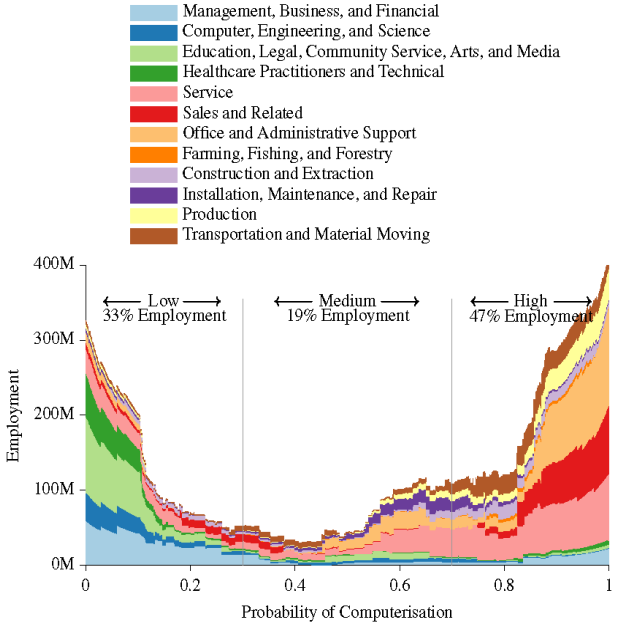
[15] S. Matsumoto, *Toward a New Dawn – The Importance and Potential of Quantifying Occupational Information*, cit.

[16] See the JILPT Research Report No. 146 (http://www.jil.go.jp/english/reports/documents/jilpt-research/no.146.pdf) and No 176 (http://www.jil.go.jp/english/reports/jilpt_research/2015/no.176.html).

[17] C. Frey and M. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?*, cit., p. 260.

support workers, and workers in production and sales. Instead, the low-risk category includes, among others, management, business and finance, education, healthcare, arts and media, and the legal sector (see Graph 1).[18]

Graph 1: Employment affected by computerization (US)



Source: Frey and Osborne, 2017

Of course, the abovementioned research had many limitations admitted by Frey and Osborne themselves, one of which is particularly interesting from the point of view of a legal scholar: it is, in fact, impossible to foresee how much the legislation of each country will be open to the change, considering the inevitable political concerns that will surround the matter. Therefore, it might as well be possible that some of the more computerizable jobs will be reserved in any case to humans by national legislation. Furthermore, a certain number of subjective biases in the selection of data are bound to remain and to be reflected in the results. Frey and Osborne, in order to mitigate possible issues regarding the O*NET data and the way in which they filtered it, adopted a mixed approach by hand-labelling 70 occupations as fully automatable on the

[18] C. Frey and M. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?*, cit., pp. 265-267.

basis of O*NET tasks and job descriptions, and by selecting O*NET variables corresponding to the potential bottlenecks to computerization (see Table 2). However, they admitted that, even by applying this method, a certain degree of subjectivity remained.[19]

Table 2: O*NET variables

Computerization bottleneck	O*NET variable	O*NET description
Perception and manipulation	Finger dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
	Manual dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
	Cramped work space, awkward positions	How often does this job require working in cramped work spaces that requires getting into awkward positions?
Creative intelligence	Originality	The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.

[19] C. Frey and M. Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation?*, cit., pp. 263-264.

	Fine arts	Knowledge of theory and techniques required to compose, produce, and perform works of music, dance, visual arts, drama, and sculpture.
Social intelligence	Social perceptiveness	Being aware of others' reactions and understanding why they react as they do.
	Negotiation	Bringing others together and trying to reconcile differences.
	Persuasion	Persuading others to change their minds or behavior.
	Assisting and caring for others	Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients.

Source: Frey and Osborne, 2017

Finally, the study is based on US data, therefore it might be difficult to replicate it in other areas in the world – or to compare it with similar studies from other countries – especially in the case of lack of data or of big differences between the variables that were collected or taken into consideration. Quite interestingly, in the case of Japan, as it was mentioned before, the outcomes divulgated by Frey and Osborne gained much attention, so much so that the two scholars were asked to develop a joint research with the Nomura Research Institute (NRI) in order to apply the same method to Japan. The results have highlighted some issues that need to be solved in order to produce a more substantial analysis of the country.

3. The results of the NRI joint research

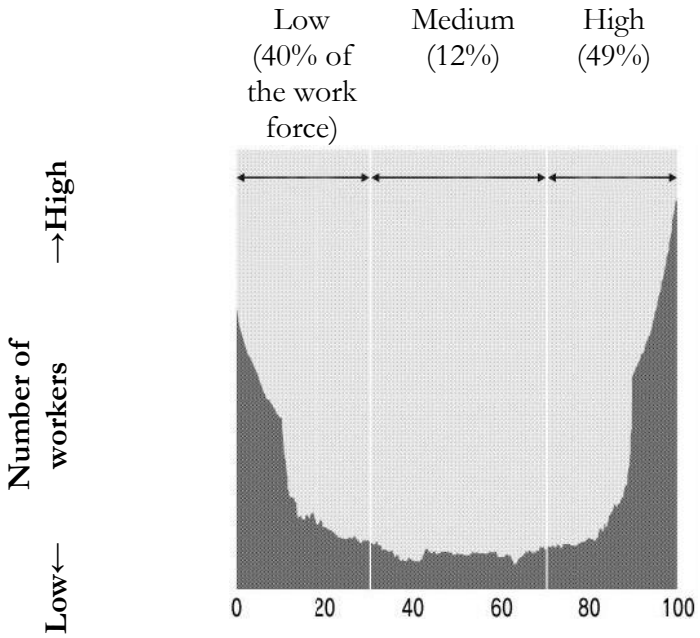
The results of the NRI joint research were published in a news release in Japanese dated December 2, 2015.[20] A summary of the whole project including some more general considerations on Japan has also appeared on the Nikkei newspaper.[21] The analysis was based on data collected by the JILPT on 601 occupations and the same algorithm used in the 2013 working paper on US employment was applied, reaching the conclusion that 49% of Japanese employment could be computerized in the near future (see Graph 2). However, as duly admitted by Osborne himself, the results are not really comparable to his original research because of the differences that existed between the two sets of data that were used, therefore the fact that the percentage is higher in Japan than the US might have no special meaning.[22]

[20] Nomura Research Institute, *Nihon no rōdō jinkō no 49% ga jinkō chinō ya robotto nado de daigae kanō ni* [49% of the Japanese Working Population Could be Replaced by Artificial Intelligence, Robots and Similar], News Release, 2015, https://www.nri.com/jp/news/2015/151202_1.aspx (accessed November 25, 2017).

[21] Issue of Monday, December 12, 2016. Available in Japanese, for subscribers, also on the website of the Nikkei: https://www.nikkei.com/article/DGKKZO95962940Z00C16A1KE8000/ (accessed November 25, 2017). Its English version can be downloaded from the website of the Oxford Martin School: https://www.oxfordmartin.ox.ac.uk/coverage/view/2086 (accessed November 25, 2017). However, it is worth noting that the newspaper article is in some cases oversimplified with regard to Japan and contains some common misconceptions on the country, for example on cultural homogeneity (Japan's heterogeneity might be less evident when compared to the United States or to the United Kingdom, but there are many minorities and regional differences in terms of language and culture), high job security (which is now more of a thing of the past, since around one third of the working population is currently made of atypical workers) and unemployment rates (in the sense that it would be important to take into consideration also the number of inactive workers, which in Japan amounted to 44.18 million people in 2016, according to the Statistics Bureau of Japan). Of course, nor Frey nor Osborne are Japanologists and these oversimplifications do not compromise the general value of their research. Moreover, for example, their observations on Japan as being a latecomer in the ICT revolution can definitely be shared.

[22] Nomura Research Institute, *Coexistence with Artificial Intelligence*, in *Iakyara*, 2016, vol. 234, 2-7, https://www.nri.com/~/media/PDF/global/opinion/lakyara/2016/lkr2016234.pdf (accessed November 25, 2017).

Graph 2: Employment affected by computerization (Japan)



(Percentages do not add up to 100% because of rounding off)

Source: Nikkei, 2016

A list of one hundred jobs that are more likely to be performed by machines in a few years and a list of one hundred occupations that instead are less susceptible to automatization were published in the news release as well, but they were not ranked in order of probability of computerization. Once again, jobs in the arts, teaching, and, for example, jobs in the medical and legal sectors were considered less likely to be performed by artificial intelligence. This list also includes some peculiar professions, such as disk jockey, *manga* artist, aromatherapy expert, and sommelier. For some reason, however, the complete results of the study have yet to be released.

In any case, the research is still at such an early stage that it is difficult to elaborate a thorough assessment of it. Apart from the original flaws in the

methodology – especially in terms of lack of objectivity – briefly summarized in the previous section, the data used in both cases is based on surveys, which could as well include a number of biases by the respondents, depending for example on the way in which the questions were asked and interpreted. This seminal research, however, has undoubtedly the potential to uncover some of the underlying structural issues of the Japanese labor market that affects productivity[23] and causes labor shortages in some routine jobs, both of which might be substantially improved by means of computerization. Moreover, it is certainly useful for identifying the skills that are, for now, less likely to be replicated by robots, and on which future professional development could focus (see Table 2 above). The question of how the Japanese society will welcome the change remains open, but some observations on the matter will be presented in the next section.

4. The Japanese society and artificial intelligence

Obviously, it is not an easy task to analyze the impact of an increased number of robots in a given society. In particular, it would be especially challenging to assess the level of acceptance by people to such a revolutionary change. Many robots, however, have already made their appearance in the everyday lives of Japanese people without causing disruptive effects. Although, of course, there is no proof of a specific high tolerance to working machines, it might ensure a certain degree of accustomization. Moreover, less conventional robots were developed for social purposes in Japan from relatively early years. For example, perhaps also many Europeans and Americans still remember the robot dog Aibo, by Sony.[24] Moving to more recent products, the humanoid social robot Pepper developed by SoftBank[25] and capable of interacting with people has gained much international attention as well. A less famous, but equally interesting robotic companion because of its allegedly therapeutic effects

[23] Japan has the lowest productivity among G7 countries, according to the OECD statistics on the level of GDP per capita and productivity, http://stats.oecd.org/Index.aspx?DataSetCode=PDB_LV (accessed November 25, 2017).

[24] Quite interestingly, Sony has announced the release of a renewed Aibo just this month: https://www.sony.net/SonyInfo/News/Press/201711/17-105E/index.html (accessed November 25, 2017).

[25] https://www.ald.softbankrobotics.com/en/robots/pepper (accessed November 25, 2017).

is Paro,[26] a machine shaped as a white seal developed in order to help patients with dementia.
Therefore, Japan has, at least, a documentable history of friendly robots that might have paved the way towards a smooth transition. This impression is confirmed also by a recent research once again by the NRI, according to which Japanese people are in fact quite comfortable with robots, although they do not use them that much.[27] A last example in this regard could be the 2014 advertising campaign by Nissan under the motto "innovation that excites." In a series of commercials, humanoid robots substitute a street cleaner and even a mother who is transporting her child in a stroller, therefore suggesting that these activities might be performed by machines in the future.[28] Curiously, nobody commented in a negative way against the commercial, at least to the knowledge of the author. Therefore, Japanese people seem to be quite aware that they can be replaced and do not seem to feel particularly threatened by it. This might be one of the reasons why the Japanese government has started a quite optimistic strategical planning towards Industry 4.0 and beyond, as it will be explained in the next section.

5. The plans of the Japanese government

The Future Investment Strategy (FIS) published by the Cabinet of Japan on June 9, 2017, is probably the most recent document of a certain length and detail revolving around Industry 4.0 and produced by the Japanese executive.[29] In its introduction, the long-term economic stagnation is

[26] http://www.parorobots.com/ (accessed November 25, 2017).
[27] H. Nitto, D. Taniyama and H. Inagaki, *Social Acceptance and Impact of Robots and Artificial Intelligence – Findings of Survey in Japan, the U.S. and Germany*, in *NRI Papers*, 2017, No. 211, 1-15, https://www.nri.com/global/opinion/papers/2017/np2017211.html (accessed November 25, 2017).
[28] See the full list here (available only in Japanese, but the videos can also be found on YouTube): http://www.nissan.co.jp/AP-CONTENTS/POSTOFFICE/ANSWERS/5141.html (accessed November 25, 2017). The two commercials mentioned in the paper are the one on the "intelligent parking assist" and the one on the "emergency break."
[29] Prime Minister of Japan and His Cabinet, *Mirai tōshi senryaku 2017: Society 5.0 no jitsugen ni muketa kaikaku* [Strategy for Future Investments 2017: Reforms Towards the Realization of Society 5.0], 2017, http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/miraitousi2017_t.pdf (accessed November 25, 2017). A very short summary in English was contained in a document presented by Japan at the G20 in Germany in 2017: http://www.mofa.go.jp/files/000272312.pdf (accessed November 25, 2017).

identified as one of the main issues affecting the country, although it is not limited only to Japan. According to the document, its solution can be found in the full realization of what is called "Society 5.0,"[30] which will integrate not only into the industry, but also into the society the innovations of the fourth industrial revolution. In this paper, the section of the document on strengthening the development and best use of human resources[31] will be summarized.

First, a series of policies aimed at expanding investments on human resources and human resources development in order to improve individual working skills is presented. Among them, there is, for example, the revision of IT skills standards so that they respond to the needs of the fourth industrial revolution; the cooperation between industry, government and academia for the development of practical skills; the support of universities as institutions for the development of IT skills; the expansion of IT skills lifelong training; the formation of IT specialists who can lead the industry; the implementation of IT education – such as programming – in primary and secondary schools.

Moreover, in terms of promotion of working styles leading to improvements in productivity and innovation, the plans are even more ambitious and include many amendments to the existing legislation, such as: to realize a diverse and flexible way of working by further limiting long working hours, correcting unreasonable differences in treatment between typical and atypical workers, and promoting the acceptance of side jobs and independent working; to increase wages; to promote diversity; to further support female workers; to support young people through career awareness initiatives; to promote the employment of people with disabilities.

Last but not least, in terms of labor market reforms aiming at higher productivity and growth, a Japanese version of O*NET will be developed in order to collect occupational information and increase its visibility, the labor mobility of elder workers will be promoted by enhancing their career education, and a labor dispute settlement system that ensures more certainty – for example by determining a monetary compensation in case of unfair dismissal – will be designed. Further actions in terms of foreign workers, robot revolution and information exchange between citizens and

[30] Because it comes after the (1) hunter-gatherer society, the (2) agrarian society, the (3) industrial society and the (4) information society, as stated in the FIS.

[31] Prime Minister of Japan and His Cabinet, *Mirai tōshi senryaku 2017: Society 5.0 no jitsugen ni muketa kaikaku* [Strategy for Future Investments 2017: Reforms Towards the Realization of Society 5.0], cit., pp. 90-101.

the public administration are also envisaged as future strategies, although they will not be discussed in detail in this paper.

To conclude with some final observations on the Japanese plan, first it must be pointed out that many – if not all – of the proposed policies are at the same time ambitious and in need of a more concrete elaboration. Moreover, when compared to the German "White Paper" mentioned above, Japanese documents seem to be more focused on the changes that might be needed in order to prepare the society for Industry 4.0 and beyond, instead of thoroughly analyzing the problems that might be posed by such a big transformation, although such issues might be inferred from the proposed policies. Finally, how much this new model actually matches – or at least could be compatible with – the current Japanese labor market is a question that remains unanswered.

Regarding the latter, in particular, it must be noted that the services sector is the one that is expanding the most in Japan, now covering more than 70% of the employment.[32] It is true that such a broad category includes both routine and non-routine tasks in the definition by Frey and Osborne, but research shows[33] that for some reasons the skills that are relatively more requested by this sector – at least in Japan – are medical knowledge, cleanliness, qualifications and certificates related to the job, likeability, social intelligence/good manners, human skills – *i.e.* the ability to create good relationships –, speaking skills – *i.e.* the ability to speak in a comprehensible way –, and reliability. Instead, in a quite counter-intuitive way, foreign language skills, mathematical skills, computer skills, the ability to innovate and leadership seem to be relatively less appreciated. The whole picture, therefore, seems to be quite different and somewhat distant from the governmental expectations.

6. Conclusions

Keynes wrote in the thirties that he imagined a future in which people would work for a maximum of fifteen hours a week.[34] All the remaining time could be dedicated to improving themselves. As a matter of fact, in

[32] S. Matsumoto, *Capabilities, Aptitudes, Consciousness and Behavior Required in Service Industries: From the Data Analysis of "50,000 Workers Web Occupational Trend Survey,"* in *The Japanese Journal of Labour Studies*, 2016, No. 666, 40-57.

[33] S. Matsumoto, *Capabilities, Aptitudes, Consciousness and Behavior Required in Service Industries: From the Data Analysis of "50,000 Workers Web Occupational Trend Survey,"* cit., p. 47.

[34] Later reprinted as J. Keynes, *Economic Possibilities for our Grandchildren*, in *Essays in Persuasion*, W. W. Norton & Co., New York, 1963.

the past, self-development was a prerogative of wealthy people who did not need to work, but it could be said that one of the promises of economic development was to increase the general accessibility of a way of living once reserved only to some. However, that pact has been kept only to a certain extent. In some cases, it could even be said that ICT had a negative impact on human lives, since information management has gradually become more and more difficult and technology has actually deprived people of their spare time, instead of ensuring that they can enjoy a more comfortable life.

Therefore, in a way, it could be said that Society 5.0 is an attempt to regain control on such innovations and make them serve the good of the people. What can be considered positive in the Japanese approach is that it did not limit its view only to the industry, but it embraced the society as a whole. This intuition is present also in Europe, but it is split in a number of separate projects that were developed over time. It might be a good idea, then, in terms of governmental planning, to connect all the dots. Moreover, the Japanese approach shares with the European counterparts a positive focus on empowering workers in the medium and long term, although the feasibility of such strategy remains an open question, considering the many issues that still exist.

From the latter perspective, legal mechanisms that have been put in place in order to solve other issues – such as inequalities in the workplace – could definitely be expanded and implemented more attentively in order to support any individual in her or his quest to develop and make the best use of their own skills. For example, an effective protection against discrimination and a punctual implementation of the "equal work for equal pay" principle could become real triggering factors towards Society 5.0 because they have the potential to improve the conditions of atypical workers. However, what is clear from the short overview offered in this paper is that, apart from the lack of legal tools, there is still a lack of data on the basis of which the transition to a new model of work based on employability and actual skills can be developed and analyzed. In Japan, it seems that they will try to solve the problem by creating a local version of O*NET, but the issue of the biases that might affect such databases remains.[35]

[35] Although different ways of collecting data that are not based on surveys and therefore are less prone to personal biases have already been developed. See, for example, the WollyBi project, which analyses online job vacancies, instead: http://www.wollybi.com/en/ (accessed January 12, 2018).

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