



## Article

# Inclusive Industry 4.0 in Europe—Japanese Lessons on Socially Responsible Industry 4.0

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**Abstract:** This contribution addresses the puzzle of whether the anti-inclusive character of Industry 4.0 development can be tailored toward a socially more responsible path (smart automation). In doing so, the paper first underlines the crucial importance of a governance being capable of fostering inclusive growth by deciphering the nexus between flaring populism and non-inclusive growth. It then turns to the case of Japanese digitalization and Industry 4.0 development to show that adding a social innovation-dimension (smart automation) to Industry 4.0 is not impossible in supporting inclusive growth in Europe.

**Keywords:** Europe; industry 4.0; Japan; automation; social innovation; inclusive growth

## 1. Introduction

The financial and economic crisis of 2008 has come with a near-death experience of global capitalism. In retrospective wisdom, we should not be surprised that nationalist, secessionist, and populist-laden voices have sprung to their feet. In this paper, we do not consider it our task to explore and describe the dynamic side effects of global capitalism, but as a starting point it is very important to take into account the fact that more and more people around the world do consider the state to have become too weak and incapacitated to act effectively in the interest of the vast majority.

The purpose of this paper is to show that the need for inclusive economic governance is more necessary than the profession would have ever thought. Its novelty appears at three levels, since this contribution (i) argues that, in opposition to the prevailing literature, pessimism is in order when expecting the short-run spectacular positive impacts of the ongoing digital transformation and Industry 4.0 developments in the current configuration of the socio-economic ecosystem; (ii) offers a deeper look at complex processes by marrying analyses of populism, inclusive development and technological revolutions; and (iii) goes beyond theorizing by outlining the contour of economic governance, making the transition politically-socially and economically more feasible.

As for the theoretical backing of this contribution, so-called techno-economic paradigmatic shifts constitute our theoretical basis, meaning that socio-economic development has a cyclically evolving pattern driven by technological revolutions (Big Boom events)<sup>1</sup>, forming a new techno-economic paradigm (Perez 2009). This concept converges on the thinking of Kondratiev (1935) and Rennstich (2002), who claim that, beginning with the Industrial Revolution in England at the very end of the 18th century, the world economy has experienced technological revolutions every 40–60 years. Each technological revolution has installation and deployment periods, and each employs new or relatively new technologies via the method of smart combination. The new ICT-based techno-economic paradigm that emerged in the early 1990s not only provoked profound changes in the production process, but also tailored them to a more service-oriented economy. Along the course of this ICT-based paradigm, a digital revolution and the next production revolution (Industry 4.0) have emerged to spread, with social consequences that are unique compared to previous



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paradigm shifts. While, previous paradigmatic shifts did generate job losses, they also created new types of job opportunities elsewhere, while also engendering productivity booms. The current phase of transition seems to be following a different path in the sense that it has been pervaded by a much stronger anti-inclusive power (i.e., upskilling of workers has become ever more difficult and the absorption capacity of other sectors has been very much lower, as [Acemoglu and Restrepo \(2019\)](#) showed) coupled with a perceptible decline in productivity growth (secular stagnation). The current configuration of the socio-economic ecosystem is therefore features declining productivity coupled with increasing income inequality that further undermines the inclusiveness of growth by feeding into distrust and recurrent populism.

As a corollary, this paper uses a more holistic approach and is structured as follows: Section 2 outlines the major data sources. Section 3 briefly reviews the drivers of flared populism and reveals the often-neglected nexus of populism and inclusive growth by addressing whether Industry 4.0 can be seen as a solution. Section 4 then addresses the crucial need for some sort of smart automation (socially responsible Industry 4.0 development) by looking at Japan in an effort to draw some lessons for the European Union (EU). Section 5 concludes by juxtaposing some important principles of an economic governance pursuing smart automation. We argue that the wave of challenges posed by Industry 4.0 and the digital transformation further underscores the inevitability of inclusive governance if and when we strive to simultaneously keep in mind not only the issue of political stability, but also of the social acceptability of technological development together with its economic feasibility in Europe. Industry 4.0 raises an important question of whether it can safeguard people's experienced and perceived well-being by leaving them within their nested social system and nested physical environments.<sup>2</sup>

## 2. Materials and Methods

The present paper builds a verbal model using quantitative as well as qualitative data and information from a wide array of domains (e.g., relying on existing and publicly available data obtained from authoritative international organizations such as the OECD, the World Bank and Eurostat etc.). As for methods, by building on a deep and comprehensive literature review, it sheds light on the complex nexus among populism, inclusiveness, and industry 4.0, considered as an analytical conceptual framework. The paper digs deeper by carrying out a case study on Japan, feeding back to the European context.

## 3. Populism, Inclusiveness and Industry 4.0

### 3.1. *Dream On—Populism*

As a starting point, we need to realize that for decades, conventional economic wisdom, which has been preferred, has proven flawed, failing to navigate the world economy towards the desired balanced and sustainable growth and development while playing an active role in coding critical instability. The most significant of these dreams is liberalization in the broadest sense, which has manifested itself in the following areas: (i) tax cuts (consciously reducing the progressivity of tax systems in order to stimulate investment, i.e., economic dynamism);<sup>3</sup> (ii) deregulation of the financial sector; and last but not at all least (iii) the dismantling of trade barriers. According to the prevailing economic narrative, these are all designed to guarantee the availability of higher profits and thus the viability of the wage-based competitiveness concept. As a result, many economic contexts that were believed to be true at the time have not been identified and substantiated, and these are processes that will certainly have a negative impact on the infrastructure of social trust.<sup>4</sup> The increase in the number and level of systemic risks and the idea of unequal development have fuelled anti-globalist movements and caused the sprouting of widespread dissatisfaction and mistrust in governments, alongside which—often only temporarily—populist ideology or, in some cases, autocratic ideologies have shown up.<sup>5</sup>

Demand for populism is by and large an autochthonous part of human nature. We always try to get an understanding of the processes of the complex world through reduc-

tionism. Since we are by nature wary of uncertainty, we always axiomatically seek for certainty, which is assumed to be the only truth. Amidst the longing for certainty, we live by rules of thumb<sup>6</sup> and believe things that we already have some knowledge of. It also follows from the latter that democratic economic governance, struggling with today's complex system of challenges, finds itself in an extremely difficult position, because in the midst of the interactions affecting our lives through multiple metastases and nonlinear feedbacks, it is very difficult to even raise the issues to be solved simply and precisely enough; indeed, it seems to be almost impossible. All of this could pave the way for a post-factual world, with authoritarian regimes with charismatic leaders who provide simple answers to complex problems, a simulacrum well known from the work of Jean Baudrillard.<sup>7</sup> In other words, chasing a basket of myopic, short-term pleasures and longer-term pain during our evolutionary development is one of our unselected traits to date.<sup>8</sup>

It is not just that populism cannot solve real social problems in a sustainable way, but that, despite all the rumours to the contrary, populism leads to socio-economic instability, a social crisis, and a dramatic restriction of democratic rights.<sup>9</sup> Paradoxically, escalating populism leads to the inflation of economic uncertainty (e.g., populist and demagogic parties coming to power, who promised to raise people's life prospects as soon as possible, divert society and the state itself toward indebtedness, and when a new crisis hits—e.g., after the crisis of 2008, which battered faith in global capitalism—again, only the more populist and even more extreme can break forward, as society will find it harder to give up its already acquired rights than to fight for what may be available in the future). In the view of Amartya Sen, or Deirdre McCloskey, this means a real shrinkage of unfolding human possibilities, the expansion of which would be equal to real development. As a result of this, economic-social spontaneity also becomes more limited, which should be the basic motive for development. Thus, society and the state can become the servants of increasing liabilities (e.g., increasing debt service, household indebtedness, increased dependence on remittances, excessive exposure to foreign direct investments etc.). However, we must say that populism alone is neither good nor bad; it all depends on how it can fulfil its function. Populism could also be a "blessing" if and to the extent that economic governance, whether at a national or supranational level, listens to areas for intervention where deep-rooted socio-economic (systemic) problems are hidden.

We mention only one thing, namely that it is as if the sacrament of the intention of inclusivity in modern economic governance has been worn out. This is nothing more than a phenomenon of social mobility stagnation, meaning that if someone is born into a poor family, she can typically expect a lower quality education, worse and lower paid job opportunities, a higher risk of indebtedness, and thus ultimately poorer life prospects. All of these preserve inequality and undermine social trust in the state and its institutions. The dynamic process of impoverishment has become a feature of the developed world, which easily calls into question the effectiveness of the social dimension of economic policies and further encodes dissatisfaction and more serious concerns about the state's ability to act. Moreover, squeezing the middle class also means that this social group loses its importance politically (it has been empirically proven that a larger share of people entering into the political system and government is more likely to stem from the middle-class, thus this group supports political stability in a more dedicated way). The thinning of the middle-class is worrying primarily from a development point of view (i.e., the fact that the wage gap has only widened over the last 35–40 years, and thereby the gap between the lowest paid and that of the middle-class has started to narrow sharply), since this is the class that has perhaps the strongest internal driving force to move upwards on the one hand (manifesting primarily in the spheres of self-development and self-education due to available intellectual and other resources, as well as savings that can be more easily mobilised to be invested in R&D and innovation), and to not fall behind on the other. Because of the latter motif, this class serves as a savior of democracy in the sense that it always supports the system of checks and balances (i.e., no oligarchies, limited inequality, more restrained corruption, etc.) and ultimately favours political stability and good governance.<sup>10</sup> If, in spite of all this,

slippage and shrinkage of the stratum take place, we must suspect that the configuration of the socio-economic system is in an evolutionary state, being incapable of providing “good jobs”<sup>11</sup> both in terms of quantity and quality.<sup>12</sup> All this calls attention to the fact that the structure of production is in a disharmonious relationship with the structure of the labour base. It should come as no surprise that productivity growth has been deteriorating (secular stagnation) for the most part since the mid-1970s. In other words, an increasing proportion of production is skill-intensive, which prevents the workforce from keeping pace (an increasing proportion are low-skilled). Of course, this does not follow the narrative of “less state” in the absolute sense that many are talking about by building on Hayek’s classic work, *The Road to Serfdom*. On the contrary, there is a need for a state that recognizes its limitations, plans more modest interventions, defines itself as an integral part of the socio-economic innovation ecosystem, and is constantly able to keep tackling complex and lasting challenges (i.e., not to solve the challenges once and for all) by strengthening the system’s resiliency.

### 3.2. *Dream No More—The Sacrosanct of Inclusiveness*

With a little exaggeration, we could say that our old glory is late in the night’s gloom because good jobs (well-paying jobs that do not shatter work-life balance and act as a benevolent balm to productivity) in the developed world have now dwindled significantly, which could actually illustrate the existence of social mobility.<sup>13</sup> In fact, on average, in OECD countries, 68% of the baby boomer generation (born 1942–1964) were, in their twenties, ranked among middle-income households, while for Generation X (born 1965–1982), that share shrank to 64%, and the respective share was merely 60% in case of the Millennials (born 1982–2002).<sup>14</sup> It means that the chance of Millennials belonging to the middle-income group has become ever-more cumbersome as compared to previous generations.<sup>15</sup> We therefore hold that inclusion has become the key to political stability and that inclusive development is an indispensable precondition for the sustainable welfare services of the state and, ultimately, for the collective promotion of well-being. The rationale of inclusive development is that no country will be able to navigate toward prosperity or stand up for sustainable development goals unless the processes that further reinforce inequalities are hampered, otherwise the social stratum that creates value and productive jobs will shrink by allowing the great benefits (including those arising from technological development) to be concentrated in the hands of a small minority. One of the most burning questions for social scientists and policymakers today is how to achieve growth that benefits everyone—how do we ensure that everyone—who is able and willing—can contribute to this growth through meaningful and valuable ways of employment?

The exclusivity of inclusive development lies in the fact that today the socio-economic innovation ecosystem is burdened with a plethora of anti-inclusive processes that make it difficult for economic governance to work in terms of supporting inclusive growth and development. Without wishing to be exhaustive, the following may be mentioned briefly, reflecting in part on what has been said previously: (i) the combined effect of ICT-based, decades-old automation and globalization (e.g., in the beginning, the new technology had basically supported to the greatest extent the efficiency of the highly educated by negatively affecting the work of the middle-skilled later on, hence the middle-class began to hollow out.<sup>16</sup>); (ii) the nature of the financial sector extending beyond the real economy is featured with the preference of large corporations, which dominance contributes to the increasing gap among companies as well;<sup>17</sup> (iii) the weakened system of institutions does not counter-balance certain processes (e.g., loosening of labour market regulations, underdevelopment of the social security safety net system, diminishing power of trade unions, etc.);<sup>18</sup> (iv) tax systems, together with corporate dominance, tend to provide incentives for automation, promising large cost savings (e.g., purchasing a machine with tax allowances and other benefits entails labour cost savings, while a new employee requires extra costs from the company and the expected productivity level from hiring does not necessarily result); (v) in the crossfire of all these developments and the coronavirus (COVID-19)<sup>19</sup>, states

may promote automation in a more vigorous way in order to avoid economic stagnation (especially in countries where labour shortages have become chronic, though of course the impact will be uneven as some occupations are at high risk of automation while others are not).<sup>20</sup>

All this is happening in an age that the science of complexity considers a phase transition, that is, an age in which we witness the emergence of a radically new technological-economic paradigm in its quality and especially in its structure: the digital transformation and the completion of Industry 4.0. This age has an unprecedented job-saving character through automation and robotization, as well as dizzying artificial intelligence research findings, and several studies have pointed out that the absorption capacity of other sectors is far lower this time than during previous technological revolutions (upgrading skills and knowledge as well as retraining are highly required, but with an unprecedented intensity and quality and, what is more, in an entirely different demographic structure of the socio-economic innovation ecosystem). According to OECD calculations, for example, 77% of today's jobs in China could be replaced by robotics and automation, 47% in the US and 54% in Europe. One in six middle-income jobs in the middle-class (e.g., in Germany)<sup>21</sup>, which has been shrinking in size and has been stagnating in terms of wealth and living standards for decades, as we emphasised, faces a high risk of automation.<sup>22,23</sup>

Although the issue of AI research and its applicability has been with us for an extremely long time—there has been an enormous number of crooked miles coupled with bottlenecks in the research program—we are witnessing AI development being accelerated over the past decade, with better results being achieved. Artificial intelligence patents grew by an average of 6% per year worldwide between 2010 and 2015 (e.g., Japan, South Korea, and the United States account for two-thirds of global AI-related patents<sup>24</sup>). Of the broad socio-economic impacts of AI (Big Data manageability, sample exploration, more accurate forecasts; increased productivity; lower costs; higher security; better understanding and manageability of complex challenges, etc.), its job-saving character is of crucial importance for this paper. AI certainly redefines at least what we call work or the workplace today. What is more, AI is supposed to come with a mass exodus, meaning that a huge number of people will be forced to leave the world of work.<sup>25</sup> Mass exodus cannot be calculated precisely by anyone *ex ante*, but will undoubtedly create significant social insecurity in areas such as the sustainability of the socio-economic system, social identity, taxation, or any other economic policy domain affecting growth and development. Empirical research on the combined impact of AI, which has been unfolding as part of the digital transformation, is heavily pervaded by embarrassing ambiguity, yet one may assume that AI does not necessarily reduce the complexity of systemic challenges facing the global world economy, which is more or less in pursuit of sustainable development goals. Without attempting to be exhaustive, we only mention that pervasive digitalization and data-based AI can pose a threat in dimensions such as rising demand for energy generation, cybersecurity vulnerabilities, or the further deepening of social disparities (e.g., a digital divide between the winners and those who lose their jobs, economic resources, and other social benefits).<sup>26</sup>

The issue of the widespread use of artificial intelligence and modern machine learning algorithms—such as in the public sector, the private economy and the civil sphere—requires further research, as many questions remain unanswered today (e.g., How will the social contract be transformed due to AI? What will economic governance look like? What will be the priorities in education and training? etc.). There is no doubt, for example, that AI will be of great help to policymakers and central banking professionals in the micro-prudential dimension, but there are also significant questions about its macro-prudential applicability. The fundamental problem is with asynchrony, namely, that full efficiency gains can only be expected from the widespread and simultaneous application of AI to the entire socio-economic innovation ecosystem. For the latter, economic history does not provide enough optimism. If real-time artificial intelligence-based interventions aim at continuously optimizing the system as a whole at the level of economic policy planning, but there is no adapted and responsive artificial intelligence in the private sector (where the

importance of the human factor has been and will remain a social priority), procyclicality will most likely increase and periods of low volatility similar to the Great Moderation will emerge, encoding larger shocks rather than indicating the absence of problems.<sup>27</sup>

In summary, the exact mechanisms associated with AI and pervasive digitalization will perhaps be better seen in the research of the coming years; until then we must not fall into the error that has been proven many times in psychological experiments, namely, that we can infer the general from individual cases. At the same time, we can say that ensuring inclusive development is one of the greatest challenges of the socio-economic innovation ecosystems of our time. If we can learn anything from history in this regard, it is that sometimes some societies rise through technological advancement, while they collapse when they are no longer able to control the processes unfolding and therefore are unable to maintain and further develop social cohesion.<sup>28</sup> Consequently, a value-based economic policy approach is needed. After obtaining a picture of the fundamental necessity of inclusiveness, the following sections dwell on whether Industry 4.0 is straightforward in this respect or not, following which we specifically illustrate a value-based economic governance in action in the case of Japan, in the context of the rise of the digital economy as well as the new production revolution, known as Industry 4.0.

### 3.3. *Dreaming Again—Industry 4.0 as Panacea?*

In his classical book on civilisation, Fukuzawa Yukichi, one of the greatest Japanese reform advocates, whose work was touched by complexity-based thinking,<sup>29</sup> accentuated that the greater the fluctuations, the more extraordinary life's transformations can be. The ongoing digital transformation and Industry 4.0 may carry such extraordinary changes, for instance, in terms of productivity growth.

Economic history unequivocally warns us that inclusive growth periods (meaning, for instance, only a limited deterioration in the distribution of household income) have typically occurred when higher labour market participation and the exploitable human capital base could couple with relatively faster productivity growth.<sup>30</sup> This highlights the joint dynamics (or entanglement) of inclusiveness and productivity by potentially resulting in an enlarged economy with an extended playing field for smart reinvestments and the enhancement of productive employment opportunities, or in other words, for the maintenance of growing inequalities as immanent features of modern capitalism, within certain bounds. Thus, stimulating inclusive growth seems to be much easier in a time when intensifying productivity growth is expected. The laconic question arising quickly is whether this will be the case with the ongoing digital transformation/Industry 4.0. This is what the state-of-the-art literature has not addressed yet with meticulous care.

The *raison d'être* of Industry 4.0 is the creation of self-optimising cyber-physical systems by building upon various technologies, starting from the wide application of Information and Communication Technologies (ICTs), sensors, and robotics, through additive production, Internet-based uninterrupted communication and interaction, simulation and virtual modelling, cloud-based services, augmented reality, data mining, and artificial intelligence, as well as machine learning.

Contrary to the ubiquitous view, believing firmly in the spectacular, productivity-enhancing impact of the ongoing digital revolution and Industry 4.0 developments,<sup>31</sup> the opposite does not seem as unrealistic as the profession thinks. In the following section, we decipher at least two complex trade-offs interplaying with each other by acting as solid counterforces to a productivity-boosting Industry 4.0 development.

Counterforce No. 1: There is a trade-off between rapid diffusion and public trust. This trade-off is mainly given by the disruptive nature of ongoing digitalisation and Industry 4.0 developments affecting both tangibles and intangibles. Regarding the tangible aspect, as we have seen throughout history (e.g., the Luddites), there will be counterparts to the processes that are just unfolding (i.e., voices being organised in a more convincing way). Since newer and newer platforms (Airbnb, Hitch, Liquidspace, Neighborgoods, Spotify, Uber etc.) have obtained the power to undermine well-established professions and spheres of business

activities, waves of protest may develop (e.g., since the business model of Airbnb differs a lot from the traditional regulatory and operational model of the US housing market, protests began in several places such as San Francisco and New York to limit the usage of Airbnb etc.). Of course, insisting to a certain extent on the status quo prevents a society from being severely destabilised, particularly at a time when mitigating disruptions (i.e., upskilling to be employed elsewhere is ever more difficult with the advent of advanced robotics and automation) seems to be a much tighter spot than ever before.<sup>32</sup> In this case, however, it can and should be expected that both the corporate and household sectors will be worse off in terms of indebtedness, which will further fuel inequalities, thereby undermining political stability.

There is no question, however, that pervasive connectedness and cyber-physical systems would be inviolable (e.g., it can be interrupted). At this point, the unresolved issue of cybersecurity arises as a trust-compromising channel because it makes a society uncertain about how fast it wants an industrial system to be digitalized.<sup>33</sup> For now, nobody really knows whether a society should prefer cyber-physical systems, with a uniform architecture to make the most of it, or whether it should be in favour of pluralism, presumably promising more resiliency and antifragile functioning (i.e., which improves even further after a serious attack). If the view is spread that cybersecurity is more than problematic, the diffusion of Industry 4.0 will be much slower, calling into question its spectacular productivity impact.<sup>34</sup> Of course, absolute security is just a mirage, since it would also result in the very limited operation of digital network building on Industry 4.0 technologies. In addition, the more power over cybersecurity state authorities exercise, the greater the potential for abuse and systemic disruption. Consequently, uncertainty would reach record levels, limiting the spread of Industry 4.0, whereby its productivity-boosting character may remain just a bucolic wish.

As for the intangible sphere, studies have also been highlighting the detrimental effect of pervasive digitalisation (and the living styles attached to them) on our mental and physical health. Due to the wide diffusion of information and communication technology-based (ICT) industrial production (Industry 4.0) and digital economy solutions, workers have become available in a non-stop way, significantly ruining their work-life balance. Additionally, employee tracking has become ever more sophisticated via algorithm-based business processes (this is why working time regulation is appreciating ever more).<sup>35</sup> Once the excessive use of ICT is accompanied with non-negligible negative repercussions on people's mental and physical health, an intentionally fastened Industry 4.0 development may hamper the effectiveness of any efforts made to dampen those negative effects (e.g., it is the first time in our history that robots can surpass humans, and the fact that employees also have to compete with machines is stressful). This per se opens up a broader research programme, incorporating the insights of neuroscience, simply because that field has empirically justified that brain health and our minds inextricably influence productivity and vice versa. In addition, a series of studies have already pointed out that working remotely, thanks to automation and digitalisation, makes people less confident and generates less trust among employees and toward their superiors as a result of ceased physical contact and active personal relationships at the workplace.<sup>36</sup>

As a consequence, significant and enduring state interventions aimed at intensifying the evolving of the Digital Economy, including Industry 4.0, are sought, adversely affecting the trust and confidence of many. Again, as discussed earlier, this is an issue of utmost importance in Japan, and, given its demographic trend, in Europe too.

Counterforce No. 2: There is an asynchronous relation between regulation over labour markets and the needs of Industry 4.0. With the transition towards the Digital Economy, including the diffusion of Industry 4.0, there is a growing importance from the side of companies to hire (and fire) more innovative/productive (less innovative/productive) workers even more easily and quickly. It means that the need for ever-more flexible labour markets exists. It is fully in line with what economics suggests, namely, that the more inflexible labour market a given economy has (i.e., higher transaction costs at layoffs and

hirings owing to higher levels of employment protection), the weaker the overall innovation capacity of the system (i.e., impaired resource reallocation leading to suppressed innovation as well as productivity performance by limiting the chance of wage increases seen as crucial incentives of risk-taking).<sup>37</sup> However, the validity of such a narrative has now become questionable with the growing complexity of the world economy. It will suffice to look at the US, barded with one of the highest labour market flexibility levels, the country has been facing hibernated real wages for decades; beyond that stagnation, income growth for the middle class was also minuscule in the period 1979–2013.<sup>38</sup> In comparison, the situation in the European Union (EU) is slightly better, with modest increases (de Pleijt and Weisdorf 2017), even in fields like labour force participation, which has been increasing since 2000. The exact opposite is observed in the United States.<sup>39</sup> As a corollary, a more flexible labour market does not per se promise better patterns (particularly if the financial universe is not serving the real economy effectively, as documented earlier). In the case of Japan, the country was among the top 10 countries in terms of ICT adoption on the list of the Global Competitiveness Report 2020 delivered by the World Economic Forum, while at the same time, Japan lags behind the cutting-edge countries regarding flexible work arrangements as well as digital skills, together with an associated legal framework.<sup>40</sup> Furthermore, estimates suggest that applying a US-like flexible regulation in Europe would result in a decline in job security even in the case of the higher skilled workers (i.e., lowering their share within the total employment).<sup>41</sup> However, these workers are exactly those being equipped with enlightened knowledge, hence their being paid more relative to others, so that the biggest cost savings can be realized through their dismissal during automation and robotics. Keeping in mind the chances of job replacement with the help of automation (e.g., the OECD average is 57%, 47% in the case of the US, 54% is estimated for the EU, 77% for China)<sup>42</sup>, expecting inclusive growth does not seem to square, especially in the context of wage stagnation and anaemic productivity growth coupled with inexorably rising inequalities.

Paradoxically, while, given the current context, an innovation mind-set shall be cultivated via significant wage increases to reinvigorate productivity growth, that step would easily prove to be an important driving force of more intensified automation and robotization in the interest of significant cost-reductions. Needless to say, such a move can be fastened once the labour market goes through a conspicuous deregulation. As it is hard to imagine a stronger incentive for companies to invest in cutting-edge machines and automation methods than rising labour costs (Beck-Krala et al. 2017), economic governance must therefore make a choice whether it chases and cultivates an inclusive development path or lets automation and robotisation prevail in the interest of the desired productivity boom (which is unclear).<sup>43</sup> Since the principle of inclusiveness has gained momentum, not only in the EU<sup>44</sup> but also in the global arena,<sup>45</sup> there is therefore an encoded systemic factor discouraging the fast spread of Industry 4.0 technologies. In sum, envisioning an EU labour market deregulation in the manner of a one-size-fits-all that triggers the resurrection of productivity growth does not seem to be realistic.

As Fukuzawa articulated, what advances civilization is beneficial and what retards it is harmful.<sup>46</sup> The counterforces mentioned above exemplify that insofar as the productivity-boom envisaged is so uncertain, potentially having a deleterious effect on inclusiveness, hence on political stability, a value-based economic governance preferring inclusive development is inevitable, as the Japan case also illustrates.

#### 4. The Need for Smart Automation—Master and Disciple: Japan and the EU

The purpose of this section is to illustrate that Europe can learn a lot from the example of Japan, which is almost structurally imbued with the spirit of inclusivity. First, we provide an insight into the key developments in inclusive growth and development for Japan and the EU. We then outline a narrative that goes beyond the usual analytical approach in the literature, and, perhaps more holistically, considers how inclusivity has become an exemplary capital of the Japanese economy, avoiding the populism outlined above. Finally,



we present the strategy of digital transformation at the dawn of Industry 4.0, which also cultivates inclusive development to make the digital revolution human-scale (Society 5.0).

#### 4.1. Intriguing Inclusiveness—EU and Japan from a Bird's Eye View

By building on authoritative and publicly available international statistical databases, we underline the growing need to strengthen inclusiveness in both Japan and the European Union. The share of the working age population (15–64 years) has been declining within the total population since 2004, accelerating in Europe, mainly due to the cyclical recurrence of COVID-19 and the structural effects of the digitalisation of labour-saving technology.<sup>47</sup> The EU seems to have reached the level that Japan has been at since the mid-1990s (Nolan et al. 2018). The decline in the labour force, as a demographic phenomenon, is detrimental to the entrepreneurial milieu, which is the activity of start-ups, and is followed by the vicious circle of an overburdened state (declining tax revenues to finance growing welfare expenditures), low productivity dynamics, and indebtedness (indebtedness of households and the corporate sector and the persistent shift toward higher levels of public debt).

The development of inclusive growth and development can be captured through statistical proxies, which are partly similar to the OECD approach, being a somewhat simplified version of it<sup>48</sup> that provides information on the demographic future of Europe based on the case of Japan (European Parliament 2019). We organize our proxy indicators under the following dimensions: (1) equal sharing of the benefits of growth; (2) inclusive and well-functioning markets; and (3) equal opportunities for future prosperity.

The dimension of equal sharing of the benefits of growth is approximated by two indicators: (i) developments in household disposable income and (ii) population poverty.

- (i) Percentage change in household disposable income: a return pattern of stagnation can be observed in both Japan and the European Union (with a further 3.1% increase in the EU in 2000; however, before the onset of the financial and real economic crisis in 2008, it was only 1.2%—not to mention the period after that, in which, e.g., households saw a decline of 0.2% in 2020); Germany, a key driver of growth in the EU<sup>49</sup>, showed, like Japan, an increase of 0.3–0.4% in this respect in 2000, compared with 1.2% in Japan and 0.2% in Germany in the year before the crisis (2007). Moreover, for the last year before the COVID-19 pandemic, there was again a significant decline in both countries (from 3.1% in 2016 to 1.6% in 2017 in Germany; from 1.4% to 0.6% in Japan).
- (ii) Poverty in proportion to the population (e.g., poverty headcount ratio at \$3.20 a day on PPP): although it is true that the population at risk of poverty and social exclusion has been on a declining path in the EU (data of 2011 was 11.8 million, compared to 9 million in 2019)<sup>50</sup>, if we look at the World Bank's data on the share of the population in which per capita consumption and income does not meet the poverty line (\$3.2 per day), one can observe that in Germany, which has a significant impact on EU growth, this figure has deteriorated rather than improved (from 0.23% in 2000 to 0.24% in 2019)<sup>51</sup>, whereas it has been particularly well managed in Japan, where it decreased from 0.98% to 0.94%.<sup>52</sup>

The dimension of inclusive and well-functioning markets can be approximated by at least three indicators: (i) productivity dynamics, (ii) employment, and (iii) SME lending.

- (i) Annual change in labour productivity (%): OECD data show that this indicator has been deteriorating both in the EU28 (including Germany as an EU core country) and Japan. Growth rates in 2000 (Germany, 2.48%, EU28, 3.2%, Japan, 2.89%) declined markedly to the last peace-year before the 2008 crisis (Germany: 1.18%; EU28: 0.96% and Japan: 0.63%), and for the last peace-year before the COVID-19 pandemic of 2019, the indicator showed a slow march towards stagnation (Germany: 0.4%; EU28: 0.7%, and Japan: 1.1%).<sup>53</sup> Therefore, the multifactor productivity (MFP) that seeks to capture overall innovation performance (the part of productivity growth that is not generated by labour and capital but by technological and non-technological innovations) suggests a weakening in both the German and Japanese economies—in

2000, MFP values for Germany and Japan were 1.6% and 1.7%, respectively, followed by 1.0% and 0.5% in 2007, and by 2018, the values were as follows: −0.1% and 0.2%, respectively.<sup>54</sup>

- (ii) Employment rate (%): while the aggregate employment rates of people aged 15–64 years seem to have improved from 2000 to 2019 (in that period, the rate in the EU27 has changed from 61% to 68.5%; in Germany, from 65.4% to 76.4%; and in Japan from 68.9% to 77.73%); still, the anti-inclusive character of economies is more pronounced, meaning that employment has increased mainly in the 55–64 age group, while in the 15–24 age group a decrease has been registered since 2005. The share of people aged 25–54 in employment is on an overall and persistently shrinking path (in 2005, their share was still 79.1%, by 2020, it was only 73.8%).<sup>55</sup>
- (iii) Loans to SMEs (% of total loans to firms): there has been a fundamentally stagnant rate with a small amount of decline in an international comparison (69.6% in 2007 and 65.9% in 2018). This is mainly due to a significant decrease in loans to SMEs between 2007 and 2012. This implicitly suggests that the SME sector does not have easy access to additional financial resources. Thus, one should not be surprised that practically 100 percent of corporate bankruptcies occur in the SME sector (their share has been on a declining trend since 2007, when 14,000 SMEs went bankrupt, while there were only 8400 companies in the same situation by 2018–2019).<sup>56</sup>

The equal opportunities for future prosperity dimension can be approximated by two indicators: (i) the gender pay gap and (ii) inclusivity in youth.

- (i) Gender pay gap: In Japan, this has been traditionally high; a surpassing degree of collegial wage differentiation is there to stay within large corporations simply because large ones are better able to attract and retain higher-skilled employees and, given their capacities, they can offer more differentiated and generous compensation regimes.<sup>57</sup> Over the last 30 years, Japan and Germany, often considered as an EU-core country, have been converging upon each other in terms of their own gender pay gaps; for instance, in 2000, the gap was 33.9% in Japan and 19.6% in Germany, and by 2017, those rates had declined to 24.5% in Japan and 16.2% in Germany.<sup>58</sup>
- (ii) Proportion of young people not in employment or education/training: in this respect, and according to the latest data available at the OECD, Japan and the German economy, one of the main engines of the European economy, have been following a similar path; the rate was 8.6% in Japan in 2014, while the corresponding figure was 9.8% in Germany in 2016.

From all this, it can be seen that inclusiveness in Japan is quite fragile, and the degree of vulnerability is very high in light of the digital revolution and Industry 4.0 having a strong anti-inclusive character. This is why some sort of smart automation and industrial approach is of high relevance both in Japan and the EU as a whole.

#### 4.2. Japan as a Sensei of Europe—Path-Dependency, Inclusiveness and Industry 4.0

The Japanese path of development in the field of digital transformation, Industry 4.0, automation and robotics, and AI can be examined from several aspects. We propose a more nuanced approach, namely, taking into account the path and performance of the Japanese socio-economic innovation ecosystem to date, and drawing lessons from economic governance practices that may inform us about the potential of materialising digital transformation. Our central message is that Japan is characterized by path-dependent solidarity, which represents a major force of inertia, so that there is a greater likelihood of artificially restrained and more moderate digital transformation (job-saving automation, robotics, AI developments, Industry 4.0 technologies). To see path-dependent solidarity, we choose a path in which we briefly review two more interrelated Japanese characteristics: (i) paradoxical duality and (ii) ailing innovation dynamism.

Paradoxical duality characterizes Japan. On the one hand, they are open in a sense—that is, they envisioned socio-economic development by scanning global competitive

advantages, thus achieving a growth miracle by the mid-1980s. On the other hand, they change culturally more slowly (a locked-in, suspicious system), remain locked, and have a sense of vulnerability (island state, earthquakes, etc.).<sup>59</sup> This type of closedness is reminiscent of the old Japanese attitude, deeply ingrained in the socio-cultural fabric, called 'kokutai', meaning that a nation is not only about a race of people with an institutional architecture working harmoniously in the back, but is also partly a desire for independence, as the famous Japanese writer Fukuzawa (2008) posited in his classical work. Japanese behavior shows that they are very afraid that the next generation will no longer have such a standard of living (which is why the birth rate may be so low).<sup>60</sup> As a result, there is a much stronger-than-average sense of solidarity in the Japanese socio-economic system.

Japan is also characterized by a declining idling of innovation. The performance of the innovation engine was greatly influenced by the fact that the configuration of processes points (and is still pointing) in such a direction that large conglomerates ultimately hold back development, i.e., in the intensity of innovation activity: they tend to innovate on a smaller scale by preferring products with a lower added value and by marketizing these on a protracted basis. In this process, the role of the following cannot be disputed: (i) the bubble-generating power of the Plaza Accord; (ii) soaring land prices with negative consequences; (iii) the growing insignificance of the idea of "small is beautiful" being reflected in a heightening tendency for monopole innovation; and (iv) stagnation.

The Japanese miracle after World War II lasted almost up until 1985, specifically until the Plaza Accord agreement. In September 1985, representatives of five governments met at the Plaza Hotel in New York (France, the then Federal Republic of Germany, Japan, the United States, and the United Kingdom) and agreed that, since the dollar had become overvalued, countries with large current account surpluses such as Germany and Japan should prop up their internal demand by not only revaluating their national currency but also by allowing its appreciation by market forces. Fiscal policy was also to foster the economic recovery. From 1989 onwards, a fiscal stimulus package was adopted, but additional resources began to flow into the real estate market, meaning that investors preferred predominantly those fields promising relatively faster returns, so organic and sustainable long-term investment practices did not develop further. In an economy struggling with space constraints, myopia had led to severe bubbling. Due to the appreciation, the country's export-oriented character cracked and Japan's international "price" jumped, which strongly contributed to the bubbling (e.g., a spectacular rise in land prices). The rapid rise in land prices—land prices in Japan were twice those of the United States—is stifling economic dynamism, especially because it makes it more difficult for new players (start-ups) to enter and develop.<sup>61</sup> Rising land prices boiled down to sharp increases in case of other costs, and that was perhaps one of the main reasons for the sharp decline in the number of children, which in turn has greatly accelerated the rate of aging of Japanese society in general. Real wages of workers have long been stagnant or even declining.<sup>62</sup> Thus, domestic demand cannot grow sustainably. This is a hotbed of deflation—a mentality of avoiding higher-risk investments that are otherwise required for far-reaching innovations that has not yet been fully overcome today. While Japanese governments have made significant investments for more inclusive growth by connecting diverse regions as closely as possible to each other, a perverse effect (i.e., an unintended side-effect of such innovation) can also be identified: during the technological and infrastructural modernisation of the road network to propel better access for many (e.g., a high-speed rail network), the intermediate settlements have become depopulated or have been experiencing significant job losses (i.e., non-linear side effects emerged).<sup>63</sup> In retrospect, another gross mistake can be identified that was made by the Japanese financial management a few years after the Plaza Accord: the capital adequacy ratio was raised from 4 percent to 8 percent (also under high US pressure) (Kang 2017; Hayakawa et al. 2021). This has drastically stifled economic dynamism, as it is not easy to raise share capital, so banks have curbed lending/lending volumes. As registered capital is highly inflexible (i.e., it cannot be raised easily), banks curbed their lending activities both in terms of intensity and volume, resulting in a drastic decline in economic dynamism

since this negatively affected the prospects of new entrants, of which the number went very low; that is, as a result of rising land prices, along with the developments mentioned above, large companies could dominate, while small ones had been screened out (and are still sifting out), meaning it is ever-more difficult for new players to enter the market. Japan has become a country of huge conglomerates. Moreover, for a long time, it seemed that the industrial use of robotics, which requires large front-load investments that can be afforded only by big players possessing all the necessary financial, managerial, and organisational resources, would result in astonishing growth rates.<sup>64</sup> It did not happen that way.<sup>65</sup> Monopole innovation was then unleashed (Swan 1970), meaning on the one hand that large companies prefer smaller scale innovations and slower development in maximising profits, while entrepreneurial dynamism (the willingness and ability of individuals to initiate and establish start-ups and new companies with innovative ideas) has become relatively low.<sup>66</sup> There is another equally important channel that is deterring rather than nurturing innovation dynamism, namely, that, with extensive aging, the behavior of the financial sector itself is adopting to certain specificities. Particularly, since households after a certain age are becoming more likely to shrink their balance sheets and to substitute safe for risky assets, limiting the credit channel of banks toward the real economy, banks and other financial institutions have become ever more wary of slowing down the financial transmission mechanism.<sup>67</sup> In Japan, there is therefore a strong and complex mechanism against productivity growth that underpins stagnation rather than helping to overcome it (a real GDP growth of 0.7% was recorded in 2019 and a shrinkage of −5.8% was expected by prominent forecasters for 2020 due to COVID-19<sup>68</sup>; the decline was, finally, −4.8% in reality). Under these circumstances, the paradoxical duality mentioned above, and in particular the above-average strength of the idea of solidarity, is not surprising at all. Nothing indicates this better, among other things, than the fact that when the bubble burst, economic governance did not prioritize the eradication of bad loans, which allowed companies to still have improving employment data by keeping them on an economic breathing machine. The principles of solidarity and social inclusion were (and are still) of the utmost importance.<sup>69</sup>

#### 4.3. *The Japanese Society 5.0—Digital Transformation in Serving Inclusiveness*

It is also clear that, due to the special demographic situation, Japan may have a basic interest in accelerating the digital transformation. As a quarter of the population is over 65 years old, Japan has the highest dependency ratio after South Korea (i.e., the percentage of those under 15 and over 64 of the working age population). Japan's population will fall below 100 million by 2050, so that there is strong pressure toward labour-saving AI and pervasive digitalisation.<sup>70</sup> At the same time, it is also true that Japan has a culture of meaningful occupation, which is accompanied by a more health-conscious lifestyle, and as a result, the program of supporting the longest possible active aging has become an economic policy preference. Furthermore, in the last 30 years, the issue of promoting assistive technologies has always been kept in mind by the Japanese economic governance in order to empower people with disabilities to get access not only to physical but also to digital services by fostering an inclusive society.<sup>71</sup> The importance of this aspect can be captured by looking at whether robotics has been crowding out employment by bearing in mind that robotics started much earlier in Japan compared to Europe. Between 1978 and 2017, the number of robots that were made domestically was on the rise without significantly endangering employment, which can be regarded as a manifestation of advanced solidarity.<sup>72</sup> A recent study revealed that an increase of one robot unit per 1000 workers increased employment by 2.2% (Adachi et al. 2021), corroborating the finding that robots and labour have been gross complements to one another in Japan. The application of robotics also awaits in areas where personal relationships are more important (the 2015 edition of New Robot Strategy also reported that despite the great fuss, robots that are truly capable of performing the multitude of tasks required in nursing and other service

sectors are still in the research and development phase). Even after the 2008 crisis (in the age of Industry 4.0), job protection was a priority. In accordance with this, companies mainly reduced working hours and did not plan any layoffs in most of the cases (working hours fell by 15% from 2008 to 2009, while the relatively low unemployment rate remained unchanged by international standards). This reflects not only a culture of solidarity, but also the socio-economic pressure that is driving the suicide rate, which has long been extremely frustrating (a historic peak was booked in 2003, then a gradual decline appeared, while it is now at a 40-year low rate) by encouraging the Japanese economic governance to support firms in retaining jobs or expanding pastoral services.<sup>73</sup>

High-volume investments in Industry 4.0 technologies are delayed for several reasons. On the one hand, it is true that after the 2008 crisis, the extra amount of capital flowing into Japan looked primarily for a shelter, thereby the appreciation of the yen was a logical repercussion of pushing export dynamics down and down, resulting in fewer and fewer profits for Japanese firms (Thorbecke 2019; Miyagawa and Ishikawa 2021). As a result, there is not enough financial ammunition to accelerate the deployment of Industry 4.0, which necessitates significant front-load investments. On the other hand, within the demographic context described, Japan is to bolster the widespread diffusion and application of robotics and automation (partly based on AI), but with the aim of prioritising human-to-machine collaboration over the development of the deeper penetration of machine-to-machine cooperation. Research on machine learning, as well as on artificial intelligence in general, and on the applicability of both of these in particular, started to revive from the side of the state especially in the 2010s.<sup>74</sup> Japan's strategy and vision for industrial development (Connected Industries Tokyo Initiative 2017) reflects some sort of smart automation in the sense that it also included the clause that human-machine collaboration should be given a central role. In addition, a state support program to encourage small and medium-sized enterprises to become more involved in AI and other Industry 4.0 activities, by offering a supercomputer capacity called AI Bridging Cloud Infrastructure in order to get ahead in the application of AI, can contribute to the dismantling of big conglomerates. Furthermore, one of the key leitmotifs of fiscal and monetary stimulus together with direct state supports (for the most severely affected sectors and industries), born as a compulsion to rescue due to COVID-19, is to keep the principle of free trade alive by supporting companies that have so far been integrated into global value chains and encouraging new ones to join. In other words, there is no trace of forcing a more autarchical development path through Industry 4.0 technologies—specifically AI, robotics and 3D printing—that is, they insist on the sacredness of an international trade concept based on an international division of labour and wage-based competitiveness. All of this sheds light on the Japanese goal of achieving a super-smart but still people-centred society (Society 5.0)<sup>75</sup>, and if Europe sympathises with this, it may well be worth learning from the Japanese path, because it could easily be the sensei of the old continent.

After Society 1.0 (prehistoric hunter-gatherer communities), which existed, for the most part, 11–12 thousand years ago, the settling and farming Society 2.0 appeared. Later the Industrial Revolution created Society 3.0, which was replaced by Society 4.0 with the development of information and communication technologies in the midst 1970s, and now a sort of Society 5.0 is on the horizon, re-armed with human proportions in the world of cyber-physical systems to be created by machine learning, artificial intelligence, Big Data, and Industry 4.0 technologies (Matas-Terrón et al. 2020). The latter is thus a people-centered society that implements a system of systems through the Internet, artificial intelligence, and Big Data (Rojas et al. 2021), that is, by integrating cyberspace and physical spaces into interconnected systems to balance economic development while addressing local and global social problems (e.g., reducing greenhouse gas emissions). While Society 4.0 has made our lives bittersweet with an abundance of information—it is extremely difficult to select, turn it into knowledge, and use it effectively—Society 5.0 is able to take that burden off our shoulders with the help of increasingly advanced machine learning and artificial intelligence as Table 1 depicts. As a result, an individual's opportunities for personal

development can be more easily established, and active and enjoyable living and real development will be a reality for a wide section of society.

**Table 1.** Society 4.0 vs. Society 5.0.

Problem in Society 4.0	Bridging Technologies	Solution in Society 5.0
Due to information overflow, finding and analysing the information desired has become increasingly difficult and burdensome (Limitless amounts of data became available to humans through cloud-based services, for example, but their analysis and evaluation depended on human skills and abilities).	artificial intelligence (AI), sensor-based networks	With the proliferation of sensor-based networks, more and more detailed data is being generated. AI relieves people of the burden of analyzing the flow of information (e.g., more accurate medical diagnostics can be developed with AI, etc.). <sup>76</sup>
People typically do a large amount of work, have severe limitations in their abilities, and have severely limited employment opportunities for the disabled and disadvantaged.	robotics, automation	Human-centered robotics and smart automation expand our capabilities and the room for inclusive development (human-machine connection helps to bridge many disabilities, etc.). <sup>77</sup>
Silo-thinking is common and the sharing of knowledge and information is severely limited, making it difficult to create added value across sectors.	Internet of Things	IoT connects people and devices, and all kinds of knowledge and information are shared, so a whole new value can be created.
An aging society and regional depopulation indicate a large gap between the social class which is declining in size but still thriving in the information economy and the social stratum, lagging behind while expanding in its size.	smart devices, sensors, 3D printer	Certain new technologies, and services based on them (e.g., drone post), can reduce the gap (autonomous taxis and buses help to address driver shortages, thus better integrating rural areas into the economy).
The information revolution did not result in a lasting and spectacular productivity boom, moreover, the ecological footprint did increase, while the financial burden on the state has been increasing.	Industry 4.0 and AI	Smart factories emerging in industry, as well as real-time AI-based use of Big Data from all walks of life, promise more efficient production and services tailored to actual needs, with less surplus, energy use, and waste. Sensors, AI, and robots specializing in more dangerous jobs can be used to more cost-effectively monitor and maintain public infrastructure.

Source: own compilation.

Japan is in a relatively good position to achieve Society 5.0. (i) The universal health system (surrounded by digital services and data management) and the relatively highly digitized manufacturing sector generate a rich dataset from month to month (Big Data), which can be an excellent input for AI-based complex analyses. According to a global survey initiated by the European Patent Office<sup>78</sup>, after the United States, Japan is actually the second society in the world where the use of artificial intelligence and the number of Big Data applications are the most prominent. Of course, in the field of cyber security, progress must also be made on the regulatory side in order to mitigate the risk-averse behaviour of economic actors. (ii) In the field of robotics and automation, Japan is also at the forefront, where robotization is practically the central driving force of industrial production (*monozukuri*). Ultimately, the long-term sustainability of public finances will also

benefit from the construction of Society 5.0, as the health and social security expenditures responsible for a significant share of public debt, resulting from the demographic situation described earlier, will allow these technologies to be contained.

## 5. Discussion

In his Nobel Lecture, Friedrich August von Hayek drew attention to the need for economic governance to guard against continuous optimization that tends to lead to painful uncertainties and distrust due to the complexity of the socio-economic system. It follows that choosing the way of trying to avoiding particularly bad outcomes is a more instructive one. Our paper suggests that *the digital transformation may somewhat overshadow this admonition*, because the high degree of automation, the dizzying development of artificial intelligence and robotics are fundamentally detrimental to the employment capacity of states, which happens to be nothing more than an important aspect of the functioning of social mobility through meaningful and valuable work. As we have pointed out, the rise of inequalities—and thus the dynamic process of impoverishment, the shrinking of the middle-class—has become the new normal state of the developed world, after which flaring nationalism and populism was a logical consequence. While the belief that we need to achieve sustainable development seems to be becoming more rock-solid in the international arena—we are thinking here of the UN Sustainable Development Goals or the Sendai Framework Programme's goal of resilient societies that can cope with natural disasters and other shocks—still, inclusive development has a rather exclusive character by becoming a *sine qua non* of political stability. An image of the state (perhaps more interventionist in this respect and striving for optimisation) that is willing to embark on a path of a kind of social digital transformation is therefore emerging on the horizon. Although, according to Hayek, the social adjective is only a kind of *privative suffix*—in other words, the social market is not a market, the social economy is not an economy—the demand for a stronger emphasis on the social dimension now seems to be greater than ever and has therefore become non-negligible with the emerging digital economy. The case of Japan was brought up here for this reason.

To sum up, our paper has signalled that we are rather pessimistic about the extraordinarily positive impacts of the ongoing digital transformation and Industry 4.0 in the short term, but that we do also hope that our line of thinking gives an opportunity to be optimistic in the long run. This would require certain steps to be taken by economic governance. In the following section, we formulate some interwoven principles along which the European economic governance may pave the way for inclusive development. Our underlying starting point is that inclusive development is not a discrete factor (not merely requiring a focus on directly raising employment) but a pattern of different, complex, intertwining channels. The case of Japan does not suggest the appropriateness of preserving jobs at all costs, but rather highlights the need for an inclusive growth direction that builds on dynamism. What is more, the Japanese way of development can also provide a reasonable basis for discourse on the future of Europe by implying that economic governance without inclusive development opens up a path for social dissatisfaction, which can cause a multi-faceted problem in the socio-economic innovation ecosystem through anti-elitism.<sup>79</sup> The comparative analysis suggests that inclusiveness cannot be treated as a single and independent factor by a sheer concentration on raising employment, but that it is being heavily influenced by a complex set of different intertwining channels such as the speed of change (directing toward gradation), limited direct job-creation power of the state (directing toward indirect and multifaceted job creation), the lack of attractive and productive jobs (directing toward cultivating good jobs), a declining innovation base (directing toward boosting innovation milieu by relying on parallel learning given by a widened base of the middle-class), cultural norms, and the value base of government (directing toward a value-congruent policy design in the age of digitalisation and industry 4.0). Putting these principles into practice may ground the development of inclusive industry.

The following intertwined principles constitute the contours of an economic governance geared toward the mission of safeguarding inclusive development in the era of digital transformation. This is the way in which to foster smart automation for a sustainable European socio-economic development path.

- (1) The principle of gradation. Preferring this principle is in order when the state seeks to support the development and completion of the digital economy. This is because economic history certainly teaches us at least one thing: the price of development can be a great social upheaval if there are no countervailing mechanisms (as this paper documented, Japan has been working on this). As a corollary, a specific policy goal arising here is that economic governance should raise public awareness of the changing areas of its competence in better communicating its ever more limited character. This is of essence in reshaping public expectations about the efficiency and effectiveness of public policy actions and the gap between reality and policy.<sup>80</sup> Gradation can be a means of preserving public trust in governance, necessary both to initiate actions and to continuously address critical exigencies such as the paradoxical nexus between digital transformation and inclusiveness.<sup>81</sup>
- (2) The principle of indirect job creation. Although many self-proclaimed Christian-conservative economic governments argue in favour of building a work-based society in Europe, and while it is true that Pope John Paul II's famous *Encyclical of Laborem Exercens* precisely advocated that work is about people-to-people contacts and solidarity and is ultimately the key to being human, large-scale state programmes directly targeting the creation of new jobs in high volume would by no means be forward-looking, but would rather just evoke lost eras, and this kind of omnipotent-like state operation would be nothing but a pompous exertion without serving the sustainable digital phase transition. There is a narrative that emerging new technology changes the nature of work, for which workers must adjust through various trainings and skill-upgrading activities. This approach assumes that technological development is exogenous. However, in reality, that assumption does not hold at all. Policies, incentives, culture, norms and ingrained values all influence the direction of technological development. Thus, economic governance dealing with complexity should focus more on systemic processes affecting the labour-aspects of phase transitions in an effort to level the playing field for indirect job creation (e.g., whether competition policy grounds low wages by disincentivising innovations; whether the tax system is taxing labour more while subsidizing capital by deepening inequalities, thereby pushing toward automation etc.). Importantly, by taking into account a trend that is relatively easy to extrapolate while extremely difficult to reverse, namely, the trajectory of demographic change together with the increase in the old-age dependency ratio, (including an increase in dependence on medical care, e.g., 75% of people over the age of 85 require continuous medical supervision and care), the most obvious thing the state can do is to prioritise those digital developments (automation, robotisation), helping to get those jobs done that are not going to be done by those who choose to care for the elderly instead. Moreover, continuous and even increasing efforts are needed to mobilise people with disabilities via assistive digital technologies, providing them the opportunity to be absorbed by the labour market in the digital age.
- (3) The principle of moving targets in the case of 'good jobs'. The concept of 'good jobs' is a moving target. Apart from the fact that further research is needed to define 'good jobs', it must be a context-dependent concept, which is, at the same time, essential if economic governance is to strengthen inclusion. Modern welfare states are still guided by the idea that good middle-class jobs are available and that all we need is just to act via social spending on education, skills and health, pensions, and social insurance against certain known risks (disability, illness etc.), so that everyone can get such a job sooner or later. However, as we documented, the anti-inclusive feature of the socio-innovation ecosystem, resulting in insecurity and inequalities on many grounds, has been a structural phenomenon, which then nullifies the validity of the



idealistic thought mentioned above. Once phase transition is taken into account (pervasive digitalisation, robotisation, automation and Industry 4.0), which has been structurally and secularly triggering the hollowing out process of the middle-class, we can emphasise that productive good jobs are available inadequately (i.e., non-productive bad jobs are out there).<sup>82</sup> Additionally, perhaps, with the advent of AI-based robotics, those jobs are going to be good ones that cultivate consciousness (i.e., jobs mastering empathy, responsibility, and creativity), which are spheres that robots cannot imitate easily. This calls for a mixture of policies geared toward breeding *value-added inclusiveness*, but not necessarily in accordance with the Rodrikian approach. It is true that the Rodrikian view admits that the concept of good jobs is highly multidimensional and can vary extremely not only from country to country, but also from firm to firm. Importantly, his approach by and large assumes that good jobs are productivist-ones at the end of the day. In our view, *good jobs as such mean social and personal well-being, improving participation in a process of preserving and creating value* (not necessarily market-based, not necessarily for-profit), such as extending the social innovations brought about by the digital economy to promote active aging; for community-funded and value-creating production, service provision (e.g., care and maintenance work, as the case of Japan illustrated<sup>83</sup>), process, or marketing and organizational modernization that underpins green qualitative growth. In short, it directs toward a sustainable good job strategy as a view to inclusive development (e.g., employer-centred active labour market policies; innovation policies targeting human-face phase transition by augmenting labour rather than by replacement by AI and robotization etc.).

- (4) The principle of interlinked parallel learning and a healthy middle class. Inclusive growth is a type of qualitative growth which cannot be pursued only by reaching quantitative employment goals. Under no circumstances should it be believed that all kinds of inclusive growth are sustainable (e.g., there can be a high employment rate which in turn compromises the sustainable development goals; it is possible to keep companies on an economic life support system by not letting the inefficient and non-competitive ones be selected out; temporary work can be promoted to reduce unemployment insurance-related public costs without engendering a lasting positive impetus on regular employment<sup>84</sup> etc.). This underlines the complex and context-dependent nature of inclusive development, requiring continuous knowledge updates as well as the monitoring of crucial interactions. The case of Japan suggests that it is by no means sufficient to advocate the mere preservation of already-existing jobs, because—in the configuration of the system—it may lead to the silence of dynamism through large corporate dominance. It is necessary to refine inclusivity that drives both productivity and qualitative growth, when the “widening” of the middle class actually becomes a means of completing the parallel learning mechanism in a period of increasingly complex products and services (e.g., the practice of the exaptation of late-comers). Thus, when we look at innovation dynamism from a systems perspective, it is not always worth focusing on the pioneers (first-movers), if for no other reason than that agile laggards can be precisely those who, with the right capacities, think more deeply about what else existing innovations could be used for to further expand the range of innovations in order to promote well-being and prosperity. As today’s products and services become increasingly complex, first-movers do not necessarily have the resources and interdisciplinary expertise required for this type of rethinking and, where appropriate, market realization. Daniel C. Dennett, one of the best-known philosophers of our time, put it this way: what we can imagine depends on what we know. This cannot work without a broad middle class serving both as a source and an applicator of knowledge. There is therefore a need for a pulsating, innovative business climate for young and agile businesses, which per se identifies a range of areas for economic policy intervention (promoting technology diffusion, ensuring financial flexibility, prioritizing human capital development, etc.).<sup>85</sup>

- (5) Value-based inclusive economics governance. In fact, the case of Japan partly refers to the literature on motivated beliefs and reasoning<sup>86</sup>, notably that the Japanese economic governance attaches value to inclusive growth and development, which strengthens Japan's social identity as a means of giving hope and alleviating social anxiety, thereby cultivating harmony in communities and groups ("wa"), which is a historical motif of Japanese society. All mechanisms should be put in place that are likely to promote (i) the expansion of more productive employment capacity in existing and competing firms; (ii) an increase in the number of firms promising more productive employment; (iii) the enhancement of the workforce, allowing it to be a driver of the digital economy (e.g., education investment to better integrate talent from lower-income families, retraining programs, redesigned training approaches to facilitate working-with-automation; (iv) at the micro level, shifting innovation towards labour-friendly technologies and non-technological solutions (e.g., support schemes to increase the labour base rather than replace it with machines); (v) the reactivation of progressive tax systems in reducing excessive inequalities as well as in attenuating large concentrations.<sup>87</sup>

Let us underscore that our line of thinking is not intended to support any expansion of state interventionism. On the contrary, intensive state interventionism is thought to be dangerous.<sup>88</sup> The unpredictability of a complex socio-economic system forces us to be modest, rather than stimulating economic policy engineers to lead to high volatility and loss of social confidence. Still, when there is critical exigency in plain sight, and when the employment effect of the digital phase transition has the potential to undermine social trust, thereby deterring political stability, economic governance shall embrace a mission of inclusiveness in the interest of all, though in a cooperative manner. It is not about a growing state interventionism in its classical form, rather, it is about a collaborative co-design of policy instruments and programmes among the state, the private sector, and the civic sector in a more conspicuous way in the common interest of grounding sustainable inclusive development. In doing so, economic governance should be based on temporality, iterativeness, continuous evaluation, and reflection combined with dialogue. This shall serve as a gradient for European integration as well.

Indeed, it was long ago that Kuhn ([1970] 1996) wrote that the critical mass of anomalies is an elementary condition for progress. If there were this critical mass, the only question is whether economic governance can provide the right answers. The case of Japan is exactly an example of the fact that there is the opportunity for every economic governance to bend the digital transformation to its own traditions and values along collective actions. As a matter of fact, the case of the Rising Sun's country has epitomized that during the digital transformation, including the development of Industry 4.0, economic governance can strive to turn the processes into *social innovations* for the further cultivation of human capabilities. All we need to do is just to follow the route advised 66 years ago by one of the greatest humanists of the 20th century, Fromm ([1955] 2008, p. 352), when thinking about robotization, namely, that we should give *human proportions* to the process to have a sane society.

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## Notes

<sup>1</sup> As regards big boom events, Perez (2002) listed the followings: Opening the Cromford Mill in 1771; Rocket steam engine in 1829; opening of the steel plant in 1875; first Ford Model-T in 1908; and the Intel microprocessor in 1971.

- 2 Rajendran et al. (2020) illustrated the importance of such a need when outlining the socio-spatial approach to inclusive well-being.
- 3 The highest income earners in OECD countries faced an average tax rate of 66% in 1981, of which the number was merely 51%  
in 1990, while 47% in 2000, and 41% in 2008. Available: <https://www.oecd.org/social/OECD2014-FocusOnTopIncomes.pdf>  
(accessed on 6 January 2022). Evaluation studies on the impact of mitigating progressivity of tax regimes on income and wealth  
inequalities have revealed that such undertakings did perceptibly exacerbate household income vulnerability and inequality. See:  
Elzinga (2015).
- 4 Economists thought earlier that when employment rises, government revenues do the same; when productivity increases, wages  
do too; *homo oeconomicus* prepares for a worse period and saves in advance to smooth out its consumption later. These ideas have  
become obsolete by today. See for instance: Standing (2016) or Kovacs (2022).
- 5 Populism basically means that the given politician (leader) pitches the public against the elites or other enemies, against which  
he or she is to defend the true people of the nation. See: Funke et al. (2020) or Guiso et al. (2020). Suffice it to think of Donald  
Trump's populist narrative at the time of his presidency, to the narrative for Brexit in the UK (Foster and Feldman 2021), to Viktor  
Orban's Hungarian narrative against Brussels, or to the recent developments in Poland (Lipiński 2021). Examples for populist  
parties in the EU are many: Syriza (Greece), Podemos (Spain), AfD (Germany), Golden Dawn (Greece), Freedom Party (Austria),  
Freedom Party (Netherlands), 5 Stars (Italy), etc.
- 6 Human nature is pervaded by the application of certain heuristics as (rules-of-thumb) as Nobel-laureate Kahneman (2013)  
showed us (e.g., people tends to interpret phenomenon in a way that confirms their preconceptions etc.).
- 7 Simulacrum is the triumph of deceit replacing factuality as Baudrillard (1983) advocated (e.g., fake news during the U.S.  
presidential election, news distorting people's knowledge about the effectiveness of vaccines like in Japan where fewer and fewer  
people had been vaccinated against HPV in Japan due to airborne research finding).
- 8 E.g., political budget cycles driving a great proportion of the population into the slavery of debt, the political myopia with the  
growing size of the state, or even the area of trade.
- 9 E.g., Venezuela or Bolivia, where decades-long populism led to hyper-inflation, capital flight, emigration, gigantic poverty and  
unprecedented consumption restrictions.
- 10 See: Birdsall (2016), Madland (2015). The middle class is of paramount importance in offering a broader tax base for the state to  
redistribute, which has become ever more important with respect to mitigating the growing share of the precariat, a class living  
outside the social safety net day by day, see Standing (2016).
- 11 The term 'good jobs' has gained more momentum by the recent works of Rodrik (2019, 2021).
- 12 Minnaar and Morree (2020) draws attention to the fact that today 85% of employees do not essentially identify with the  
organization where they work; 23% feel burned out and 37% believe that their work does not represent any social utility.
- 13 The document of the famous Rio +20 conference, which took place in 2012, also notes that the lack of decent work is a growing  
problem in the world economy as a whole. Available: [https://www.un.org/ga/search/view\\_doc.asp?symbol=A/69/700&Lang=E](https://www.un.org/ga/search/view_doc.asp?symbol=A/69/700&Lang=E)  
(accessed on 6 January 2022).
- 14 Squeezing of the middle class is a worldwide phenomenon, not leaving untouched countries like Sweden or Germany. The  
respective data for the generations of baby boomers, generation X and the Millennials in the case of Sweden were as follows: 84%,  
63% and 62%; while the German data were 71%, 70% and then 61% (close to the OECD average of 60%). See: OECD (2019).
- 15 ILO (2020, p. 27) reported that globally, 35.6 per cent of the young working-age population was employed in 2019, down from  
46.4 percent in 1999.
- 16 OECD (2011) documented that as globalisation proceeded, the gap between rich and poor has just widened.
- 17 Gutiérrez and Philippon (2020) showed that, contrary to common wisdom, dominant US firms have not become larger, still, have  
not become significantly smaller either, moreover, they have not become more productive, and their contribution to aggregate  
productivity growth has fallen by more than one third since 2000. For instance, top 5 equity market share rose vividly between  
2015 and 2020. For more on the concentration of big players, see: Babina et al. (2021) or Cavenaile et al. (2021).
- 18 See: <https://www.oecd.org/els/emp/4358365.pdf> (accessed on 6 January 2022).
- 19 Which drew attention to the unfortunate fact that a third of the world's population does not have the resources to survive  
the economic effects and consequences of the pandemic. In December 2020, half billion people worldwide were registered as  
underemployed or unemployed. See: Oxfam (2020).
- 20 By way of comparison only, in six weeks during the COVID-19 pandemic between March and April 2020, S&P500 and Dow Jones  
(industry average) indices dropped by 35%; such a downturn took 6 months during the 2008 crisis. It is hard to deny that it  
is much easier for companies to embark on the path of automation and robotics (or AI) when COVID-19 has already led to a  
number of layoffs. In the US, that number is close to 40 million, but millions in Europe have also been put in a special position by  
the pandemic.
- 21 In case of Germany, often regarded as one of the core engines of EU growth, 22% of lower-income workers in occupations are at  
high risk of automation, while it is 10% in the case of upper-income workers. These data are hovering around the OECD average.  
See: OECD (2019), Under Pressure: The Squeezed Middle-class.

- 22 For more about the trends in the squeezed middle-class, see OECD (2019) revealing the perplexing fact that the top 10% of  
23 households in the income distribution has approximately half of the total wealth, while the bottom 40% possesses with only 3%.  
24 Not only manual tasks, but also sophisticated jobs, requiring more serious intellectual efforts, are at risk of automation and  
robotics because of machine learning or artificial intelligence (e.g., those involved in tourism, hospitality, retail, food preparation,  
shipping, freight, education, but also lawyers, screenwriters, etc.).  
25 See: OECD, Science, Technology and Industry Scoreboard, 2017.  
26 The issue of upskilling was shown by Acemoglu and Restrepo (2019) by demonstrating it along the trend in reinstatement.  
27 Prettnner and Bloom (2020) do also consider the reform of the tax system to be more suitable for automation (e.g. introducing  
progressive consumption tax).  
28 Danielsson et al. (2021) shed light on the unvarnished fact that a more vivid and broader application of AI will require more  
decisive interventions from the side of the state (e.g., to optimise the financial system).  
29 Toynbee (1962) already pointed out that development ultimately stands or fails in the ability of societies to offset the difficulties  
associated with development by strengthening social cohesion. Toynbee (1962).  
30 According to Fukuzawa, “[ . . . ] the workings of the human mind are complex and constantly changing. Today’s gentleman  
is tomorrow’s commoner and today’s enemy tomorrow’s friend. The greater the fluctuations, the more extraordinary life’s  
transformations can be.” (Fukuzawa 2008, p. 61).  
31 Of course, the number of factors that are influencing productivity growth is higher, for instance, even the political system matters,  
see Jalles and Mello (2019).  
32 Despite the lack of convincing empirical backing (Baldassarre and Ricciardi 2017), improved productivity via Industry 4.0-related  
technologies (e.g., robotics) and nontechnological solutions is widely expected in the literature. See: Aichholzer et al. (2015);  
Vaidya et al. (2018); and World Economic Forum (2018).  
33 For more on upskilling, see: de Pleijt and Weisdorf (2017) or Krzywdzinski et al. (2016).  
34 A survey conducted by Chapman University in 2016 showed that, after corruption, what Americans fear the most is cyberterrorism.  
Available: <http://www.usatoday.com/story/news/nation-now/2016/10/12/survey-top-10-things-americans-fear-most/91934874/>  
(accessed on 6 January 2022). It is hardly by chance that the number of reported industrial control incidents as well as  
the number of cyberattacks against manufacturing firms have been conspicuously growing (Piggin 2016).  
35 It is per se telling that, as Pleger et al. (2021) illustrated, even the difference between data security and data protection is not clear  
for many in one of the growth engines of Europe, Germany.  
36 People analytics is here to stay as Isson and Harriott (2016) argued.  
37 Since telework proved to have a negative impact on work efficiency at IBM, the company stopped the two years of experimenting  
with telecommuting in 2017, before the coronavirus came out.  
38 For more on the reallocation channel, see: Martin and Scarpetta (2012). Of course, not only the tangible (salaries/wages, bonuses  
etc.), but also the intangible (e.g., autonomy, space for self-realisation, increased responsibility) part of the incentive regime  
matters (See: Beck-Krala et al. 2017), whose power can be curbed in the case of extensive ICT-based monitoring and control,  
encoding the culture of anxiety mentioned above. For instance, UPS follows every move of its drivers via ICT devices, or,  
at Amazon, harrowing work conditions have been revealed as an undercover journalist reported after visiting an Amazon  
warehouse where workers are using bottles when they have to urinate because fulfilment demands are too high at the company.  
39 Komlos (2019) found that, between 1979 and 2013, welfare growth was substantially slower than income growth, and that the  
middle-class quintiles fared worse.  
40 See the data at Eurostat (lfsi\_emp\_q). still, as Nakamura and Zeira (2018) demonstrated, automation can give rise to unemploy-  
ment unless rising wages is feasible in a sustained way—which is not the case in many countries.  
41 See: WEF (2020).  
42 Labour market flexibility simulations on Europe is therefore suggesting perverse effects to emerge as Cette et al. (2016) or Kurz  
(2017) righteously pointed out.  
43 Source: Statista, Citigroup, World Bank.  
44 In a survey carried out by Capgemini Research Institute, 58% of company respondents reported that the positive impetus of  
automation on productivity was actually invisible. Available: <https://www.capgemini.com/wp-content/uploads/2018/11/Report-%E2%80%93Upskilling-your-people-for-the-age-of-the-machine.pdf> (accessed on 2 December 2021)  
45 The growing importance of ageing and its multifaceted consequences have become a deeply researched topic today, when life  
expectancy has reached 70 years in the world (and has even exceeded it in many countries), and for the first time in the history of  
mankind, the number of individuals aged 60 or older has eclipsed that of the number of children under the age of five. On the  
increasing European awareness over the issue of inclusion, see: Europe2020 Strategy or the Annual Convention for Inclusive  
Growth.  
46 See: OECD Inclusive Growth Initiative. Not to mention the Sustainable Development Goals of the United Nations accentuating  
the promotion of sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for

all. Recent work, among others, offers work–life balance in a more dedicated and flexible way, which is required more and more by generation Y. See: [Robak \(2017\)](#).

46 It was exemplified in [Fukuzawa \(2008, pp. 46–49\)](#), however, freedom and independence were also mentioned as key prerequisites and, at the same time, results of any real development

47 According to Eurostat, COVID-19 has caused fractures in sustained trends. For example, the share of the population outside the labour force has started to increase again, which has been declining for almost 17 years. It rose from 26.6% to 27.1% by 2019.

48 See: <https://www.oecd-forum.org/posts/52681-inclusive-economic-growth-are-we-talking-about-the-same-thing> (accessed on 6 January 2022).

49 Germany is used here as a core EU Member State that is widely considered as an engine of EU-growth. Insofar as relevant processes can be identified even in Germany, one of the most competitive and innovative countries of the EU, it offers a more fertile ground to see what is happening in Europe as compared to Japan. Germany is by no means tackled as a hegemonic power over the EU as [Freudlsperger and Jachtenfuchs \(2021\)](#) demonstrated.

50 If one takes a mere glimpse on the at-risk-of-poverty rate among employed persons at EU28 level, it becomes clear that the rate did increase from 8.3% of 2010 up to 9.2% of 2019. See: Eurostat (ILC\_IW01).

51 By reflecting partly upon the demographic challenge with an ageing society in Germany, it is also telling that the share of 65 years old and older people at risk of poverty after social transfers was 15% in 2009, while it has been rising since then up to 18% by 2019. See: Destatis.de, Leben in Europa (EU-SILC).

52 In Japan, the proportion of people living below the \$1.9 per day poverty line has started to rise (from 0.48% in 2000 to 0.73% in 2019), which is not in line with the global trend. For data, see World Bank, PovcalNet Database.

53 Data are stemming from OECD.Stats, doi:10.1787/02c02f63-en

54 Data are stemming from OECD.Stats, doi:10.1787/a40c5025-en

55 See: Eurostat (lfsi\_emp\_a)

56 See: OECD Financing SMEs and Entrepreneurs 2020, [OECD \(2020\)](#).

57 Of course, this is not always the case, as the cultural background of Japan results in the primacy of community and group consciousness, that is, the preference for collective performance (e.g., productivity) (see [Sakamoto et al. 2012](#)). As a corollary, the Japanese cultural values manifest as a strong counter-incentive to large wage gaps. See [Ikeuchi et al. \(2021\)](#).

58 In France, which can also be seen as a core EU country, there has been an ever increasing share of the gender wage gap between 1995 and 2015. See: [Palladino et al. \(2021\)](#).

59 The relative closedness of Japan dates back to ancient times and many comprehensive works have been written on this. [Diamond \(2005, pp. 296–97\)](#) stressed that Japan had seemingly fared quite well during the two centuries when the country cordoned itself off from the rest of the world. However, this self-sufficiency did not mean that they would not have been self-dangerous: closeness entailed with intensive deforestation that caused serious environmental and population crisis (increased flood tendency leading to soil erosion and river siltation etc.). Closing was rather self-defeating.

60 The fact that Japan happens to be the most indebted country in the world (with a debt ratio above 250% of GDP) with the lowest inflation in the world, what is more, the fact that the propensity to save, as a demographic consequence, is uniquely high in global comparison (demographic consequence) also underpin this argument. Furthermore, in the 2021 edition of the World Values Survey on Japan, it was clear that most Japanese do not feel that they can control their lives properly, so they want the next generation to no longer value hard work (which gives them a sense of security to carry on their current standard of living) but to imagine a completely different way of life. <https://www.worldvaluessurvey.org/WVSNewsShow.jsp?ID=439> (accessed on 6 January 2022).

61 Among other things, [Hawkins \(1993\)](#) explained the persistent deterioration in the number of independent start-ups (i.e., not founded by large companies) by the rise in land prices. What is more disappointing is that start-up dynamics (including the trajectory of unicorns, that are reaching the current valuation of one billion U.S. dollars or over) have not been showing any spectacular improvement since then in international comparisons. See: [Storz \(2006\)](#), [Kettenhofen \(2021\)](#).

62 Between 1995 and 2013, for example, average real wages increased by only 0.3 percent, while real median wages increased by 0.2 percent. See: [OECD \(2018\)](#), p. 56.

63 On the power of enhanced interconnections on aggregate employment, see [Hayakawa et al. \(2021\)](#).

64 Abe Shinzo’s pro-growth economic policy has also sought to counter this, but the Yoshihide Suga administration, was also expecting faster and visible smaller results from increased competition, deregulation and fiscal and monetary stimulus, which will hopefully provide the social capital for more painful reforms.

65 High expectations have been falling short for decades with respect to robotics, see [Togai \(1984\)](#), or [The Production Engineer \(1982\)](#).

66 [Honjo \(2015\)](#) documented that there are relatively low levels of entrepreneurial attitudes and activities in Japan, and, what is more, individuals tend to invest in a new business if and when the necessary entrepreneurial network is available for him/her. This type of collaborative mindset is culturally carved into the Japanese business life since the well-known concept of “wa” (see

Konishi et al. 2007) makes them strive to think in groups and collegial performances rather than predominantly attaching value to individual efforts.

67 Imam (2012) also documented that older households are exposed to new types of risks, such as longevity risk resulting in serious implications for sovereign debt and equity re-pricing, and also by affecting insurance companies.

68 See: OECD Outlook (OECD 2019).

69 In Japan, a questionnaire embracing 10,000 respondents found that 30% of employees associated a high risk with AI, robotics, and automation with respect to their job outlooks (Morikawa 2017a, 2017b). Where occupational-specific skills are of paramount importance and where personal contacts are predominantly preferred (in spheres like childcare, health and education), there was less fear of losing their jobs (these employees faced a much lower share of teleworking under COVID-19, see Okubo (2021)). Basically, in Japan, with the advancement of computer technology, the risk of job losses has increased (today 55% of jobs could be replaced by robotics and automation), but the risk of replacement is even more pronounced for non-regular employees (David 2017).

70 It follows from the high dependency rate that there is a high demand for robotics. The number of robots per 10,000 workers is around 350, close to the South Korean value, which means that almost three times as much is invested in robotics as in the United States or Finland. Source: *Robotics and Automation News*. At the same time, the Ministry of Education introduced the teaching of programming logic in primary schools from 2020 onwards in promoting the awareness of the younger generation of AI and the digital economy itself by not letting forgotten the cultural root of always respecting the elderly (e.g., the Japanese word, *Senpai*, expresses the crucial importance of human relationships, traditionally considered in case of the elderly who offers mentoring for the younger ones and shares the experiences obtained with them).

71 According to the ILO's definition, an assistive technology (AT) is any information and communications technology, product, device, equipment and related service used to maintain, increase, or improve the functional capabilities of individuals with specific needs or disabilities. For more on the advanced AT development in Japan, see Crume (2018) or Neumann (2016).

72 Of course, preferring the domestic economy and its people has been a solid feature of Japan As Lind (2018) showed, lingering trade barriers were imposed in agriculture and non-tariff barriers in industrial sector by protecting different sectors. Additionally, where the economic governance allowed liberalisation, the next task was always to uphold the social compact of extending benefits to dislocated and displaced workers as soon as possible. That kind of inclusive growth-orientation saved the country from populism.

73 This political-, economic and social constellation has been systematically disincentivising a more balanced investment in tangible and intangible assets Miyagawa and Ishikawa (2021).

74 The Artificial Intelligence Research Center (AIRC) was established after 2015.

75 COVID-19, of course, steered (and is still steering) the economy towards a higher degree of digitalization as a result of epidemiological measures. Japanese economic governance tried to create the possibility of telework in the public sector as soon as possible (but also in the case of SMEs); they set up for distance learning and were to digitalise as many public services as possible.

76 Robot scientists are able to make new scientific discoveries (e.g., robot scientists Adam and Eve formulate hypotheses about yeasts and validate or reject them experimentally; and a robot platform called Rose helps minimize complex neurosurgical procedures). In education, Big Data offers more learning opportunity as the Andalusian case by Matas-Terrón et al. (2020) illustrated.

77 E.g., the BioMind AI system has proven to be more successful in tumour diagnosis than an elite medical team. See: European Society of Radiology (2019).

78 See: <https://www.lexology.com/library/detail.aspx?g=08273de9-b847-4a3e-8dcd-9831e120e1a9> (accessed on 6 January 2022).

79 In Japan, we have seen that there is less and less chance of getting into (good) jobs, which makes the masses of young Japanese new entrants stressful and disappointed. A similar phenomenon can be recognized in the US or in some European countries. The share of agile young people with more than one degree, obtained with a lot of effort and investment, who are unable to find their calculations (do not get into good jobs, cannot become part of the elite, either) has been accumulating. According to a CEDEFOP (2020) survey, 30% of workers in the UK are proved to be over-skilled, a minimum of 30% of workers in the EU are not in a position to match their qualifications and skills, and 45% believe they could work more effectively through further training or employment. 25% of young adult workers are considered to be absolutely over-skilled, but an even more worrying trend is the increase in the proportion of workers (40%!) who, after leaving a job that matched their qualifications and skills, only find a new job showing serious discrepancy between expected and existing capabilities. This encodes discontent and populism.

80 On a refined industrial policy regarded as knowledge-oriented industrial policy, see: Rumen (2009).

81 This line of thinking may converge with the sentiment of neo-Luddites (Jones 2006; Mueller 2021), who are pervaded by a more nuanced as well as care-taker behaviour when arguing that technology should not be seen as a panacea but must be tailored to benefit society as a whole (e.g., cherishing inclusiveness but freeing people from the mind-numbing toil of human works).

82 The OECD Job Quality index discloses that between 2005 and 2015, job strain, defined as jobs where workers face more job demands than the number of resources they have at their disposal, was shrinking the least in case of high skilled jobs across the OECD relative to medium and low skilled ones, implying that their productive-nature was suffering more relative to the latter ones.

- 83 It was illustrated by [Katona and Meleg](#) (2020) by deciphering current trends in the European care market.
- 84 For example, [Van der Klaauw and Ziegler](#) (2019) found that although Dutch temporary work agencies are able to mediate jobs to unemployed workers, this increase in job finding does not have long-term consequences (which would be the one and only ultimate goal of active labour market policies geared toward enhancing inclusiveness).
- 85 There is a necessity for bringing directionality into the financial universe through regulation in serving a sustainable transformation.
- 86 The literature on motivated beliefs and reasoning suggests that beliefs are of high importance in our daily life and can be seen as goods and assets to be purchased, invested in etc. See: [Bénabou and Tirole](#) (2016).
- 87 Rebuilding and redesigning progressive tax systems seems to be in diametrical opposition to what the decades-long neoliberal narrative has proposed by arguing for reducing the progressivity in the interest of intensifying capital flow around the globe.
- 88 The classic work by [Hayek](#) (1976) suggested that direct and intensive state interventions in the name of defending the welfare state as well as the markets might lead to a dictatorial-like system.

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