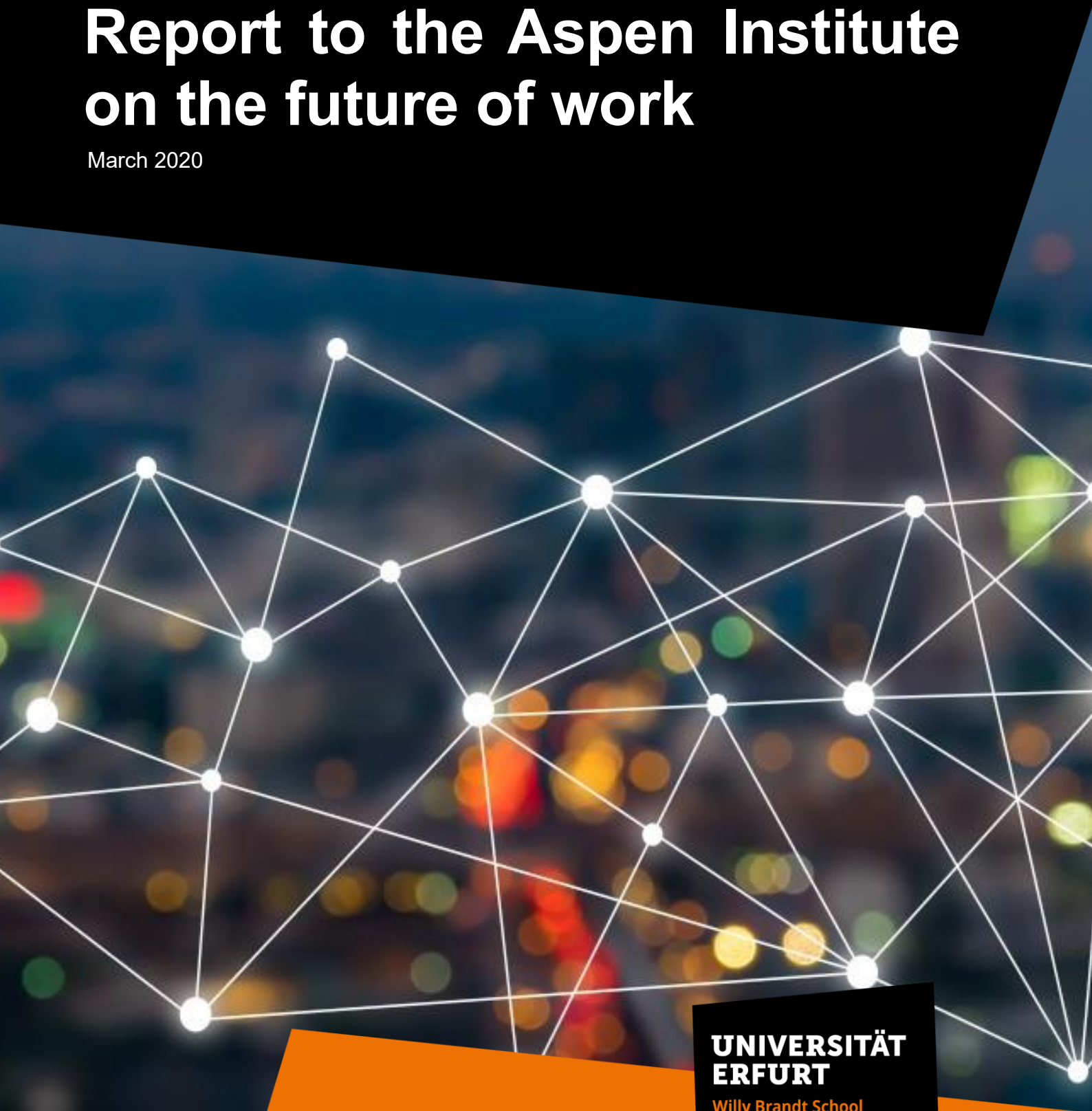
Willy Brandt School of Public Policy

Report to the Aspen Institute on the future of work

March 2020



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The future of work

March 2020

Dutta, Kankana; Fuentes, Consuelo; Gul, Faiqua; Hebel, Hendrik; Oyebamiji, Usman; Kizito, Jean de Dieu; Santana Fano, Emma; Santiago, Alyssa; Volkmann, Stefan

1. Introduction: This time will be different

The increasing use of technology to replace human labor has raised anxiety about what the future of work will be. Termed the fourth industrial revolution, analysts have opined that a surge in automation, including robotics and artificial intelligence, could have substantial displacement effects on jobs, create further job polarization, and widen income and wealth inequalities. The frequently cited Frey and Osborne (2017) method predicts that up to half of U.S. occupations and two thirds of jobs in lower-income nations may be at risk of automation (World Bank, 2016).

Nonetheless, improvement in work tools and skills historically also created new jobs and net-prosperity. It brings a nexus that transits the economy from the initial displacement effects, which substitute jobs and tasks currently performed by workers, to the skill-complementarity effect, which is an increase in jobs and tasks necessary to use and maintain new technology at work. Afterwards, there is the productivity effect, which is a demand boost as a result of the reduction of product prices and higher disposable income – both as a result of automation.

The first and second industrial revolution introduced new machine tools that increased productivity and created job opportunities in the U.S. and Europe. Industrialization changed how work was done and transformed previously agrarian societies into industrial hubs. The third industrial revolution introduced the use of internet and digital technology that helped industries to grow and expand their operations globally. At the same time, these nations saw more stringent labor laws, increased wages, and a further surge in urban-rural migration. To avoid high material and labor costs, multinational companies moved large parts of their value chains to lower income economies, creating job opportunities slowly industrializing the latter, in turn.

This positive and progressive narrative tends to conceal, however, that the workers living during the key years of these industrial revolutions mostly faced disruption, while said benefits manifested only decades later. Since the last thirty years, the previous boost of wage increase has decoupled from productivity growth in OECD countries (OECD, 2019a). Moreover, the impacts of automation are predicted to be far more disruptive than earlier technology shifts (Aspen Institute, 2019): Artificial Intelligence and machine learning, as general purpose technologies, similar to the discovery of electricity (Arntz, Gregory, & Zierahn, 2019), may reach deeper and broader into occupational practices and across industries, with an exponentially faster pace. Especially in cultures that value and identify with the traditional notion of work and occupation, one can expect deeper social and psychological disruptions. As such, this time, the past may be of little guidance; the further into the future one attempts to predict the effects of automation on labor and society as a whole, the higher the ambivalence.

Acknowledging this challenge, we complement recent attempts of long-term foresight. After a review of global labor forecasts and scenario exercises, we look at different scenarios and their implications for policy options. Our special focus lies on lower- and middle-income countries. These seem more vulnerable to the socio-economic shocks of technological change but have seen less discussion so far. Our results can guide states in creating future capacities to both *mitigate* automation-induced labor shocks and to *absorb* them when they happen.

2. Review of the foreseen impact of automation on labor

2.1. Forecasts

To understand what is at stake, we first review existing labor forecasts. We structurally review 13 forecasts[1], six scenario reports[2], four publications of mixed foresight applications[3] and 13 reviews[4] from the past decade. They include peer-reviewed articles and discussion papers, reports from international consultancy firms, multilateral organizations and research institutions. We compare their estimations of jobs being 'threatened' to be displaced by technology, as well as the job creation potential. Most reviewed sources describe the impact of *automation* on labor, which subsumes AI, robotics and other technologies. We follow this conceptualization and specifically analyze differences in impact estimates between countries with low, medium and high average income, as differentiated by the World Bank (2020). The appendix structures our findings.

All 36 reviewed publications agree that technological innovation will substantially affect not only labor markets, but society as a whole. Which kind of world automation will create is shrouded by a high level of uncertainty. The predictions of the theoretically automatable percentage of jobs of a given economy vary depending on the applied foresights methodology and is guided by assumptions of how automation may displace work (see Figure 1: The theory that automation may lead to the displacement of entire occupations (Frey & Osborne, 2017; World Bank, 2016) yields the highest estimations. Assumptions that automation may rather displace certain heterogeneous tasks and activities that a job is composed of (Arntz et al., 2019; Manyika et al., 2017) yield lower results. Neglecting this broad variance tends to lead subsequent publications that cite only Frey et al. methodology to regard automation as a high-risk issue, while those acknowledging diverse estimates employ a far more nuanced outlook. Regardless of which methodology is applied, lower- and middle-income countries tend to show a higher exposure to automation risks.

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[1] Arntz, Gregory, and Zierahn (2016); Arntz et al. (2019); Berriman and Hawksworth (2017); Frey and Osborne (2017); Gardener et al. (2017); Gorle and Clive (2013); Hawksworth, Berriman, and Goel (2018); Hopkins (2016); OECD (2019a); Poitevin et al. (2017); Vermeulen, Kesselhut, Pyka, and Saviotti (2018); World Economic Forum (2018); World Bank (2016)

[2] Blit, St. Amand, and Wajda (2018); Daheim and Wintermann (2019); The Millennium Project (2018); Dellot and Manson, Rich, Wallace-Stephens, Fabian (2019); Frontier Economics (2018); Abdychev et al. (2018); Jousilahti, Koponen, Koskinen, Leppänen, and Lätti (2017)

[3] Federal Ministry of Labour and Social Affairs (BMAS) (2017); Arntz, Gregory, and Zierahn (2017); Halal, Kolber, and Davies (2016); Manyika et al. (2017)

[4] Atkinson and Brown (2019); Schlogl and Sumner (2018); Barbieri, Mussida, Piva, and Vivarelli (2019); Servoz (2019); African Development Bank (AfDB), Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), and Inter-American Development Bank (IDB) (2018); Aspen Institute (2019), World Bank (2016, 2017, 2019a), Brookings Institution (2016); International Labour Organization (ILO) (2018); Nübler (2016); Yusuf (2017)

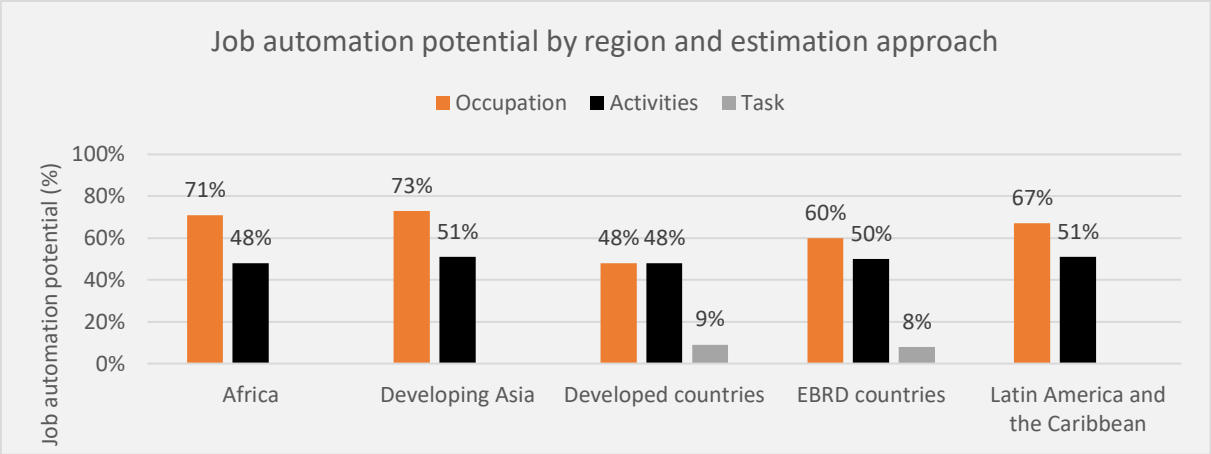

Figure 1: Job automation potential by region and estimation approach (African Development Bank et al., 2018, p. 14)

At the same time, automation is said to be able to especially create jobs if incomes steadily rise over time (Manyika et al., 2017) Many recent forecasts agree that automation will create more job opportunities than it will displace in the long-run, though this may be preceeded by an initial wave of stronger net-job-displacement. Such a 'rebound' scenario can be illustrated as in Figure 2. However, this scenario looks overly optimistic, given the current stagnation of wages in the OECD.

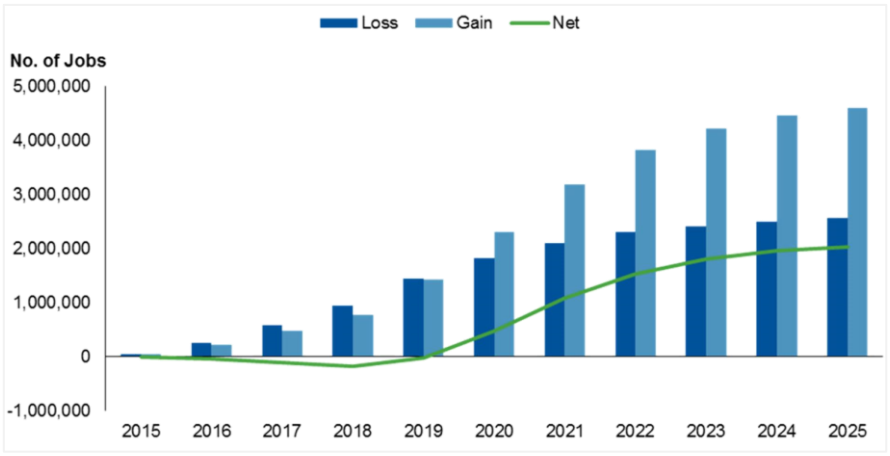

Figure 2: Projected Impact of AI on Jobs Through 2025 in the U.S. (Poitevin et al., 2017, p. 3)

Particularly prone to automation are occupations and tasks that are predictable and routine-based, including finance, administration, manufacturing and logistics in high income economies, and agriculture, manufacturing, hospitality and retail in lower income economies. Conversely, across the globe, demographic change will force job growth in the care sector, while new kinds of service and customer interaction jobs emerge as novel technologies become cheaper. The human element is unlikely to be fully displaced in any occupation, though no country or industry will remain completely unaffected. This challenges the future composition of occupations and demands other skills from workers, besides the acceptance that changes in job tasks or entire careers, combined with retraining and continued learning become unavoidable in the future.

2.2. Scenario literature

As a second step, we look at scenario reports to understand how a world of high net-losses or -gains of jobs may form and look like. Scenario building differs from quantitative forecasts of labor figures in that it aims to draw up plausible, future realities, which are purposely and radically distinct from each other. This gives policymakers a basis to decide which future they want to realize and which actions are appropriate to embark on this path.

Many holistic scenario-building projects pick up on the above forecasts to imagine extreme yet plausible futures, each with a different degree of automation impact. The Millennium Project (Daheim & Wintermann, 2019), the Canadian Centre for International Governance Innovation (Blit et al., 2018), as well as a World Bank scenario-building for Sub-Saharan Africa (Abdychev et al., 2018) demonstrate surprising agreement in how they view the long-term influences of quickly-spreading automation technologies on not just labor, but society as a whole. Figure 3 two emerging (meta-)scenarios that are plausible anywhere around the world in the long-term: a utopian and a dystopian future.

Effect of automation on...	**Utopian long-term scenario**	**Dystopian long-term scenario**
… human-tech-relationship	Humans embrace automation and radically redefine life with tech.	Tech. increases the divide between humanity and empowers elites.
… labor	Redefinition of 'work'; radically new types of occupations and life-models.	Massive job displacement forces many into informality.
… economy	Fast and radical tech. adoption; job growth; entrepreneurism dominates.	Benefits of tech. adoption remain largely with asset owners.
… equity	Innovative tech., business and policies redistribute gains better than today.	Income and opportunity discrepancies widen and solidify.
Early signs of path dependence	Global cooperation; tech. seen as complementary to human prosperity; visionary policy paths are explored.	Protectionist attitudes and conflicts solidify, limiting financial and political capacities to respond, creating a dead lock.

Figure 3: Juxtaposing the two most common extreme scenarios of long-term effects of automation

Figure 3 illustrates that automation may lead to either a large net-loss of jobs, accompanied by high societal and economic inequality, or an eventual net-job-growth, characterized by a new common understanding of work and previously unthinkable human-technology synergies. These two scenarios apply irrespective of average income and geographical location of a country (see appendix). In the following, we therefore cease to compare economies of different income levels.

Curiously, in both scenarios we see an increase in labor informality, either because an economy cannot transform displaced jobs into new ones, or because entirely new industries and job types are emerging, which are less and less defined by consistent and long-term employee-employer relations. This is supported by the already today existing tendency of engineering firms to employ factory workers solely with short-time contracts. In other words: self-employment and short-term contracting are on the rise and could become the standard. This means substantial challenges and changes to worker identities, alongside political unrest about a changing labor market, the nature of work, as well as the conception of what constitutes a 'good' job. We foresee a growing grey-zone of labor, which is currently hardly regulated nor subject to social security nets. Accommodating for such a transition is a key responsibility of states, labor unions and employers.

Another insight from Figure 3 is that the capacities of countries to cooperate, innovate as well as to pilot strategic policy responses to automation are key path predictors for governments to avoid the rather bleak and dystopian net-job-loss scenario. The crucial policy question is therefore how in the short to medium run, policies can affect the impact technological change. For this purpose, in the following, we reduce the number of scenarios to two contrast cases:

1) Automation displaces more jobs than it creates - a net-loss.
2) Automation creates more jobs than it displaces - a net-gain.

To simplify the analysis, we distinguish two types of policy reactions creating the capacity to absorb or steer the shock. These are defined as an economy's ability to …

A. Preemptively mitigate a future net-loss and steer towards a net-gain in jobs.
B. Absorb a labor shock of massive unemployment or massive job potential into the domestic labor force (even if the informal labor market).

Figure 4 illustrates the matrix emerging from contrasting these four variables. Based on their appropriateness for the given scenario, we plot policy recommendations from the literature. Some options should not only be regarded in isolation, but as interdependent solutions, which build on or require each other, and which imply a certain sequencing of policy responses. Each option is explained in further detail in the next section.

3. Policy Solutions for Lower- and Middle-Income Countries

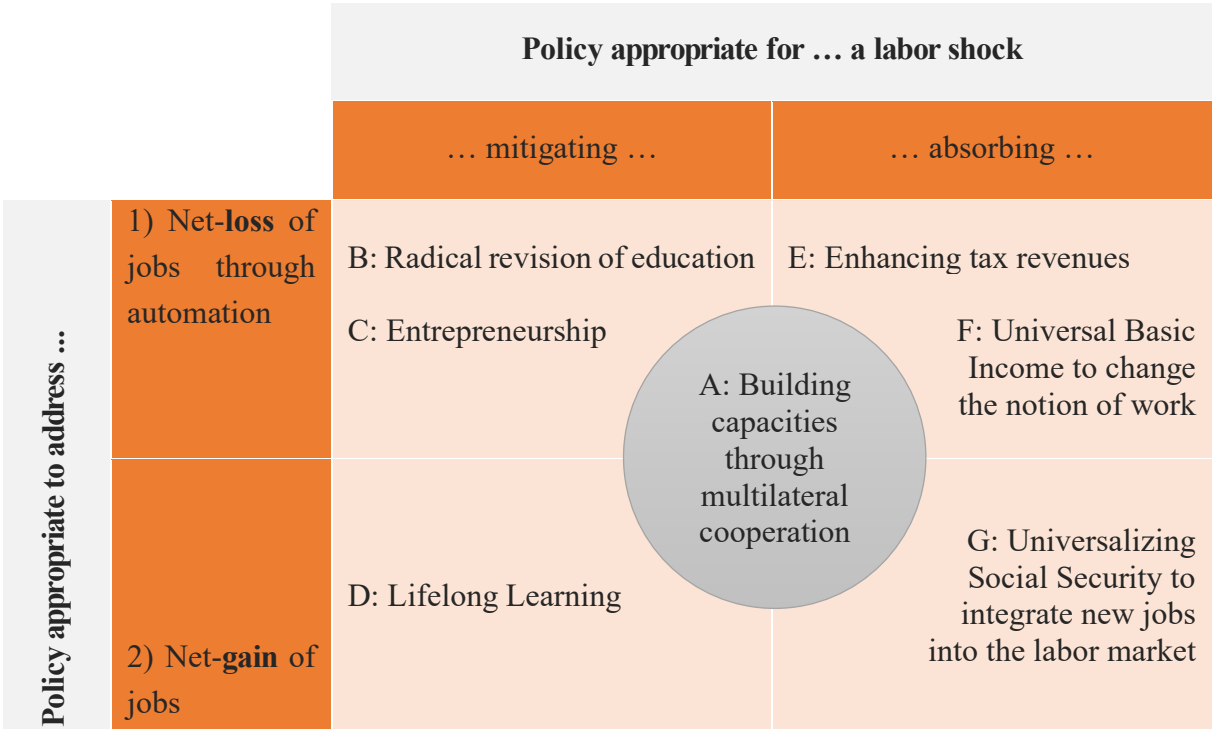

Figure 4: Appropriateness of policy options to a given scenario

3.1.1. Policy recommendation A: Building capacities through multilateral cooperation

Although the foreseen disruptive effects of automation have a global dimension and will likely cause ripple effects, individual economies' capacities to influence or absorb the forthcoming labor shocks are limited by and to their borders and jurisdiction. To overcome these limitations, investing early-on and preemptively in multilateral cooperation can create vital synergies between neighboring and other interdependent economies.

Multilateral cooperation has the potential to enhance future absorption capacities directly. As increases in global migration become highly likely under the above dystopian scenario, domestic and international labor shocks could be dealt with by creating EU-like cross-border job mobility rights and programs, and wage harmonization. Standardizing and digitizing labor biographies and skills could be used to effectively and fairly match local labor gaps with the right talent. Given that even high-income economies face large talent gaps already today, such solution paths would not only be favorable to states, but could also be demanded by multi-national, regional employers. Should states themselves not be able to make such multilateral

commitments, it is likely that the role of cities and regions in international diplomacy will grow during the next few years[5].

Seen from the opposite perspective, *ceasing* participation in multilateral policy fora is likely the more plausible reality during the next few years, given that some democracies have recently turned away from them. This could be interpreted as an early sign of a dystopian future manifesting, where international disputes and inequality eventually diminish state capacities to contain technology-induced labor shocks. Consequently, given the uncertainty of the future of labor, we see it as imperative to invest ever more into multilateral cooperation, so that nations retain their capabilities to react early on and to coordinate with others. Doing so is also a universal precondition to the following recommendations, which may otherwise end up politically unfeasible. It is therefore recommended for governments to ensure that their foreseen strengths and challenges regarding automation impacts, as well as their policy solution paths are appropriately reflected in their multilateral commitments.

3.2. Mitigating a net-loss scenario

3.2.1. Policy recommendation B: Radical revision of education

Education reform has always been a part of education systems across the world. Reforms are regularly done to ensure quality, but the exponential technological changes of the Fourth Industrial Revolution require more than the routine. To address both existing and future workers, this recommendation is two-pronged: one deals with the primary, secondary, and tertiary education; the other with adult learning i.e. reskilling. Since LMICs have shortcomings in education (Chimombo, 2005; World Bank, 2018) more aggressive educational measures are needed to cope with automation. Education is a key solution in mitigating expected future job-net-loss shocks because it equips labor market participants with necessary skills to avoid structural unemployment. In terms of implementation, governments are keen at improving education because it is a primary concern of the people, especially in this case where neglecting it leads to threat to employment. Education serves as an engine for economic growth which in turn boosts the popularity of the government.

Curriculum revision from the primary to tertiary level is necessary to instill soft skills and digital skills in incoming workers. Expansion of the access to education, structure and equipment provision, and teacher training must be developed alongside curriculum change. Delivery and testing methods need to be rethought as well. Revolutionizing the education system needs funds which LMICs are short of. The International Commission on Financing Global Education Opportunity (2016) suggests bringing together Multilateral Development

[5] For example, a plethora of local governments can be seen to have joined forces in various international networks to collectively solve issues like climate change, regional sustainability or refugee migration. The scholarship of Acuto (2016); Acuto, Morissette, and Tsouros (2017); Acuto and Rayner (2016); Davidson, Coenen, Acuto, and Gleeson (2019) has been vital to make visible these recent slow changes of the global governance role of cities over states.

Banks that have the power to leverage up to $20 billion of extra funding for education annually. It argues that raising international funding levels for education to match those already achieved by the health community is not just a moral imperative but a smart and vital investment given the interconnected global economy.

Under increasing automation, existing workers face a disjunct between their education background and the new skills requirements of the labor market; hence the need for reskilling. Reskilling is the learning of new sets of competencies to enable the transition into a new occupational role. Since they have already left initial education, the changes in the primary, secondary, and tertiary levels do not apply to them anymore. In line with this, Sweden's Job Security Councils (JSC) offer an interesting model. The councils are funded by employers for the purpose of assisting workers whose skills have been deemed collectively redundant. The process of finding new employment starts the moment a worker knows they would be laid-off. The council assists them through retraining, job coaching, and business start-up support. Employers fund the council to avoid union resistance. Consequently, Sweden has enjoyed the best re-employment rates in the OECD with about 90% of laid-off workers back in work within a year (OECD, 2018). Through its job security councils, Sweden enables technological change and the move to higher skilled jobs, by employing labor market-oriented reskilling that is embedded in a job transition system. LMICs can use Sweden's JSC as reference in creating their reskilling programs. In the absence of funding from employers, governments can step in particularly because the types of support given in the program already exist even in LMICs albeit fragmentedly. It boils down to redesigning various support into one comprehensive program.

3.2.2. Policy recommendation C: Entrepreneurship

Job creation should not depend on big industries since these are looking for cheaper ways to produce without human intervention, displacing workers by robots. Thus, efforts should be focused on increasing the quality and viability of self-employment conditions that can guarantee the independence of workers. In this way, self-employment comprises all the job schemes that an individual may use to generate its own income, for instance, entrepreneurship (small and medium enterprises) and freelancer jobs.

Therefore, the enhancement of self-employment is a counterstrategy to automation taking jobs from workers and it is most required in the developing countries with a net job loss. In the face of increasing worker displacement, the onus rests more on the government to provide an enabling environment for new businesses to flourish.

a. *Data sharing schemes.* Data collection provides the opportunity to analyze aggregate information of communities in order to know their behavior, preferences, and many other statistics. The analysis of big data is "*a competitive parameter to innovate services and products*" (Crémer, de Montjoye, Yves-Alexandre, & Schweitzer, 2019, p. 2). In this vein, data has leveraged the big tech companies to keep and increase, their market

power. Hence, to increase competitiveness and boost the economy for all, countries need to make de-identified data, held by private and public organizations, available to everyone, adopting appropriate data sharing schemes.

Data sharing arrangements, such as community data, data commons, open data, data trusts, or private-public collaborations, may be the main enablers for entrepreneurship and innovation because they aim to democratize the power of data. Public policy projects are being discussed in the world (i.e. Community Data in India), in order to find feasible data flowing schemes.

In the European Union, the Open Data and DECODE Projects are setting a precedent of sharing public and private data respectively (Decode, 2020). DECODE's objective is to decentralize the current innovation ecosystem giving back to the people the control over their personal information with a view to end the monopolization of data, create more equal opportunities, and a sustainable economy. While Open Data is an initiative that urges governments to make their data available for public benefit. Alongside these projects, other cutting-edge solutions are embedded in digital platforms that allow data interoperability and accessible user applications for governments, businesses, and citizens (i.e. JoinUp in the European Union). As a result, it is estimated that Open Data will help to create 25,000 jobs and save more than €30 million in 2020 (Berends, Carrara, & Radu, 2017).

b. *Simplify administrative procedures for SMEs.* Even though great improvements have been made by low and middle-income countries to start a business easily, most of them are still lagging far behind. According to the Doing Business Report (World Bank, 2019b), the average time to start a business in low and middle-income countries is 23 days compared with 11 days in high-income countries. Much of it might be the result of the weak state capacity to enforce contracts or dealing with the necessary permits that prevail in those economies (The World Bank, 2019). In this vein, automating legal advice and registration of new companies could also facilitate the administrative procedures in favor of start-ups.

3.3. Steering towards a net-gain scenario

3.3.1. Policy recommendation D: Lifelong learning (LLL)

The concept of *lifelong learning* covers all education and training during a lifetime - including both initial education and training and adult learning. It is considered 'lifelong' but also 'lifewide', covering learning in institutions, families, communities and workplaces. Moreover, it is 'life-deep', as it recognizes the ongoing and active acquisition, development and deployment of knowledge over a lifetime (Bélanger, 2016). In this recommendation, we would like to emphasize the importance of the 'life-deep' aspect of lifelong learning.

In a scenario in which there is a net-gain of employment, we assume that the supply of labor is momentarily well suited to the future of work and the automation that it entails. At this moment in time the workforce has the required skills and capabilities to benefit from automation (see Policy recommendation B for capacity building through a 'Radical Revision of Education'). As technology continues to evolve, however, maintaining the required skill sets necessary to perpetually benefit from these developments is essential. Lifelong learning caters to this need and therefore can both mitigate pre-emptively and absorb labor shocks. We recommend focusing on the life-deep updating of skill sets and capabilities. Thereby, this recommendation distinguishes itself from our recommendation on revising the education system which pertains to the learning of new, distinct capabilities.

In operationalizing lifelong learning, we propose the creation of a lifelong learning fund. We would like to stress the importance of an equitable sharing of the financing thereof. In line with the OECD, we propose a "'*healthy mix' of co-financing by government, employers and individuals."* (2019a). Given the expected broadening of the tax base in this scenario, due to a net-gain of jobs, the fund could, for example, be partially financed by taxing labor on the sides of both the employer and the employee. This presupposes capable tax collection authorities and we highly recommend institution building in this area, particularly for low- and middle-income economies.

3.4. Absorbing a net-loss scenario

3.4.1. Policy recommendation E: Enhance tax administration

Investments into R&D, infrastructure, job creation, as well as measures to avoid and absorb future surges in unemployment require elaborate financial resources and reserves both in advance and during a labor shock. Currently, the state capacity of tax enforcement is still weak in low and middle income economies, raising only between 10% to 20% of total GDP compared to 40% in high income economies (Ricciuti, Savoia, & Sen, 2019). Because simply raising taxes would slow down growth and thereby deter vital job creation, low- and middle-income economies must invest in domestic tax efficiency. This could simply build on top of recommendation A, international cooperation, in order to address cross-border corporate tax substitution effects, as advocated for by the OECD (2019b). The resulting increase in financial capacities can be used to advance more costly and innovative policy measures.

Novel technology can itself be a solution to higher tax efficiency. For example, in 1990 the Democratic Republic of the Congo introduced SYDONIA, a software aimed to operationalize all customs transactions online to increase the public treasury. Over the last thirty years, the software has gradually but consistently increased the revenue generated by over 300%. The first slow pace of adoption is because in developing countries, contributors need to acquaint themselves with the new technology and the culture of its usage. The outcome was slowed down because customs officials who leveraged the manual means of transaction for personal gains did not welcome the digitized system that takes away their discretionary power.

3.4.2. Policy recommendation F: Universal Basic Income to change the notion of work

Universal, or unconditional basic income (UBI) is a structured social security program, that has regained global attention since the 2008 world financial crisis (van Parijs & Vanderborght, 2017). The concept of UBI is that every member of a society or a political community by a government is entitled to an explicit financial gain per week or month, with no strings attached. It is not an equivalent as a minimum financial gain, that currently exists in European countries: the key word is “unconditional,” which suggests that despite a person’s labor contribution, they are going to receive a hard and fast financial gain ample to measure and perform social functions in dignity. Individuals with targeted backgrounds, who are unemployed will receive it, by right of birth, irrespective of social or monetary standing. UBI is additionally periodic and could be considered as a monthly or annual reward. It ought to be granted to people in money, not within the kind of food or services: everyone receiving UBI ought to be able to decide for themselves what they require to pay cash on.

The existing conception of a state implies that someone receives “free” finances solely just in case if he or she cannot sustain themselves. The most distinction between a UBI and the existing state or incapacity pensions is its universality; and, in contrast to several pensions, it ought to

be enough to measure on, to not simply survive on. UBI is anticipated to not solely increase the general quality of life during a state, however, conjointly to decrease forms and the scales of governmental management over people's eligibility; for the very reason, this idea is quite favored by libertarians and leftist politicians. They tend to ascertain UBI as some way to repair an oversized range of issues connected to social safety, and whilst a remedy from "wage slavery," once individuals got to work while not breaks solely to sustain their basic desires. The concept of UBI is additionally engaging partly as a result of they see it as a continuation in recent feminist demand for payment for work. This is often expected to lift jobless people's motivation to appear for jobs, as a result of in contrast to the present social network (which implies that even low earnings at work cause immense cuts in social payments received) UBI is paid fully despite a person's financial gain. Therefore, from now on, finding employment means a rise in monthly wages, not a decrease.

Globally, there are many countries in which pilot projects of UBI have already been launched, while the implementation and outcome of them, has been observed to be less effective in many countries, nonetheless, positive outcomes have also been there. In Namibia, the a UBI project helped decrease economic condition and crime rates, and faculty group action among youngsters and teenagers went up considerably (Osterkamp, 2013). In India, people who received basic financial gain shares used them to start out their own businesses, exemplifying how UBI may be used as a method to assist poorer individuals "help themselves out" (Standing, 2013).

If political resistance is large against an unconditional cash transfer one could think of a a gradual introduction of UBI that starts with a conditional program (such as work requirement). Over time, the program successively broadens the notion of work to include more and more non-remunerated forms (e.g. working for non-profit sector, caring of family members etc.). This would also help establish a different culture of work, shifting towards the social purpose of work and slightly away from defining work exclusively as paid work.

3.5. Absorbing a net-gain scenario

3.5.1. Policy recommendation G: Universalizing Social Security to integrate new jobs into the labor market

In a scenario of net loss of employment, UBI is unlikely to be financially sustainable, as welfare systems would face the loss of contributory funds from workers, especially those who are less qualified. Hence, to cope with such a labor shock will require pre-emptive tax interventions (recommendation F), and more subtle systemic adjustments. Since many economies are expected to face a surge of self-employment, it is frequently suggested to integrate also the informal parts of the labor force into the formal social protection system (Weber, 2017). One case of this is Chile, which has progressively established a mandatory contribution system for independent workers since 2012, where contributions are deducted from the annual tax refund, health and unemployment insurance, and pension contribution.

Furthermore, economies must face the increasing employability of sporadic jobs through digital platforms, such as applications, which are associated with precarious social protection conditions (Berg, Furrer, Harmon, Rani, & Silberman, 2019). Since 2015, this business and employment model has gained considerable ground in the five continents, especially Brazil, India, Nigeria and Indonesia. Hence, countries should put emphasis on regulating these platforms in a firm yet flexible way, to achieve greater inclusion to all types of workers. Germany is an example of how trade unions have pushed to generate inclusive policies such as the reduction in almost 50 percent of the minimum contributions of self-employed, which work as an incentive for the contributors. In parallel, the European Union is also working on setting minimum rights for workers under the 'GIG economy', such as the right to compensation for late cancellation of work.

On the other hand, new technologies can also be used to formalize the informal sector. People working in the platform economy can easily be authenticated and this could be used to formalize them into basic social security nets. This requires political will against powerful platform companies, however.

States can furthermore innovate in policies such as relocation allowances, already considered in the American program Trade Adjustment Assistance, that would allow families to move from places with less work concentration, to other areas that do (Stettner, 2018). Moreover, since reskilling and promoting entrepreneurship seem to be cross-cutting recommendations to face automation, the use of the social security fund could extend beyond disability, unemployment or pension, and also cover training education or as entrepreneurship capital (Servoz, 2019).

4. Conclusion

In this report, we review the past decade's varying estimates on how automation may affect future labor markets, how countries may build capacities to avoid technology-induced job displacement, drive job growth and cope with future labor shocks that may appear in spite of preemptive policy.

First, in general, labor market forecasts agree that the lower the average income of an economy, the higher the estimated automation potential of jobs. Across the income spectrum, different job types and industry sectors are expected to lose and gain differently and at different points of time, while low wages, lacking infrastructure and slow technology adoption may generally delay automation effects in lower income economies.

In a second step, we review scenario exercises, which warn that the foreseen automation-driven labor market effects may affect societal structures and equity. Irrespective of income levels, 'muddling through' to maintain today's status quo is seen as possible, though inequality will nonetheless be an increasing risk factor. Economies beginning to optimistically explore global cooperation, novel human-tech synergies, as well as visionary policy throughout this decade are seen to embark on a rather utopian future path. Conversely, economies where conflict and protectionism persist will have limited financial and political capacities to mitigate labor market disruptions and surging inequality.

Consequently and third, state capacity appears as a determining factor in steering and coping with future automation-labor effects around the world. Should automation end up displacing entire domestic industries, all economies' capacities to absorb the resulting unemployment are debatable. Moreover, labor skill-gaps may deter new technology-driven industries to become globally competitive, raise incomes and create jobs.

Albeit anticipating relatively different capacity profiles and optimal policy responses between lower and higher income economies, both exhibit similarly uncertain capabilities to steer their labor market from a net-job-loss scenario path into a future with a plentitude of new. As no economy will be spared from the effects of automation in the long-term, it is imperative to preemptively build appropriate state capacities. This includes, first, capacity building, such as the optimization of tax revenues or partaking in multilateral cooperation, policy experimentation and harmonization, in order to enable more costly policy paths. Building upon this foundation, early and direct policy measures include updating both life-wide and sector-specific education systems, as well as preparing the labor market with incentives and safety nets to embrace work models currently deemed non-formal.

Appendix

4.1. Net-loss and net-gain scenario per economy type

Based on the review, we observe that lower-income countries less frequently appear in this debate, although automation may impose a higher risk to their labor markets and societies (World Bank, 2016). We thus create a scenario framework to contrast the *capacities* of countries with different income-levels to cope with future, automation impacts of different size. Because forecasts illustrate uncertainty on the magnitude of job displacement and creation, we are interested in the two distinct extreme scenarios of a *(1) net-job-loss, and (2) a net-job-gain*.

The previous scenario review has illustrated that *both* a massive net-loss and a net-gain of jobs is plausible in the long-term, essentially determined by the *capacity* of a state to embark on a certain policy path. In order to derive concrete policy options for low-&-middle as well as high income economies, the following contrasts to what extend these economies have the estimated capacities to influence as well as absorb a future net-loss or net-gain of jobs.

Which capacities do countries of different income levels have to absorb or prevent a net-job-loss and to encourage and absorb a net-job-gain in the long-term?

		Low & middle income economies	High income economies
1) Net-**loss** of jobs through auto-mation	State capacity to **prevent** net-loss	Uncertain Risk aversion to experiment with policy and tech-innovation slows capacity building	
	State capacity to **absorb** labor shock	Rather low Exception: economies with non-contributory welfare systems	Rather low Unemployment and demographic change overwhelm welfare system
2) Net-**gain** of jobs	State capacity to **promote** net-gain	Uncertain Rising consumer incomes and high technology adoption create jobs, but these factors are difficult to steer	
	State capacity to **absorb** labor shock	Rather low Lack of job mobility and infrastructure + skill gap	Uncertain Potential skill gap despite mature welfare systems and job mobility

X variable: Income

We differentiate between high as well as low-&-middle income economies based on the World Bank's (2020) Atlas Method of calculating GNI per capita.

Y variable: Two scenarios of net employment effect of automation

1) Automation displaces more jobs than it creates, i.e. a net-loss.
2) Automation creates more jobs than it displaces, i.e. a net-gain.

Analyzing capacity: We differentiate between a state's current capacity to

a) Preemptively *prevent* a future net-loss (1) and promote the likelihood of a net-gain in jobs (2).
b) *Absorb* a labor shock of massive unemployment (1) or massive job potential (2) into the domestic labor force (even if the informal labor market).

Our assessment of state capacity is guided by the assumption that low, medium and high-income economies have generally and respectively lower, mediocre and stronger capacities within the areas of economy, education systems, institutional maturity and welfare functions.

Based on the reviewed literature (see appendix), we estimate that any economy has rather low capacities to absorb a domestic unemployment resulting from a large net-loss of jobs due to automation. For jobs emerging from automation, low- and middle-income economies face a domestic skill gap that hinders the effective staffing of job opportunities. Under neither scenario do the two economies have a significant advantage. As such, it appears imperative for both to preemptively address the future effects of automation on labor. Capacities to do so are uncertain, however, depending on governments' capabilities and will to experiment while driving consumer demand and income.

4.2. Net-loss and net-gain scenario per economy type – details

What if an economy is hit by net-job-loss or net-job gain due to automation until 2050? What capacity do they have to absorb or prevent such a labor shock?			
		Low Medium income countries	High income economies
Net-loss of jobs[6]	Many Jobs displaced[7]	Worst case estimation: 50-75% of a country's labor force displaced. In lower-income countries, majorly affected are agriculture and manufacturing, where global goods are concerned. (Manyika et al., 2017; Vivarelli, 2012). In Middle-income countries, additionally affected are the hospitality sector, retail and wholesale trades, construction and manufacturing (Yusuf, 2017). Reshoring is more impactful than expected while business-process- outsourcing is automated (World Bank 2017, UNDP 2018)	Worst case estimation: 35-60% of a country's labor force displaced. Unpredictable and predictable physical labor, office support; Finance, administration Manufacturing, Logistics, Information & Communication, Scientific and technical, retail. (Hawksworth et al., 2018; Manyika et al., 2017)
	Few Jobs gained	"Premature deindustrialization", dominated by global capital instead of domestic momentum, slows productivity and limits job creation to informal, low productivity service occupations (Rodrik, 2016). Mostly customer interaction, care providers, builders, educators (Manyika et al., 2017), producing "Consumer services for elites" (Abdychev et al., 2018)	Only occupations benefiting are professionals, care providers, managers (Manyika et al., 2017). The informal sector is expanding (Daheim & Wintermann, 2019).
	State capacity to absorb shock	Systems and capacities inadequate to turn incoming technology into productive potential and to provide a safety- and a mobility net for those unemployed; high inequality due to low wages (Schlogl & Sumner, 2018). The youth continue to fail to enter the job market (Bloom, McKenna, & Prettner, 2018).	Systems and capacities likely fail to absorb a mass- unemployment, including possible immigration waves from lower-income regions.

[6] More jobs are lost due to automation than gained, resulting in unemployment.

[7] For the high job displacement scenario, forecasts based on Frey and Osborne (2017) occupation-based method are utilized, such as by World Bank (2016); Hawksworth et al. (2018).

		Inter and intra state conflicts likely (Abdychev et al., 2018). LICs with agriculture-based economies are less exposed than MICs with large manufacturing bases. Shortcomings in basic skills education, among other weaknesses, will severely hamper countries in South and South-East Asia. Positively, noncontributory social benefits can help the unemployed maintain economic subsistence, while emigration would offset a part of the burden for the country.	Demographic change puts additional sustainability pressure on welfare systems (Bloom et al., 2018). Strengthening of existing unemployment insurance schemes by extending existing boundaries to include people who decide on their own to quit their job to pursue training or transition to Entrepreneurship.
	State capacity to prevent shock	Only in long-term, if government can commit to funding radical policy and context-adapted technology solutions, thereby incentivizing new types of investment (Nübler, 2016).	Only if radical policy innovation and experimentation, global cooperation, as well as a cultural redefinition of labor (Blit et al., 2018)
Net-gain of jobs[8]	Few Jobs displaced[9]	Relatively high job displacement in commodities, particularly if trade wars spur and protectionism persists (Abdychev et al., 2018) Displacement in some industries may not be economically viable as wages remain low. Low-skill employees most likely to be left behind (AfDB et al., 2018)	Predictable physical work within logistics, construction, manufacturing, administrative support (Hawksworth et al., 2018; Manyika et al., 2017)
	Many Jobs gained	All job types and industries, except for predictable physical labor (McKinsey), largely driven by domestic economic growth, increasing demand and income (AfDB et al., 2018) Service jobs complement the IoT rise (Frey & Osborne, 2017)	Professionals, Care, builders, managers, educators, tech, creatives (Manyika et al., 2017). Increasing degree of self-employment forms (Daheim & Wintermann, 2019).
	State capacity to	Risky, due to urban and job mobility shortcomings. Job opportunities may not realize due to lacking appropriate skills.	Systems can absorb if shock losers are deliberately targeted.

[8] More jobs are created through automation than displaced. If those losing their job can transition into another depends on state capacity.

[9] For the low job displacement, forecasts based on the task- or activity-based method are utilized, such as from Arntz et al. (2019); OECD (2019a); Manyika et al. (2017).

	absorb shock		
	State capacity to further this scenario	Possible, if continued rising middle class ((World Bank, 2016)) and if local strategic industry opportunities are identified to focus on entrepreneurially 'leapfrogging' technology adoption beyond just emulating development paths of advanced economies, while syncing education to these foci (World Bank, 2017). Regional protectionism can limit job displacement, but sprawls informality and reduces state finances (Abdychev et al., 2018).	High, if national R&D and labor mobility and infrastructure and real estate market is enhanced. Rising consumer incomes enable job growth (Manyika et al., 2017)

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