



Research Paper

Technology and the Future of Work

Ian Goldin





About the Author

Ian Goldin is the Professor of Globalisation and Development at Oxford University and Director of the Oxford Martin Programme on Technological and Economic Change.

Acknowledgments

We are grateful to the Open Society Foundations for supporting this research, and to the governments of Sweden and Canada for supporting the Grand Challenge on Inequality and Exclusion. Ian Goldin thanks Alex Copestake for his excellent research assistance with this paper.

About the Grand Challenge

Inequality and exclusion are among the most pressing political issues of our age. They are on the rise and the anger felt by citizens towards elites perceived to be out-of-touch constitutes a potent political force. Policy-makers and the public are clamoring for a set of policy options that can arrest and reverse this trend. The Grand Challenge on Inequality and Exclusion seeks to identify practical and politically viable solutions to meet the targets on equitable and inclusive societies in the Sustainable Development Goals. Our goal is for national governments, intergovernmental bodies, multilateral organizations, and civil society groups to increase commitments and adopt solutions for equality and inclusion.

The Grand Challenge is an initiative of the Pathfinders, a multi-stakeholder partnership that brings together 36 member states, international organizations, civil society, and the private sector to accelerate delivery of the SDG targets for peace, justice and inclusion. Pathfinders is hosted at New York University's Center for International Cooperation.



Table of contents

Automation, artificial intelligence, and jobs	4
Is this time different? Technological upheaval in perspective	5
A possible future: impact of new technologies by country and sector	9
Transformation, redistribution, and recognition	10
COVID-19 and the future of work	12
Case studies of successful adaptation	13
Policy recommendations for governments, international agencies, and other partners	15
Conclusion	18
References	19

Figures and tables

Figure 1: Stock of robots per worker	4
Figure 2: Machine vs. human performance at image recognition.....	5
Figure 3: Declining job creation in manufacturing exports	6
Figure 4: Manufacturing and services growth in China and India	7
Figure 5: Estimated and projected old-age dependency ratios by region, 1990-2050	8
Figure 6: Automation as a potential source of social division	11
Figure 7: Indian vs. Chinese exports	13
Figure 8: Public expenditure on active labor market policies, % of GDP, 2016	14
Table 1: Ratio of foreign domestic or care workers to households in East Asia.....	9
Table 2: First-order effects of new technologies on employment growth.....	9
Table 3: Policy options for developing and developed countries, and international partners	17

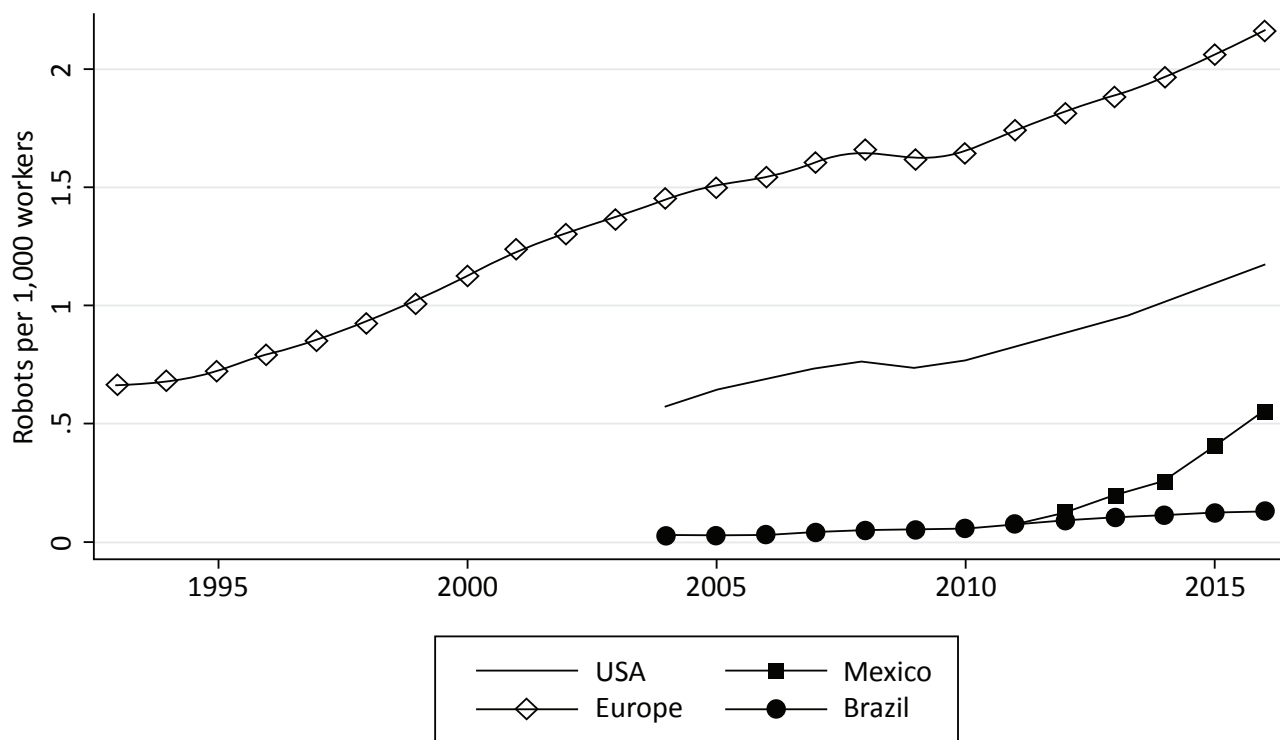


Automation, artificial intelligence, and jobs

Recent decades have seen rapid increases in the use of robots (Figure 1) and rapid advances in artificial intelligence, driven particularly by improvements in machine learning. From games like chess and Go to speech recognition and image recognition (Figure 2), machines have come to outperform humans in an expanding range of activities. This development has motivated many attempts to gauge the impact on the future of work for humans. Frey and Osborne (2017) estimate that 47% of total US employment is in jobs at high risk of automation within the next decade or two. Arntz et al. (2016) in turn estimate the figure is 9% in the USA and 10% in UK, while PwC (2017) estimate 38% in the USA, 35% in Germany, 30% in the UK, and 21% in Japan are at risk.

Regardless of the exact shares, which are necessarily uncertain, such predictions are particularly concerning for developing countries for two reasons. Firstly, they currently contain a relatively large share of workers performing routine tasks, which are easier to automate—for instance, the World Bank (2016a) estimates that two thirds of all jobs in developing countries are ultimately susceptible to automation. Secondly, the classical route to income growth in developing countries has been through a burgeoning manufacturing sector absorbing low-skilled labor—but with manufacturing increasingly automatable this path looks ever less reliable (Rodrik, 2019).

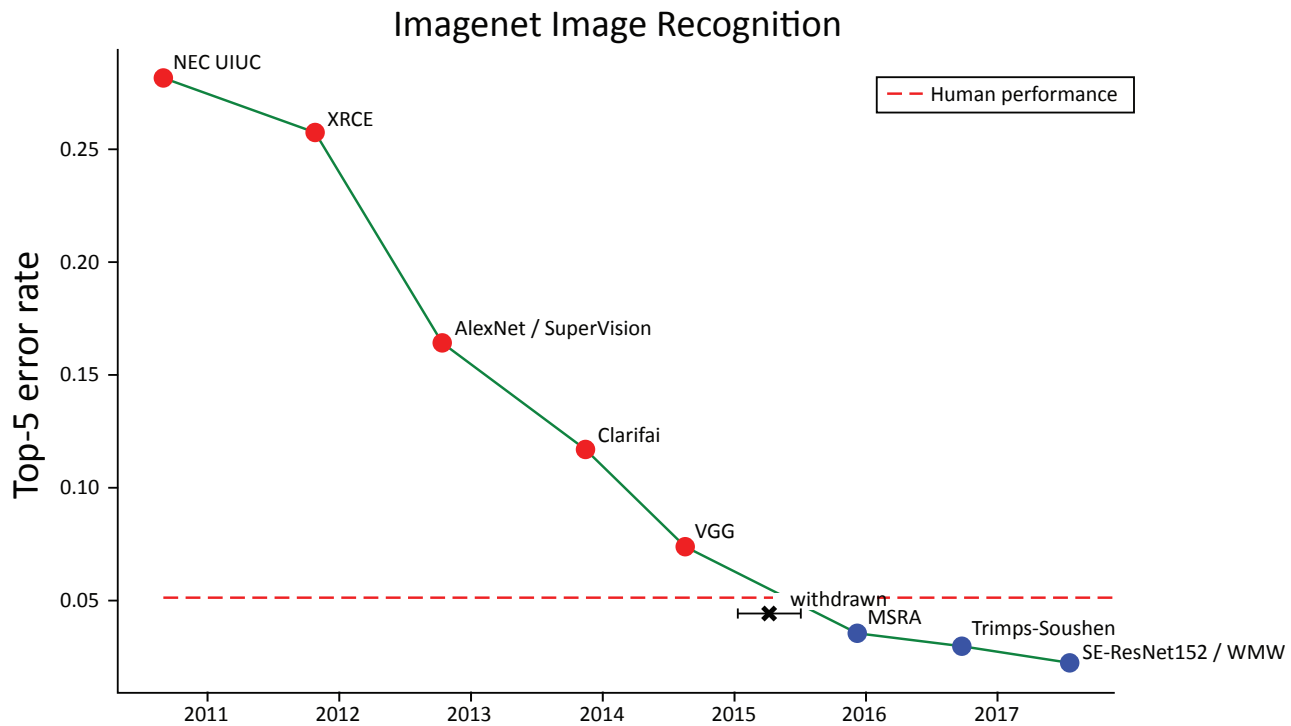
Figure 1: Stock of robots per worker



Source: Artuc et al. (2019)



Figure 2: Machine vs. human performance at image recognition



Source: Electronic Frontier Foundation (2017)

Is this time different? Technological upheaval in perspective

Previous waves of globalization and automation have created upheaval and backlash, from the Luddite riots in 19th century Britain to striking streetlamp lighters in New York in the early 20th century. The potential negative impacts on both jobs and incomes are clear in the apocryphal exchange between Henry Ford II and United Automobile Workers leader Walter Reuther:

Ford: “Walter, how are you going to get those robots to pay your union dues?”

Reuther: “Henry, how are you going to get them to buy your cars?”

As Frey (2019) notes, while in theory new technology, like globalization, expands the total productive potential of the world and allows everyone to benefit, in practice these gains may not be shared. In the long run, everyone may be better off, but over the lifetime of any given individual many will lose out.

Historically, a growing manufacturing sector has consistently provided jobs and incomes for low-skilled labor. There are several reasons to think this is unlikely to remain the case for developing countries. Firstly, there is a declining labor share in manufacturing (Baldwin and Forslid, 2020; Rodrik, 2015); indeed, Gilchrist (2016) suggests we should instead talk about “robotfactoring.” Secondly, there is little evidence of manufacturing leaving China to find new low-wage labor elsewhere (Stapleton, 2019). Instead, China is upgrading its manufacturing technology (Hallward-Driemeier and Nayyar, 2020; Xu et al., 2017) under the ‘Made in China 2025’ plan, following Xi Jinping’s call for a “robot revolution” and the “jiqui huanren” (machines replace workers) directive. Thirdly, the substitutability of low-skilled workers for high-skilled workers is falling (Rodrik, 2019). Global firms require high standards of quality control and compliance in their value chains, which is hard to achieve with low-skilled labor and small, informal firms. For instance, Goger et al. (2014)

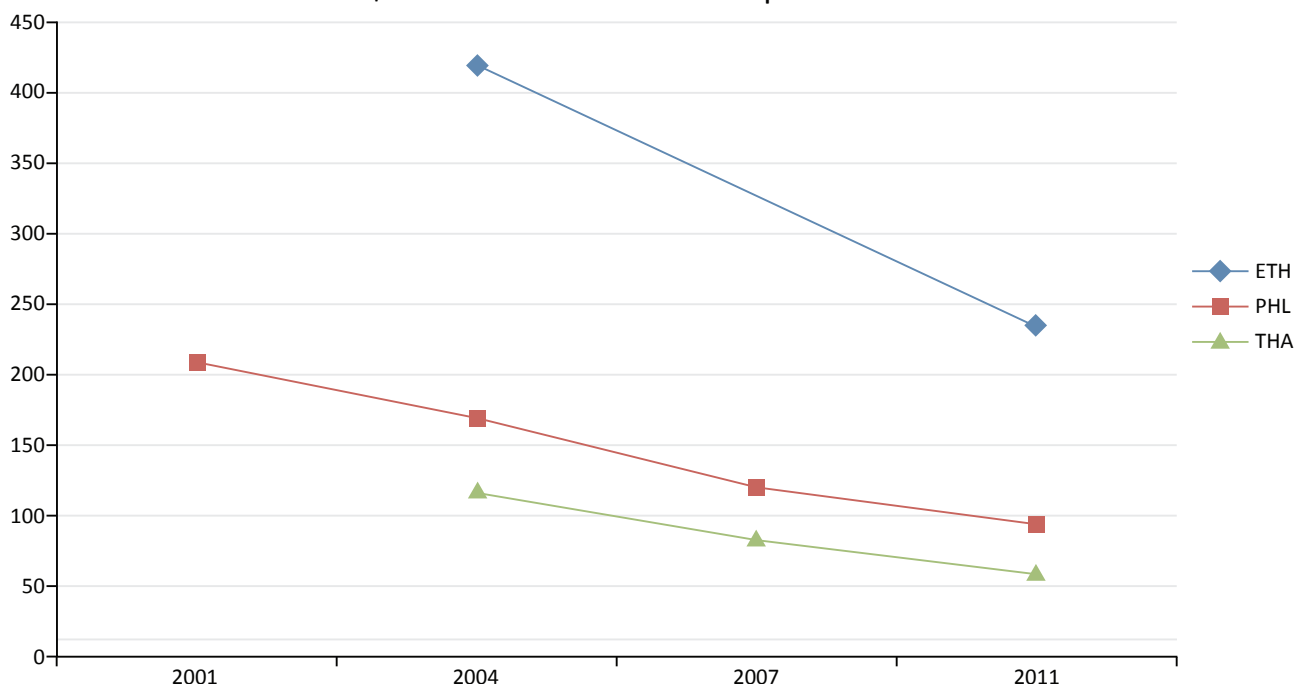


consider horticulture in Africa and acknowledge that supermarket standards can “limit participation to only those with the necessary investments needed for compliance.”

Together, these issues show up in the data as a decline in the number of jobs created per dollar of manufacturing exports (Figure 3). Without large and growing employment in manufacturing for export, knowledge and technology diffusion also slows down, raising potential inclusion issues. Inequality may rise as populations polarize into high-skilled manufacturing workers, working for export and connected to global knowledge networks, and the rest who are locked out by low skills.

Figure 3: Declining job creation in manufacturing exports

B. Total jobs (direct and indirect) created per \$1 million manufactured exports



Source: Rodrik (2019)

Blue = Ethiopia; Red = Philippines; Green = Thailand.

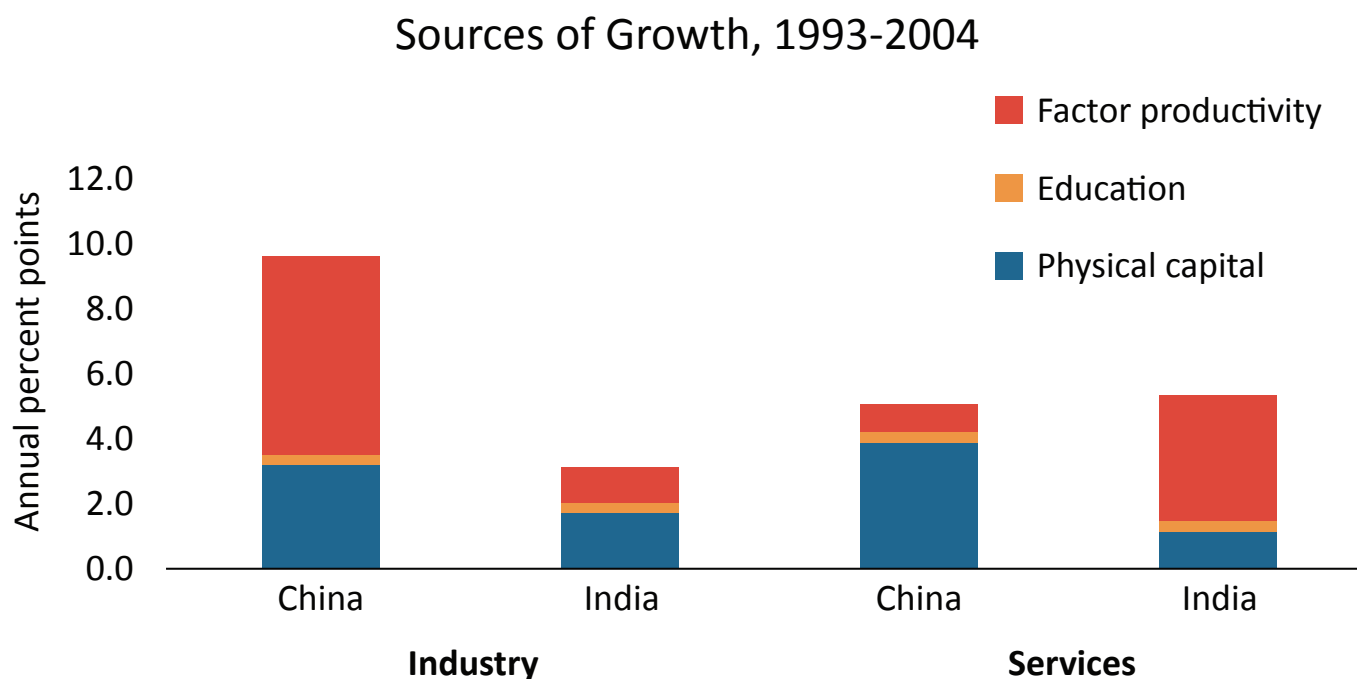
Could agriculture offer an alternative development path? Agriculture in developing countries is currently very labor-intensive, and agricultural technology tends to be labor-saving—plus the share of income spent on food tends to decline with growth (Rodrik, 2019). Thus, unfortunately, the prospects for agriculture-led development are not encouraging.

How about services? Historically, the role of services in long-run employment creation has been downplayed (Eichengreen and Gupta, 2013), but an emerging literature suggests it is poised for growth. First, we must distinguish between different types of services. The “services” category tends to absorb anything which is not clearly agriculture or manufacturing. Some services, e.g. many personal and retail services, are “non-tradable, technologically stagnant, and dominated by small informal enterprises” (Rodrik, 2019). Others, including IT and finance, are highly tradeable and technologically dynamic, with prospects for rapid productivity and employment growth. This latter group potentially have many of the advantages that originally made manufacturing attractive for long-run employment growth: tradability, scale, innovation and learning-by-doing externalities (Braga et al., 2019; Hallward-Driemeier and Nayyar, 2020; Loungani et al., 2017).



What does the evidence say so far? On the optimistic side, several studies have found sustained increases in labour productivity in services in the US (Triplett and Bosworth, 2004) and South Asia (Ghani and Kharas, 2010). Services are increasingly traded, and can potentially absorb large amounts of labour (Ghani and O’Connell, 2014). While India had slower growth overall than China during the 1990s, its recent services-driven expansion (Figure 4) does show that it is possible have strong productivity growth in services at scale (Baldwin and Forslid, 2020). On the pessimistic side, Rodrik (2019) notes that some of the tradeable services with most growth potential (e.g. business services) are relatively skill-intensive, so may not absorb low-skilled labor, and much of current service sector employment is in a large number of low-productivity informal firms, which are less likely to join global value chains.

Figure 4: Manufacturing and services growth in China and India



Source: Baldwin and Forslid (2020)

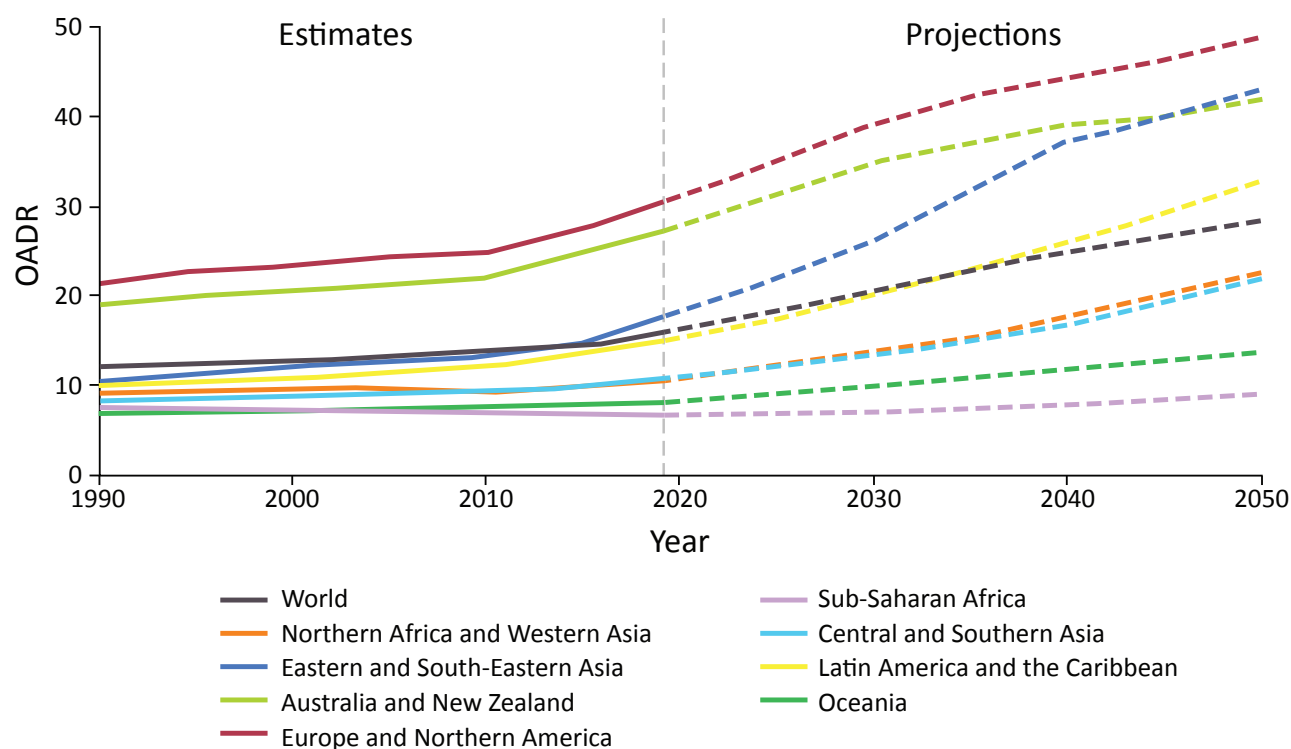
Ultimately, empirical evidence on past trends can only take us so far—the key question is whether large numbers of new types of services jobs will be created. Baldwin and Forslid (2020) argue that service-led growth is likely to become the new normal: digital technology is facilitating services trade (e.g. through machine translation and virtual telepresence), which allows workers in developing countries to directly export the source of their comparative advantage, low-cost labor, rather than having to first make goods with that labor. Firms such as Samasource, which employs workers in developing countries to tag data for use in machine learning, could grow substantially, as could employment through online freelance labor platforms like Upwork and Mechanical Turk. As developed countries’ elderly populations grow, nurses in developing countries could provide routine check-ups online, aided by diagnostic data from the patient’s mobile phone. There are currently around a billion people who could sell services in English online—machine translation could double or triple that number. Furthermore, a different physics applies to this form of trade: as the Philippines case study below illustrates, it is possible to increase flows of data far faster than one can increase flows of goods, so the transformation can be rapid. Thus, there is some reason to hope that, despite little broad evidence to date of mass employment growth in tradeable services, such growth is possible, and will provide ways to overcome the challenges posed to jobs by automation and artificial intelligence.





Other trends are also likely to support a rise in services employment. Climate change mitigation and adaptation measures also include many labor-intensive tasks, from retrofitting insulation to installing solar panels on roofs. Rapid aging is expected in every continent except Africa by 2050 (Figure 5). Older, and richer, populations spend a larger share of income on care services, which—given the requirement for a high degree of empathy and dexterity—are hard to automate. Changing gender norms, particularly rising female participation in the labor force, can also increase demand for outsourced cooking, cleaning and childcare services. Depending on regulation in rich countries, migration from developing countries to provide such services overseas could be a major driver of growth in remittances. Given the high and rapidly-increasing dependency ratios projected for Europe, North America, and East and Southeast Asia, more countries are likely to adopt the migrant-dependent model of Singapore and Hong Kong (Table 1). Thus, both new technologies and secular trends are likely to result in a substantial expansion of developing countries' services sectors.

Figure 5: Estimated and projected old-age dependency ratios by region, 1990-2050



Source: United Nations Population Division (2020) Notes: The old-age dependency ratio is the number of people aged 65 and above per 100 persons of working age (20-64 years).

Table 1 – Ratio of foreign domestic or care workers to households in East Asia

Country	Population (million)	Number of households (million)	Number of foreign domestic or care workers	Ratio of foreign domestic or care workers to households
Singapore	5,600,000	1,263,000	243,000	1 in 5
Hong Kong	7,400,000	2,548,000	370,000	1 in 7
China	1,411,500,000	375,069,000	20,000,000	1 in 19
Taiwan	23,600,000	8,386,500	245,576	1 in 34
South Korea	50,800,000	19,561,000	200,000	1 in 98
Japan	127,500,000	53,330,000	2,798	1 in 19,000

Source: Peng (2017)

A possible future: impact of new technologies by country and sector

A simple summary of recent work on the future of work in developed and developing countries is shown in Table 2 below. Automation substitutes high-skill labor for low-skill labor in agriculture and manufacturing. New communication technologies allow developing countries to export their comparative advantage, low-cost labor, through tradeable services, undercutting low-skill service workers in developed countries (while high-skill workers in developed countries are likely to still have a strong comparative advantage in the most sophisticated operations, which are not outsourced). Non-tradeable services (NTS) are not directly affected, but likely experience second-round effects: low-skill workers substituting away from agriculture into NTS will push down wages, while NTS workers moving into tradeable services (either by switching jobs or through a previously NTS job becoming tradeable) will raise wages.¹

Table 2: First-order effects of new technologies on employment growth

Employment growth:	Skill level	Agric.	Manuf.	Services (Non-tradeable)	Services (Tradeable)
Pre-industrial	Low	↓	↓	--	↑
	High	↑	↑	--	↑
Industrialised (includes China)	Low	↓	↓	--	↓
	High	↑	↑	--	--



Transformation, redistribution, and recognition

The simple country-sector framework above elides substantial heterogeneity of effects within societies. As with the “services transformation” of the late 20th century, the “globotics transformation” (Baldwin, 2019) is likely to increase inequality within countries, as the opportunities it brings are most readily available to those who already have other advantages. Women will have fewer opportunities to reskill or take advantage of new technology where they spend more time on unpaid care work or have lower representation in STEM fields than men (McKinsey Global Institute, 2019). In developing countries with large gender gaps in education, or where women have less access to digital hardware, these issues are exacerbated (Comin and Ferrer, 2013; OECD, 2016). Most rural or remote communities, which house 80% of the world’s poor, do not have internet access, so are de facto excluded from most jobs in tradeable services (World Bank, 2016b). The elderly, people with disabilities, and social and ethnic minorities also generally lag the rest of the population in access to digital technology (World Bank, 2016a).

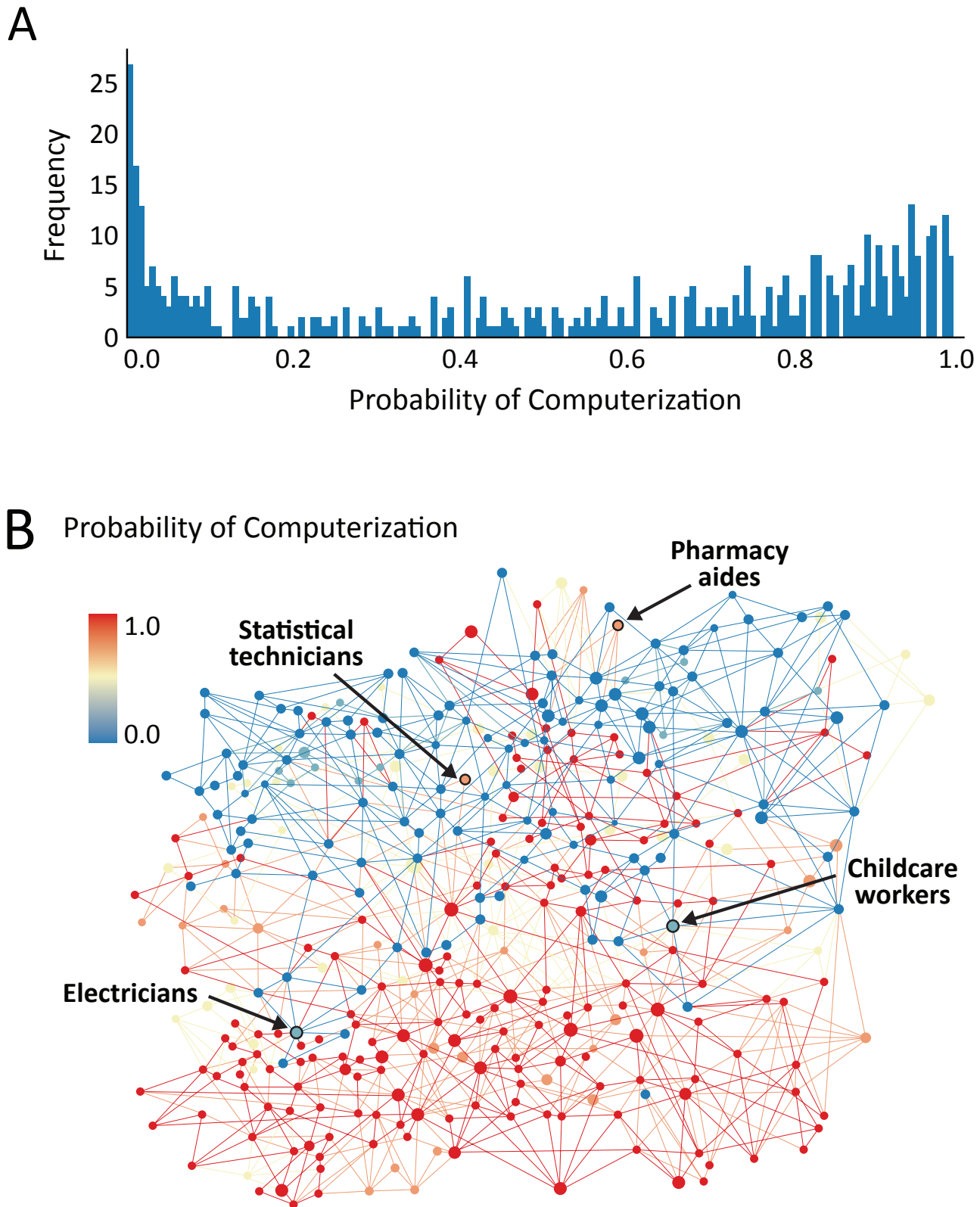
These inequalities of access are particularly pernicious because they affect not just the “politics of redistribution,” but also the “politics of recognition” (Fraser, 1997). Jobs do not just provide an income; they also provide meaning and status. Political activity from the local to the international level is increasingly moving online. Thus, exclusion from the digital sphere will not just affect the economic welfare of disadvantaged groups—it will also prevent them from playing an equal role in the governance of their societies. Conversely, this implies a form of reverse recognition for those with good digital access: they implicitly and inadvertently receive disproportionate representation.

Increasing automation will generate new forms of social divides. Del Rio-Chanona et al. (2020) highlight that it is not merely the automation probability of one’s occupation that determines future employment prospects: the automation probability of all those jobs to which one could reasonably transition is also critical. For example, while dispatchers and pharmacy aides are both estimated to have a computerization probability of 0.72 in their model, projected automation only increases long-term unemployment for dispatchers, because they (unlike pharmacy aides) can only transition to jobs which are also likely to be automated. As the distinct blue and red areas of Panel B in Figure 6 suggest, this could lead to polarization of society along new lines—a cluster particularly vulnerable to automation, and a cluster which mostly benefits from it.

More optimistically, automation may lead to a reappraisal of some jobs which were previously undervalued by society. Many activities which require a high degree of empathy and dexterity, such as nursing or domestic work, receive only limited wages and social status, yet are relatively insulated from automation. As technological and demographic shifts raise their relative wages, society may increasingly recognize the contribution of “key workers,” as seen in the “Clap for our Carers” response to COVID-19 in the United Kingdom, and similar popular campaigns around the world.

¹ A key question for future research is whether new services technologies, such as robotic process automation (RPA), will ultimately automate away low-skill tradeable services jobs in developing countries faster than falling communications costs can increase them.

Figure 6: Automation as a potential source of social division



Source: del Rio-Chanona et al. (2020)

Note: Panel A shows the probability of computerization of different occupations, following Frey and Osborne (2017). Panel B depicts the “occupational mobility network,” with nodes representing occupations, node sizes reflecting the number of workers in each occupation, and edges constructed from observed job transitions. Red nodes have high probability of computerization, and blue nodes have low probability of computerization.



COVID-19 and the future of work

The long-term impact of the COVID-19 pandemic on the future of work will not be clear for some time. The full impact on government finances and social norms will depend on how long social distancing measures last, and thus on the development and distribution of a vaccine. This section presents some early speculations on the main effects.

In the short term, COVID-19 has exacerbated inequalities that were already set to be worsened by new technologies. High-skill workers are more likely to be able to work remotely during lockdowns, while those low-skill workers still employed are disproportionately in workplaces with significant exposure to the disease, such as supermarkets or train stations. Rich countries with stronger health services and more fiscal capacity have more options for dealing with the virus. The most significant effect of the pandemic on the future of work may be the loss of resources for social support, education, and retraining programs, particularly in developing countries. Here, international organizations with greater liquidity can play a major role in responding, as with the recent expansion in IMF lending.

In the services sector, transitions to telecommuting will accelerate as people are forced to learn new ways of working, and tradeable services are likely to boom. There may also be a phase in which developing economies have more opportunities to develop manufacturing, as multinationals seek to diversify their supply chains away from China. But China's relatively swift recovery may temper this motivation—ultimately, the dominant effect of the pandemic may be to accelerate automation, as highly robotized factories are less vulnerable to disease. Urbanization may slow down, at least temporarily, while cities evolve their public health measures and firms adjust to a new flexible-working equilibrium. With the widespread increase in the numbers of people working from home, at least for part of the week, many urban professionals may move further from city centers, lowering rents to the benefit of urban key workers. Yet in a world with a COVID-19 vaccine, it is likely that the forces of agglomeration will dominate again. The world's great cities have survived many previous disasters, both natural and manmade. Past advances in communications technology have tended to complement, rather than substitute for, face-to-face interaction, and so increase urbanization (Gaspar and Glaeser, 1998; Glaeser, 2012). We cannot know yet whether virtual reality teleconferencing or other new technologies will have the same pattern, but history so far suggests it is unwise to bet against the city.

The impact of the pandemic on gender inequality in the labor market is not yet clear (Alon et al., 2020). With persistent gender norms, school closures place additional burdens on mothers, who tend to do a higher share of domestic labor. Yet greater paternal presence in the home during lockdowns, and afterwards, could further erode this norm and so have the opposite effect. The distribution of the impact of the pandemic across large and small firms is also currently unclear. It seems likely that the pandemic will increase market concentration, as large firms have more assets to sell or greater access to credit to weather a major negative shock. But the extent to which such effects persist, and the speed with which new small and informal firms open, remain to be seen.



Case studies of successful adaptation

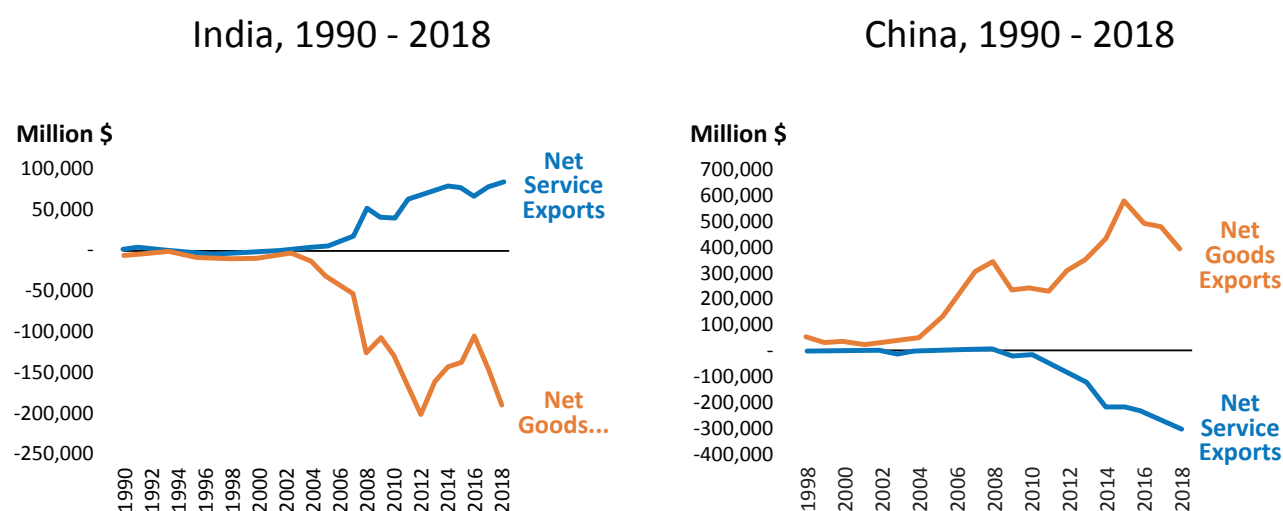
This section highlights two prominent success stories of developing countries creating tradeable services industries, and two examples of novel policies in developed countries to ensure that the benefits of new technologies are widely shared.

India: tradeable services

India's recent history provides a promising example for other developing countries in a world where manufacturing is dominated by China and robots. As Basu (2018) put it: "What India saw was a most unusual growth pattern for a developing country. It was not the manufacturing sector that led India's growth but the services sector." In contrast to China, India's export growth has been driven by services (Baldwin and Forslid, 2020), as shown in Figure 7. While it is impossible to identify the causes of this services boom with certainty, they likely included: (1) India's "overproduction of engineers throughout the 1960s, 1970s, and 1980s" (Basu, 2015); (2) High spending on tertiary education more broadly, creating world-class workers—by 2000, more than half of all US non-immigrant work visas requiring specialized skills were issued to Indian citizens (Baldwin and Forslid, 2020); (3) The relative attractiveness of investing in the services sector—while the manufacturing sector was tangled in the "license Raj" system of permits and regulations until the 1990s, the service sector faced few trade barriers and was largely untaxed.

This services boom is epitomized by the emergence of Bangalore as the "Silicon Valley of India." Following initial investment by Texas Instruments in 1985, further encouraged by the government's Software Technology Parks of India (STPI) initiative, the cluster has become an international hub for software development. Fed by the high density of science and engineering colleges in the area, it has become a global center for tradeable IT services, including hosting the headquarters of major multinationals like Infosys and Wipro.

Figure 7: Indian vs. Chinese exports



Source: Baldwin and Forslid (2020)



The Philippines: business process outsourcing

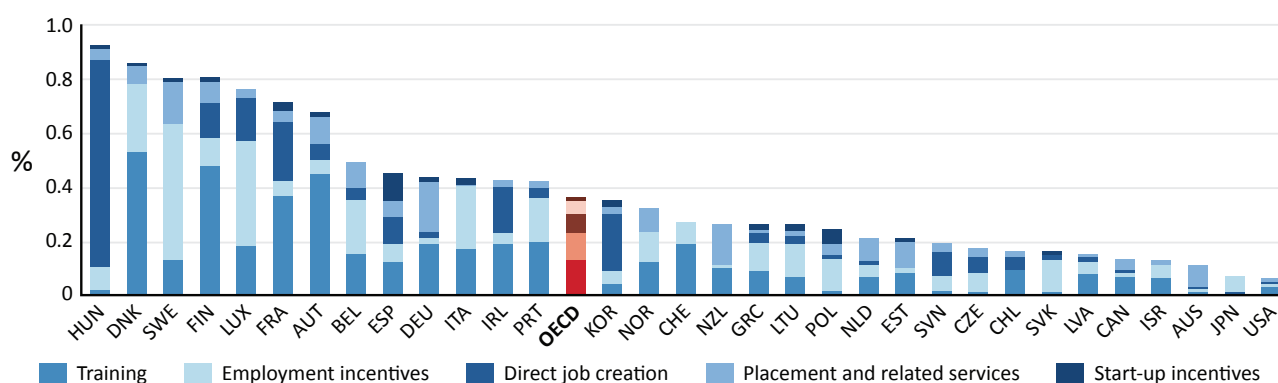
“Rarely has a new industry traced the trajectory from concept to prime economic driver as quickly as business process outsourcing (BPO) has in the Philippines,” according to the Oxford Business Group (2016). From 2400 employees in 2000, the BPO sector grew to 375,000 employees in 2012 (Chang and Huynh, 2016). By 2016 it had over 1.1 million employees and accounted for about 7% of GDP (IBPAP, 2016). Beyond their quantity, these are also high-quality white-collar jobs, with BPO employees typically earning double the national average (Baldwin and Forslid, 2020).

As with tradeable services in India, this boom was rooted in the confluence of good factor resources and successful government policy. The Philippines had a large and young population with good English-language and literacy rates; the BPO industry association also argues that the population had a strong customer-service orientation and a facility for Western culture (IBPAP, 2016). Special economic zones created in 1995 provided favorable tax conditions, while two key data security laws passed in 2012—the Data Privacy Act and the Cybercrime Prevention Act—facilitated a move into higher-value services (Baldwin and Forslid, 2020). Education policy has also responded to the new industry, with the IT & Business Process Association collaborating with several government agencies on programs to ensure continued supply of proficient English-speakers (IBPAP, 2016).

Scandinavian active labor market policies

The Nordic countries have led the way in combining employers’ needs for flexibility with workers desires for security (Figure 8). Through a range of policy initiatives, from direct economic support and regulation to collective agreements and social compacts, they have developed a system which is well prepared for future technological disruption in labor markets. One prominent example, the Danish “flexicurity” model formalized during the 1990s, is a “golden triangle” of policies comprising: (1) flexibility in the labor market—it is relatively easy to hire and fire; (2) social security—a comprehensive social safety net for workers losing their job; (3) activation policies for the unemployed, including job-search assistance, counseling and retraining. The goal is to preserve a dynamic private sector through a flexible labor market, while also ensuring that those citizens who lose their jobs are protected from severe financial hardship and then supported to find new work. The policy has resulted in low long-term unemployment rates and high rates of hiring, leading to high perceptions of employment security (Andersen et al., 2011; Eurobarometer, 2010). Such a system is well-suited to a future in which automation eliminates jobs in manufacturing industries, while being critical for the competitiveness of firms: by supporting workers to find new employment it ameliorates the inequality-increasing effects of new technologies and reduces the chances of a backlash.

Figure 8: Public expenditure on active labor market policies, % of GDP, 2016



Source: OECD (2019a)



Estonia's "Tiger Leap" policy

Since independence from the USSR in 1991, Estonia's economy has grown rapidly—achieving convergence from around 15% of EU GDP per capita in the early 1990s to almost 70% today. Under the Tiigrihüpe (Tiger Leap) policy, begun in the late 1990s, the government has rolled out internet access to all schools, installed new computer labs, and introduced the one of the most comprehensive systems of e-government anywhere in the world (OECD, 2019b). Everything from voting to filing tax returns to reviewing schoolchildren's homework assignments can be done online, while children as young as ten are taught to code and to design 3D-printable models. The country has since developed several tech "unicorns," as well as the video conference application Skype, and was selected as one of McKinsey's nine "digital frontrunner" countries in Europe (McKinsey & Company, 2017).

Policy recommendations for governments, international agencies, and other partners

In light of the above, we can distinguish three categories of actions to support employment and inclusive growth in the face of technological change:

- 1. Facilitate the expansion of the major growth areas that gain from technological change.**
- 2. Protect the welfare of those people, groups and places which lose out. (Note: this does not necessarily entail protecting specific jobs, which may undermine 1.)**
- 3. Support those people, groups, and places that lose out to move to or connect more closely with those that gain, so that they can share in the benefits of technological change.**

Each of these categories can be supported through a range of government policies, in partnership with employers, unions, and other civil society organizations. As we have seen with previous technological transformations, cooperation between these different groups is vital for action to be successful in the long term. Specific actions within each category are outlined below, but the precise details of implementation will depend on the particular circumstances of each country.

- 1. Facilitate the expansion of the major growth areas that gain from technological change:**
 - a. Invest in physical digital infrastructure. Many new technologies require new infrastructure, e.g. 5G networks for many self-driving cars. From a reliable electricity supply to fiber-optic broadband, states at all levels of development will benefit from upgrading their core public infrastructure.
 - b. Invest in "soft" digital infrastructure. Many digital products rely on Application Programming Interfaces and "microservices," e.g. identity authentication, payment process, or route planning. While many of these are provided privately, in some cases there are anti-trust or public goods arguments for price controls or state provision (Pathways for Prosperity Commission on Technology and Inclusive Development, 2018).
 - c. Invest in education and training—in both the "hard" cognitive skills (e.g. programming) required to create new technologies, and in the "soft" skills required to design and evaluate them effectively.
 - d. Support innovators. Governments can help create an ecosystem of public, private, and third-sector agencies such that the best ideas have access to finance, markets, and talent. For instance, Singapore rose from 17th to 8th on the Global Entrepreneurship Monitor's activity ranking in the five years after its SME21 innovation-promotion program was introduced (Chernyshenko et al., 2011; Pathways for Prosperity Commission on Technology and Inclusive Development, 2018). Ensuring that such support is inclusive (against, for example, the notoriously white- and male-dominated venture capital industry in Silicon Valley) is also critical.

- e. Develop high-quality cities. A large literature in urban and spatial economics highlights the agglomeration economies found in cities. A 2010 study by the Netherlands Bureau for Economic Policy Analysis considered how the country could future-proof its economy, and concluded that cities were the key: “Cities should not be thought of as mere collections of people, but rather as complex workspaces that generate new ideas and new ways of doing things” (Baldwin and Forslid, 2020; Weel et al., 2010). For developing countries seeking to export services, the dynamic interchange of ideas in city centers may be crucial for creating, attracting, or maintaining cutting-edge firms (Glaeser, 2012; Moretti, 2012). The world’s major cities have survived plagues, fires and riots; even as the centripetal forces of higher productivity and wages continue to drive urbanization, cities must invest in managing the latest problems of density. From omni-contactless payment to elbow-bump greetings to mask-wearing, many pandemic-era social innovations may persist.

2. Protect the welfare of those people, groups, and places that lose out:

- a. Provide basic income and targeted cash transfer programs to support those most in need. Universal Basic Income, while superficially appealing, is a red herring: even in the richest societies, it would be unaffordable to set it at a decent standard of living, and its universality prevents it from addressing inequality (Goldin, 2018). The level of support that states can provide will vary dramatically, so multilateral institutions and NGOs can support those with the greatest gap between the costs of technological upheaval and the state’s capacity to meet them.
- b. Support or develop mechanisms for ensuring that all groups are adequately represented in national and international decision-making bodies. This could involve affirmative action in governance, such as specific national ministries (e.g. the UK’s Minister for Disabled People) or quotas for officials from particular backgrounds (as in e.g. India’s Scheduled Areas). This may also mean encouraging a diverse range of mechanisms for elevating individuals to political power—e.g. unions, local government, or political parties—that actively promote those outside of existing elite networks. Ensuring that the most disadvantaged groups have a strong voice in national and international governance not only increases their chances of receiving compensation, but also accords them status, so they avoid being perceived merely as passive recipients of redistribution.

3. Support those people, groups, and places which lose out to move to or connect more closely with those that gain, so that they can share in the benefits of technological change:

- a. Provide education and training. Early-life education should not focus entirely on narrow vocational training, which may quickly become obsolete in a rapidly-changing labor market—instead it should aim for resilience and the ability to adapt to take advantage of change. Lifelong learning is likely to be critical, and subsidies for re-training can help those laid off find new work: under “flexicurity,” the average unemployment duration in Denmark has been one fifth of that in the Netherlands and Germany (Andersen et al., 2011).
- b. Create enhanced education and training support for vulnerable groups (i.e. “levelling up.”) Digital upskilling may be particularly important for women, the disabled, and minority groups with reduced access to technology. Some ethnic and racial groups may have particular difficulties relocating to high growth areas if their employment is tightly bound to linguistic and cultural networks, or if there is limited information available on job prospects elsewhere. In such cases, targeted information campaigns, recruitment centers or even migration subsidies (as in Bryan et al., 2014) may play a useful role.
- c. Support domestic integration. While paying attention to different impacts across countries and sectors, policymakers should not lose sight of large productivity gaps within sectors and within regions. As Rodrik (2019) notes, “the key challenge is to disseminate throughout the rest of the economy the capabilities already in place in the most advanced parts of the productive sector.” An ongoing process of collaboration between public and private sectors is required, to facilitate connections among domestic suppliers—for example, the sectoral roundtables discussed by Ghezzi (2017). This may be supplemented by hard infrastructure investment, e.g. to increase core-periphery communications links.

While each of these policies will need to be tailored to specific contexts, the core ideas are very broadly applicable, as shown in Table 3. Rather than attempting to “pick winners,” whether sectors or companies, states should focus on fundamental investments that will be beneficial across many different future scenarios. Governments, in partnership with firms, unions, and interest groups, will thrive if they create the capacity to capitalize on new technologies while protecting those who are threatened and supporting them to find new opportunities. International institutions can support many of these policies, with actions ranging from trialing novel interventions that others can scale up, through to direct funding of capital-intensive projects in poor countries. They can also coordinate broader multilateral efforts, such as preventing a “race to the bottom” in new tradeable services industries through global labor standards (ILO, 2016) or anti-social dumping schemes (Rodrik, 2018).

Table 3: Policy options for developing and developed countries, and international partners

Policies:	Developed countries	Developing countries	Inter-governmental organisations	International NGOs
1. Facilitate expansion				
Invest in digital infrastructure	P	P*	P*	
Invest in education and training	P	P	P	P
Support innovators	P	P		
Develop high-quality cities	P	P	P	P**
2. Protect welfare				
Provide a targeted basic income	P	P*	P*	
3. Support transitions + diffusion				
Provide robust early-life education	P	P	P	P
Provide life-long learning	P	P	P	P
Subsidize retraining, esp. for vulnerable groups	P	P		P**
Assist with job search, esp. for vulnerable groups	P	P		P**
Facilitate domestic supply connections	P	P	P	P
Upgrade core-periphery communications links	P	P*	P*	

* Support from intergovernmental institutions will be particularly important for capital-intensive projects in states with low fiscal capacity.

** International NGOs can have an outsize impact by trialing small-scale interventions in the areas with most scope for policy innovation.



Conclusion

Future paths to sustainable growth and full employment will not look like those of the past. It is too early to have clear empirical evidence on “what works,” but emerging trends and technologies suggest tradeable services are likely to be particularly promising. There is a great deal that governments, employers, civil society, international agencies, and other partners can do to facilitate a successful transition. It will be critical to keep the long-term structural issues of technological transformation in mind, even whilst dealing with the short- and medium-term exigencies of the current crisis.

Two main directions for future research stand out. Firstly, the interactions between the evolving COVID-19 pandemic and the future of work require further investigation. This should consider questions such as: (1) How do we measure “work safety” and “ability to work remotely” across occupations, and how do these vary across income and demographic groups, and across countries? (2) Will it be possible to target support based on these metrics? (3) What are the likely long-run effects on market concentration, and what does this mean for employment—if small and informal firms disproportionately shut down, how can we ensure that there are enough jobs for low-skilled workers?

Secondly, we urgently require greater understanding of the political economy of labor market reform. Major geopolitical events can open the way for major policy shifts—from women’s suffrage after World War I, to the adoption of the New Deal after the Great Depression in the US, to the British National Health Service after World War II. Further investigation of how such movements seized their critical moments, and which options have been opened by the current crisis, will be important—particularly given the appetite for fresh thinking revealed by the recent global mobilization for racial justice.

References

- Alon, T.M., Doepke, M., Olmstead-Rumsey, J., Tertilt, M., 2020. The Impact of COVID-19 on Gender Equality (Working Paper No. 26947), Working Paper Series. National Bureau of Economic Research. <https://doi.org/10.3386/w26947>
- Andersen, T.M., Bosch, N., Deelen, A., Euwals, R., 2011. The Danish flexicurity model in the Great Recession. VoxEU.org. URL <https://voxeu.org/article/flexicurity-danish-labour-market-model-great-recession> (accessed 4.27.20).
- Arntz, M., Gregory, T., Zierahn, U., 2016. The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis. <https://doi.org/10.1787/5jlz9h56dvq7-en>
- Artuc, E., Christiaensen, L., Winkler, H., 2019. Does Automation in Rich Countries Hurt Developing Ones? Evidence from the U.S. and Mexico 59.
- Baldwin, R., 2019. The Globotics Upheaval: Globalisation, Robotics and the Future of Work. W&N.
- Baldwin, R., Forslid, R., 2020. Globotics and Development: When Manufacturing is Jobless and Services are Tradable (Working Paper No. 26731), Working Paper Series. National Bureau of Economic Research. <https://doi.org/10.3386/w26731>
- Basu, K., 2018. A short history of India's economy: A chapter in the Asian drama, 124th ed, WIDER Working Paper. UNU-WIDER. <https://doi.org/10.35188/UNU-WIDER/2018/566-4>
- Basu, K., 2015. An Economist in the Real World: The Art of Policymaking in India, 1st edition. ed. The MIT Press, Cambridge, Massachusetts; London, England.
- Braga, C.P., Drake-Brockman, J., Hoekman, B., Jensen, J.B., Low, P., Mamdouh, H., Sauvé, P., Schwarzer, J., Stephenson, S., 2019. Services Trade for Sustainable, Balanced, and Inclusive Growth, Policy Brief. T20 Task Force on Trade, Investment and Globalization.
- Bryan, G., Chowdhury, S., Mobarak, A.M., 2014. Underinvestment in a Profitable Technology: The Case of Seasonal Migration in Bangladesh. *Econometrica* 82, 1671–1748. <https://doi.org/10.3982/ECTA10489>
- Chang, J.-H., Huynh, P., 2016. The future of jobs at risk of automation (Report).
- Chernyshenko, O.S., Gomulya, D., Phan, W.M.J., Lai, Y.Y., Ho, M.R., 2011. Global Entrepreneurship Monitor 2011 Singapore report 61.
- Comin, D.A., Ferrer, M.M., 2013. If Technology Has Arrived Everywhere, Why has Income Diverged? (Working Paper No. 19010), Working Paper Series. National Bureau of Economic Research. <https://doi.org/10.3386/w19010>
- del Rio-Chanona, R.M., Mealy, P., Beguerisse-Díaz, M., Lafond, F., Farmer, J.D., 2020. Automation and occupational mobility: A data-driven network model. arXiv:1906.04086 [physics, q-fin].
- Eichengreen, B., Gupta, P., 2013. The two waves of service-sector growth. *Oxford Economic Papers* 65, 96–123.
- Electronic Frontier Foundation, 2017. AI Progress Measurement [WWW Document]. Electronic Frontier Foundation. URL <https://www.eff.org/ai/metrics> (accessed 4.26.20).
- Eurobarometer, 2010. Flash Eurobarometer - Monitoring the social impact of the crisis: public perceptions in the European Union (No. 289), Flash EB Series.
- Fraser, N., 1997. *Justice Interruptus: Rethinking Key Concepts of a Post-Socialist Age*, 1 edition. ed. Routledge, New York.
- Frey, C.B., 2019. *The Technology Trap*. Princeton University Press, Princeton, New Jersey.



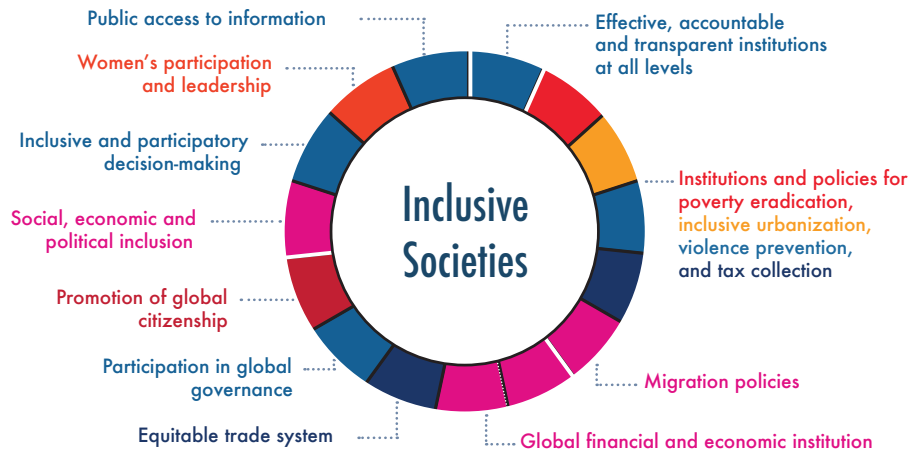
- Frey, C.B., Osborne, M.A., 2017. The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change* 114, 254–280. <https://doi.org/10.1016/j.techfore.2016.08.019>
- Gaspar, J., Glaeser, E.L., 1998. Information Technology and the Future of Cities. *Journal of Urban Economics* 43, 136–156. <https://doi.org/10.1006/juec.1996.2031>
- Ghani, E., O’Connell, S.D., 2014. Can Service Be a Growth Escalator in Low-Income Countries?, Policy Research Working Papers. The World Bank. <https://doi.org/10.1596/1813-9450-6971>
- Ghani, Kharas, 2010. The Service Revolution. World Bank.
- Ghezzi, P., 2017. Mesas Ejecutivas in Peru: Lessons for Productive Development Policies. *Global Policy* 8, 369–380. <https://doi.org/10.1111/1758-5899.12457>
- Gilchrist, A., 2016. Industry 4.0. Apress, Berkeley, CA. <https://doi.org/10.1007/978-1-4842-2047-4>
- Glaeser, E., 2012. Triumph of the City, Main Market edition. ed. Pan, London.
- Goger, A., Hull, A., Barrientos, S., Gereffi, G., Godfrey, S., 2014. Capturing the Gains in Africa: Making the most of global value chain participation. OECD.
- Goldin, I., 2018. Five reasons why universal basic income is a bad idea. *Financial Times*.
- Hallward-Driemeier, M., Nayyar, G., 2020. Trouble in the Making?: The Future of Manufacturing-Led Development 255.
- IBPAP, 2016. Accelerate PH Roadmap 2022. IT & Business Process Association Philippines.
- ILO, 2016. Non-standard employment around the world: understanding challenges, shaping prospects. International Labour Organisation, Geneva.
- Loungani, P., Mishra, S., Papageorgiou, C., 2017. World Trade in Services: Evidence from A New Dataset. *IMF Working Papers* 17, 1. <https://doi.org/10.5089/9781475589887.001>
- McKinsey & Company, 2017. Shaping the future of work in Europe’s 9 digital front-runner countries.
- McKinsey Global Institute, 2019. The future of women at work: Transitions in the age of automation 168.
- Moretti, E., 2012. The New Geography of Jobs. Houghton Mifflin Harcourt, Boston.
- OECD, 2019a. Measuring the Digital Transformation: A Roadmap for the Future. OECD. <https://doi.org/10.1787/9789264311992-en>
- OECD, 2019b. Economic Survey of Estonia.
- OECD, 2016. The Future of Productivity.
- Oxford Business Group, 2016. The Philippines’ Business Process Outsourcing Sector Expands into High-Value Services, in: The Report: The Philippines 2016.
- Pathways for Prosperity Commission on Technology and Inclusive Development, 2018. Charting Pathways for Inclusive Growth: From Paralysis to Preparation 1–85.
- Peng, I., 2017. Elderly Care Work and Migration: East and Southeast Asian Contexts.
- PwC, 2017. UK Economic Outlook March 2017.
- Rodrik, D., 2019. New Technologies, Global Value Chains, and the Developing Economies 30.
- Rodrik, D., 2018. Towards a More Inclusive Globalization: An Anti-Social Dumping Scheme, Research Brief. Economists for Inclusive Prosperity.
- Rodrik, D., 2015. Premature Deindustrialization (Working Paper No. 20935). National Bureau of Economic Research. <https://doi.org/10.3386/w20935>



- Stapleton, K., 2019. Automation, Global Value Chains and Development: What do we know so far? 23.
- Triplett, J., Bosworth, B., 2004. Productivity in the US services sector: New sources of economic growth. Bibliovault OAI Repository, the University of Chicago Press.
- United Nations, 2020. World population ageing, 2019 highlights.
- Weel, B. ter, Horst, A. van der, Gelauff, G., 2010. Strengthen cities to prepare the Netherlands for the future (No. 88.rdf), CPB Special Publication, CPB Special Publication. CPB Netherlands Bureau for Economic Policy Analysis.
- World Bank, 2016a. World Development Report 2016: Digital Dividends (Text/HTML). World Bank.
- World Bank, 2016b. Taking on Inequality (Text/HTML), Poverty and Shared Prosperity Report. World Bank.
- Xu, J., Gelb, S., Li, J., Zhao, Z., 2017. Adjusting to rising costs in Chinese light manufacturing. Overseas Development Institute.



The Grand Challenge on Inequality and Exclusion is an initiative of the Pathfinders for Peaceful, Just and Inclusive Societies



Member States

 Canada

 Ethiopia

 Indonesia

 Jordan

 Liberia


 Mexico

 Republic of Korea


 Rwanda

 Sierra Leone

 Sweden

 Timor-Leste

 Tunisia

 Uruguay



pathfinders@sdg16.plus

<https://www.sdg16.plus/inequality>

NYU | CENTER ON
INTERNATIONAL
COOPERATION
SECRETARIAT