



Automation and inequality

The changing world of work
in the global South

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This paper examines the relationship between rapid technological change, inequality and sustainable development. It asks how development processes can be shaped to provide decent, sustainable and inclusive work opportunities in low-income developing countries. In discussing this policy challenge, the paper seeks to stimulate thought and debate among a broad audience of researchers, civil society organisations and public practitioners.

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Summary

How can development processes be shaped to provide 'decent work' on an inclusive and sustainable basis in low-income developing countries?

The literature on *accelerating technological change* and the world of work offers varying scenarios for the future we face, and some claims of future human redundancy are overblown. But we can reasonably expect to see the following marked trends continue and accelerate:

- Disruption to the world of work in both developed and developing countries
- Erosion of jobs in manufacturing even in countries where manufacturing output is growing
- Increasing impact of automation and digital supply chain management on agricultural production, processing and trade, with eventually a profound impact on rural society in developing countries
- Increasing impacts across other sectors of economies (services, retail); change impacting the conditions of work as well as the nature of work, particularly through digital 'on demand' platforms that are transforming both local labour markets (taxi rides) and global ones (accounting services).

Accelerating digital development (including automation/robotics, artificial intelligence (AI) and advances in information and computing technology) will *affect inequality* at different levels and in different ways. To take the 'negatives' first, we can identify six stylised causal pathways that could amplify income and wealth inequality at the global or national levels.

1. *The 'structural transformation' route to growth declines.* Many Asian countries have grown rapidly through simple manufacturing for export to rich country consumer markets. Automation is already eroding this pathway and can be expected to continue to do so, with significant implications for inequality between countries.¹ Manufacturing for export has driven dramatic convergence between poor and rich country GDP since the late 1990s, so any closing of this route is likely to stem the reductions in global inequality that have been achieved over the past 20 years. Some of the sectors in the front line of the next wave of automation (for example, call centres using AI and voice recognition software) have been important for expanding opportunities for women in developing countries, so automation could bring a sharply negative impact on gender equality. And for

Africa, with a burgeoning cohort of young people entering the workforce, not being able to capitalise on low-cost labour to attract manufacturing investment is a particular concern.

2. *Increasing returns to capital vs labour.* The tendency of technological advance to increase financial returns to capital and decrease returns to labour will further polarise incomes and wealth, in effect boosting the process of increasing inequality.²

3. *Raising incomes of top-end workers.* Digital technologies can provide a huge boost to the productivity of highly skilled workers in some sectors, eroding demand for the less skilled.³

4. *Transforming rural economies.* If automation lets agribusiness develop more profitable business models, that could drive further waves of commercial land acquisition, which, under weak land governance, would put the asset base of poor households at risk. Similarly, digital management of supply chains will integrate production, processing and marketing to an increasing degree. Smallholders may struggle to engage with these changing distribution systems.

5. *Increasing insecurity and isolation for workers in the digital economy.* Whether in the global internet-based market for services, or in arenas such as domestic labour, on-demand 'gig economy' platforms create challenging conditions for collective action for workers, thereby eroding worker protections and living standards.^{4,5}

6. *Eroded openness and solidarity in rich countries.* The erosion of the world of work's meaning, security and certainty in rich countries also has potentially serious impacts on developing countries.³ If this is a factor (among others) in promoting a nativist and nationalist political reaction, then it could have multiple impacts on poor countries, through reducing tolerance for migration, public support for aid, openness to imports and support for multilateral action to tackle global challenges such as climate change.

But growing inequality is not inevitable. Any of the causal pathways described above can be mitigated or reversed by policy interventions. And a range of other developments could drive powerful benefits for the populations of developing countries. Among the many

possible *positive* effects on livelihoods of poor people in poor countries:

- *Energy access.* Smart grid systems or other digital technologies could greatly enhance access to clean energy from renewable sources — a powerful boost to livelihood potentials in poor countries.
- *Information and computing technology.* Mobile phone technologies have already brought immense benefits to livelihoods, and access to services and information, in developing countries. Further applications include: enhancing people's access to social transfers (including offering more reliable delivery); reducing the cost labour migrants face when sending money home; climate and weather information; and market information.
- *Enhanced smallholder production.* Micro-technologies, such as drip irrigation and gathering crop information by drones, could enhance small producers' productivity and help to stimulate a vibrant smallholder sector. It is not inevitable that smallholder farming will fail to hold its own against agribusiness.
- *Globalising markets for services.* The rapid expansion of global 'on demand' platforms trading skills such as translation, accountancy and copywriting provides a way for educated workers in the global South to access northern clients. In theory, this could have an equalising effect on wages on a global scale — although in practice evidence suggests the emergence of new forms of intermediation that prevent benefits spreading broadly within the workforce.

Policy and action responses to this accelerating change in the world of work are wide ranging.

For poorer developing countries, policy agendas include:

Get there while you can

In the short term, the export manufacturing route will continue to be viable in some sectors that are challenging to automate (such as textiles) for countries with the right conditions of labour supply and market access.

Build on what you have — natural capital and the informal economy

Natural capital is abundant in many developing countries and can underpin a sustainable development strategy under the right conditions. Costa Rica, for example, has sustained healthy comparative growth rates that have drawn substantially on the success story of forest regeneration.

Where countries lack rapid formal sector growth, the informal sector offers alternatives. The spread of mobile phones through Africa, for example, built on a hybrid of formal and informal retail networks, particularly kiosks that supply or top-up SIM cards. Formal companies depend on informal retailing at least as much as the retailers depend on the formal telecommunication companies. The low level of capital in relation to labour in the bulk of informal sector micro-enterprises also suggests that informal employment will be quite resistant to automation.

Addressing inequality

Measures to address inclusive, sustainable development in a changing world of work can be seen in three stylised categories — pre-distribution, distribution in the labour market and redistribution. Policy priorities include:

Pre-distribution

- Active and far-sighted *education* policy that gives future and present workforces marketable skills and the cognitive and social capacities people will need in rapidly changing labour markets
- Protection for local *rights in land and natural resources* through enhanced land governance that empowers people holding customary land rights to engage effectively with a changing land market.

Distribution within the labour market

- Enhancing *digital infrastructure and access* is an obvious priority in order to let workers engage with global work platforms, and to enhance opportunities for providing work-enhancing services (for example, affordable renewable energy). Access at the local level (typically through smartphones) is generally highly unequal, so attention to providing access to women and other groups prone to exclusion requires policy engagement.⁶
- Maximising opportunities for landholders to earn income from effective land management that provides *ecosystem services*.
- Promoting micro-automation innovations (for example drip irrigation, processing technologies) to help smallholder household farming remain viable in the face of increasingly productive agribusiness.
- Supporting smallholder farmers to engage with changing supply chains as buying, processing and distribution is increasingly managed on digital platforms.
- Labour guarantee/public works schemes develop local infrastructure that can both help communities to build resilience to climate change and protect local natural capital.

Redistribution

- A range of 'social transfers' can deliver the social protection people need to navigate rapid changes in the world of work. At the extreme end are proposals for a universal basic income. Most importantly, social protection should not penalise people for working while claiming if it is to co-exist with casualised, disruptive and informal labour markets. It is worth noting that a range of schemes in southern (predominantly middle income) countries already meet this criterion.

A proactive, innovative and watchful state

Mazzucato⁷ documents the central role that modern states have always played in shaping transformative innovations, from the railways to the internet. She stresses that this goes beyond research and development to supporting 'patient' capital for diffusion, as well as shaping demand through regulation. The capacity to keep a watching brief on those who are disadvantaged by technological change (alongside other stressors) will be important. Short-term reactions may mostly take social protection forms. But the ability to shape markets so that innovations enhance livelihoods and empower workers is a potentially more valuable asset.

Taxation in a changing world

Public action underpins a great deal of the policy agenda outlined above. A priority therefore is to find simple, intuitive ways of implementing taxes that are fair and will be workable despite rapid technological change. Many dynamics will reduce the potential tax take of nations, particularly poor nations: reduced formal sector employment due to automation implies less income tax; trade taxes may fall due to transfer mispricing practices by multinational corporations; increasing transactions in crypto-currencies creating challenges for tracking and taxing economic activity. A great deal of this can be offset in the short term by diligent work to strengthen national tax authorities in developing countries. In the long run, there would be great advantages to shifting taxation on to points where wealth interacts with the material world: taxes on pollution (especially carbon taxes, which are a powerful

instrument to combat climate change); and taxes on property and land, which are easy to implement and relatively resistant to technological change.

A changing politics

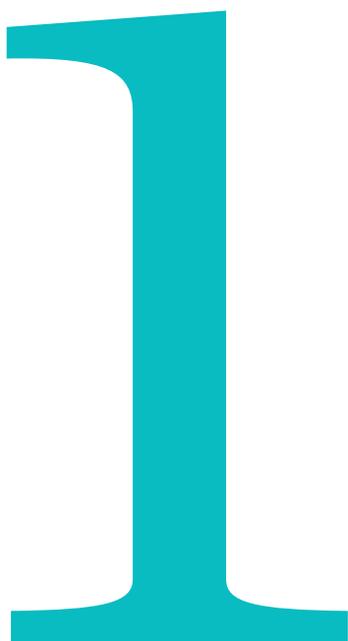
Envisaging a politics that will support an equitable global labour market in a sustainable global economy raises challenges at many levels. Institutions for workers' collective action have underpinned our notions of democratic change and provided the basis for a politics of global solidarity (to the limited extent that has been achieved). If these institutions are eroded by delocalised and increasingly precarious work, the implications are fundamental. Where will the emerging alternatives for a politics of social justice be found? Perhaps mobilisation can already be seen in both the global movement calling for a universal basic income⁸ and the claims for non-contributory social transfers in large parts of the global South.⁹ Early ideas and forms of collective action that suit the on-demand 'gig economy' (both global and local variants) are emerging.⁴ But however the lines of political aggregation develop, the models of engagement will be very different and will reflect the impact of digital communications on social action.

A policy research agenda

The territory covered in this paper is broad, and it would be possible to pick out many directions for further work. Understanding how tax systems need to evolve, and the risks and opportunities for green transitions, are both important areas. We will need frameworks for understanding the impacts of the transformations described here, disaggregated by gender, location and social groups. Emerging impacts on rural societies in developing countries will need to be tracked, and this seems to be an underexplored area in the literature at the moment. For the poorest countries, access to rich country service markets via the global online 'on demand' economy could provide livelihood opportunities and a route to increasing prosperity, if such markets can work in fair ways. What will feasible options for regulation and for worker action look like? Above all, there will be a need to understand and document political change, as both the fault lines and the means for political mobilisation continually transform.

Disruption and technological change

Expectations of technology differ widely. Some anticipate huge benefits in a 'digital future', others see new threats to human wellbeing in a machine-automated world. Technology is developing exponentially, costing jobs in some sectors while bringing new business models and changed working conditions to others. Increasing internet access is expanding a global market in services like copywriting and accounting, and facilitating 'management by algorithm'. If these dispersed, digitally managed labour forces struggle to establish social institutions for collective action, their sense of 'work identity' could be precarious and lacking in social substance.



There are lots of uncertainties in writing about the evolving world of work. Future scenarios are unknowable, and depend on cultural, political and policy reactions as well as technological drivers. For example, greater inequality in the short run might lead to less in the long run if it stimulates a political reaction. The human impact of technological change is also unknowable. For every vision that projects robots and machine learning algorithms destroying human employment, there is another that says technological advances will co-exist happily with humans as we learn to ‘work with the machines’.¹⁰ Many projections ignore real world change dynamics and the political reactions to change that will influence final outcomes. The impacts on job markets in developed countries are contested. It is clear that rapid technological change has imposed costs and reduced employment in specific sectors and localities, and has triggered serious social dislocation,¹¹ but there is little evidence yet of rising technologically driven unemployment at an aggregate level.¹²

Discussions about technological drivers of change are multifaceted, referencing a bundle of things including robotics, 3D printing, machine learning/AI, distributed ledgers and communication technologies. At the heart of all of them lie exponential advances in digital processing.

One big division in the literature concerns how rapid technological change is framed. Talking about change as ‘automation’ focuses on digital or robotic systems replacing human actions. The advantage of this perspective is that it highlights how change affects people. The downside is that it may not take into account new possibilities for human agency that radical new technological developments create. ‘Automation’ of tasks implies a trajectory from human to machine. In contrast, framing the current of change as ‘digital’ moves the focus towards information technologies, the internet and mobile phones, which are more natural enablers of human potential. ‘Digital’ narratives tend to stress the upside, though at times expressing disappointment that social impacts are not better.¹³

Reflecting these framing challenges, arguments are often formed in ways that reflect one view or another, but do not effectively describe causality. For example, there has been a heated debate on whether developed country ‘rust belt’ manufacturing jobs have been lost to trade (eg what some US commentators call ‘the China shock’) or automation.¹⁴ Whatever the detail of these varying assessments, digital technologies greatly eased the ‘offshoring’ of manufacturing jobs from developed to developing countries in the 1990s and 2000s by making it much easier to manage complex supply chains. So, arguably, the effects of trade and technological change are not possible to separate.

Similarly, the decline of organised labour as a force in developed country economics and politics

reflects falling numbers of union members and declining bargaining power, driven by both trade and technological change (among other things). Changes in technology, economic dynamics and power relations move together and influence each other in multiple ways. Understanding the interactions between changing technologies and changing power relations is important, but the territory is complex and uncertain. Accordingly, any conclusions and policy directions offered should come with appropriate caution.

Exponential change and why it matters

‘*The second machine age: work, progress and prosperity in a time of brilliant technologies*’ by MIT academics Erik Brynjolfsson and Andrew McAfee¹⁵ had a big impact on the debate about technology and social change.

It provides an arresting insight on the nature of exponential change and the difficulties of conceptualising and understanding it, starting with ‘Moore’s law’ — the observation from Gordon Moore in 1965 that the computing power a dollar can buy was doubling every year and was likely to continue to do so. This has broadly held good, although the consensus says 18 months to two years now, rather than a year, and there are emerging questions about the metric’s salience.¹⁶

In short, exponential development has brought accelerating change and disruption that experts in AI and technological change have failed to predict, even over quite short time frames. For example, things that experts thought were too complex to automate in the foreseeable future as recently as the early 2000s because of the range of complexity and requirement for ‘pattern recognition’ — such as driving a car — are becoming commonplace.

Impacts on the world of work

‘*The Rise of the Robots, Technology and the Threat of Mass Unemployment*’¹⁷ explores how automation could threaten generalised employment and, as a result, social prosperity, as broad-based consumer purchasing power begins to evaporate. Author Martin Ford rehearses how manufacturing employment can decline even as industry booms (for example, China lost 15 per cent of its manufacturing jobs between 1995 and 2002). Ford raises the spectre of automation affecting high-skill, high-wage jobs too, as machine learning algorithms are applied to tasks ranging from project management to basic journalism.

Similarly, in a study of contemporary US labour markets, Acemoglu and Restrepo¹⁸ compared the level of

automation in predominant industries in different 'commuting zones' and found significant negative impacts on both wages and employment. They note that the level of impact is significant and surprising, that it is likely to grow, but also say that the impacts will be on a relatively small segment of the US labour market.¹⁹

A change that definitely will affect many workers in developed, and in due course developing, countries is self-driving vehicles. A study commissioned by the US White House²⁰ estimates 2.1 to 3 million driving jobs to be at risk from technological change — though it emphasises these will not necessarily be aggregate losses to the workforce (because it is easier to see old jobs being replaced than new ones being created, and policy can make a difference). But rapid change on that scale will certainly be disruptive and could leave many people adrift.

However, the literature's emphasis on change that disrupts male northern jobs gives a very restricted picture. Automation that removes jobs in call centres in the South affects a predominantly female labour force, but a much less visible one.⁶

Other narratives envisage broadly beneficial effects on society and the world of work from rapid technological change. The McKinsey Global Institute²¹ anticipates disruption but also, in the long run, benefits — for example an estimated increase in productivity growth of 0.8 to 1.4 per cent annually through to 2060.²²

But while the more optimistic side of the argument tends to see workers enabled by, rather than replaced by, digital technology and automation, some detail a sharp and counter-intuitive drop in the proportion of US workers shifting into jobs associated with technological advances (8.2 per cent in the 1980s, 4.4 per cent in the 1990s and just 0.5 per cent in the 2000s).²³ One report²⁴ placed 47 per cent of total US employment in the 'high-risk' potentially automatable category. This methodology tends to find that the proportions at risk in developing countries are higher in the long run, due to the higher proportion of the labour force in manufacturing and agriculture. A startling prediction from the Oxford Martin School, for example, put 85 per cent of jobs in Ethiopia 'at risk'.²⁵ However, the methodology does not take account of differences in labour costs, so the results need to be viewed with caution.

The term 'gig economy' has emerged in recent years to describe work where previously stable full-time jobs have been broken down into task-by-task commissions that self-employed contractors take on, often through a company 'app' (also described as the 'on demand' economy in some texts). A well-known model is the 'Uber' taxi system. The literature on the 'gig economy' focuses on how technological change and digitisation, rather than destroying employment, can alter working conditions and also let businesses control an army

of independent workers through 'management by algorithm'.⁸ It is important to note that casualised task-based hiring is nothing new and represents a larger share of employment in many countries than formal wage employment. So talking about the 'gig economy' in relation to technological change implies the additional element of the online platform.

There is also an expanding new 'global gig economy'¹⁴ that allows workers anywhere in the world with good internet access to bid for work on digital platforms performing services like translation, transcription, programming, graphic design, writing or accountancy. This system is organised as a competitive bidding process: clients list jobs on platforms like Upwork.com or Freelancer.com, and workers then try to outbid each other for contracts by offering a lower price or better service. Some workers in developing countries are able to increase their earning power considerably, while others struggle to establish the online profile (of client ratings and track record) necessary to access work on good terms. These lower ranked workers are often subcontracted by others on disadvantageous terms (sometimes on the same platform). New workers spend huge amounts of time seeking work — a process that becomes easier the more good online 'ratings' the worker has. Such global digital labour platforms are growing in volume of business at 2.5 per cent per year. Clearly, millions of people in developing countries can be expected to turn to outsourced work as internet access (covering more than 40 per cent of the world's population in 2017) continues to grow.

Guy Standing's analytic construct of the 'precariat'¹⁸ outlined some interesting features of the changing world of work. He defines the precariat through multiple forms of insecurity (of income, employment, representation) — but also through the lack of a work-based identity: "When employed, they are in career-less jobs, without traditions of social memory, a feeling they belong to an occupational community steeped in stable practices, codes of ethics and norms of behaviour, reciprocity and fraternity." It seems clear that global labour markets for services, with their geographically dispersed labour force, combined with the distancing effect of 'management by algorithm', will make it challenging to establish social institutions for collective action. Without these institutions, work identity will be precarious and lacking in social substance.

Employment in much of the informal sector has always lacked security and protection of rights. The 'gig economy' is nothing new in developed or developing societies. But digital work platforms seem likely to spread these characteristics more widely, to increase both access and competition, and introduce these ways of working to new sectors — probably quite rapidly.

In summary, much of the literature deals with uncertain future scenarios in a context of rapid change, and can be difficult to assess with any certainty. However, the following trends seem clear:

- There will be substantial and accelerating disruption to the world of work in both developed and developing countries.
- Jobs will continue to be eroded in manufacturing, even in countries where manufacturing output is growing.
- Eventually the new generation of automation and robotics will affect agricultural production. This will increase automation's impact in developing countries (over half of the labour force in sub-Saharan Africa and South Asia works in agriculture).
- The impacts of automation will profoundly disrupt other sectors (eg services, retail) in complex ways.
- Technological change affects people's working conditions as well as the nature of their work, particularly through the digital platforms that are transforming both local labour markets (taxi rides) and global ones (accounting services).

The inequality dimension

Digital technology helped drive significant global reductions in poverty and inequality from the late 1980s to the early 2000s. It did this largely by making it possible to manage complex supply chains. That let a few large and rapidly industrialising middle income countries capture large segments of global manufacturing industry, achieving huge productivity gains. But it now seems likely that automation of manufacturing will close off these pathways-to-rapid-growth to poorer countries in the long run. Furthermore, unchecked technological change could boost processes that have exacerbated within-country inequality over most of the past 30 years.



Inequality — what do we actually know?

It is important to be aware of the severe limitations in current datasets and tools for measuring inequality — of both wealth and income.

The primary instrument for measuring country level income and consumption is the household questionnaire survey, based on a representative sample of a country's population. Researchers Chandy and Seidel recently examined how much we really know about inequality within countries.²⁶ They note that the household questionnaire survey is unable to record the wealthiest people's incomes for two reasons — rich people are unwilling to participate in surveys and there is a very high probability of missing super-high-income households in the sample.²⁷ To this we can add a third reason — substantial amounts of the super-rich's wealth and income are hidden for tax avoidance purposes.²⁸ Given that trends in inequality in the past decades have been driven by rapidly growing elite wealth and income, this is a significant issue for measuring trends as well as the absolute level of inequality. Using a methodology pioneered in 2013,²⁹ the authors use the gap between income reported in survey data and national accounts to correct the deficiency. The 'missing amount' is added progressively to the top decile of incomes. Adjusted country Gini coefficients are on average nine percentage points higher than without the adjustment.

Chandy and Seidel conclude, however, that the adjustments — although they suggest systematic under-reporting of country-level income inequality — do not change our understanding of what has been happening broadly to trends. National level inequality mostly rose in the 1990s but this rise has not continued. This finding reflects the World Bank's 2016 analysis³⁰ in which within-country inequality rose steeply from 1988 to 2008 (up six points based on a population-weighted Gini index). Since then there is a slight average decline of just under one point to a Gini of 39 in 2013.

These observations modify, to some extent, what had become the standard narrative on trends in global versus national inequality — which sees a slight reduction in global income inequality as against generally rising national level inequality. Based on the aggregated results of more than 600 household surveys, Milanovic, for example, compares global against national trends in inequality.³¹ Between 1988 and 2008, he observes that (as far as we are able to record it) global inequality declined modestly. In that period he sees national inequality as mostly having risen — with some exceptions, mostly in Latin America.³²

Thomas Piketty, in the seminal work '*Capital in the Twenty-First Century*',² examines the dynamics of convergence and divergence in both wealth and income, based mostly on data covering long historical periods from the US, the UK, France and Germany. He demonstrates a consistent rise in the ratio between capital and income at the national level since about 1950.³³ This in turn implies that the share of national income going to returns on capital will grow relative to returns on labour.³⁴ At the core of Piketty's argument is the observation that, when the return on capital is higher than aggregate growth in an economy, then inequality will rise. These 'forces of divergence' are powerful. Without strong policies to counter the dynamic, they are likely to drive increasing inequality in rich countries for long periods.

Comparable data on wealth is available for very few developing countries (particularly on the taxation/fiscal side). Efforts are underway to extend the key data resource, the World Income and Wealth Database, to some large middle income countries, and there are some preliminary results from China.³⁵ A key feature of this work is to demonstrate that — whatever is happening with general inequality as measured by the Gini coefficient — the top one per cent of the population is gaining a growing income share in all countries measured (13 per cent according to the most recent data in China and 20 per cent in the US).

The debate on global wealth inequality has been energised over the past three years by a series of papers from Oxfam that have provided eye-catching estimates of global wealth concentration. The latest report³⁶ found that since 2015, the richest one per cent of the world's population has owned more wealth than the rest of humanity, and that eight super-rich individuals (you could fit them all in a people carrier) own as much wealth as the bottom half of humanity.³⁷

Whatever the difficulties of measurement, there are some solid and clear directions of change in inequality at the national and global levels:

- The 'rise of the plutocrats' — increasing elite wealth, increasingly concentrated in the hands of few people³¹
- The rise of the 'Asian middle class' — a huge increase in general living standards in a range of industrialising countries in Asia over the 20 years up to 2008
- Convergence between poor and rich country GDP levels (83 developing countries grew at more than twice the average rate of economic growth in OECD countries between 1998 and 2008³⁸)
- Stagnating incomes for the OECD (rich country) middle and working class over the last 20 years.

The current scale and pace of technological change is likely to have major consequences for the global distribution of wealth and income. Global and national level trends are not entirely separable, but it is possible to do some stylised analysis of likely future trends and scenarios.

Automation and ‘the end of convergence’

It is likely that global inequality trends will be primarily affected by steadily closing opportunities for the poorest countries to build rapid growth paths through expanding export manufacturing. Economist Dani Rodrik¹ has explored a narrative of ‘premature deindustrialisation’ with significant implications for policy choices in poor countries.

For a long time — at least since the economic emergence of South Korea in the 1960s — many low income countries have been able to achieve rapid economic growth through industrialisation. The process usually starts with low-end manufacturing (apparel, footwear, plastics) and entails many workers moving from low productivity smallholder agriculture to high productivity export manufacturing. This process, termed ‘structural transformation’, was boosted by an earlier era of technological change. Improved communications enabled global businesses to manage supply chains in ways that multiplied opportunities for industrial development in many poor countries. This point is elaborated in Richard Baldwin’s *The great convergence: information technology and the new globalization*.³⁹ Baldwin places the moment of acceleration at around 1990, when rapid improvement in communication made it radically easier to coordinate complex activities at distance — leading to vertically integrated supply chains, taking advantage of cheap labour.

This form of industrialisation has helped to drive an unprecedented convergence between rich and poor country wealth levels. By the early 2000s, 83 developing countries were achieving growth rates over twice the rate of OECD members³⁸ (though some of this was driven by enhanced demand for commodities that helped countries that were not industrialising⁴⁰). The ‘structural transformation’ model was at the heart of the process of ‘convergence’ between poorer and richer countries. But Rodrik argues that, over time, industrialisation has been losing its economic development magic. Most rich countries have seen manufacturing decline in their economies for a long time. And the process of industrialisation made them richer and boosted incomes more than countries that industrialised later. Rodrik calculates that industrialisation peaked in Western European countries such as Britain, Sweden and Italy at per capita annual income levels of around US\$14,000 (in 1990 dollars). India and many sub-Saharan African countries appear

to have reached their peak manufacturing employment shares at income levels of US\$700.¹

This process is likely to accelerate as automation shifts the balance of advantage to locating light manufacturing close to consumers rather than cheap labour.⁴¹ And, as noted above, historic pathways suggest simple manufacturing puts countries on a labour productivity escalator in a way that other options (agriculture, extractives, services, tourism) cannot replicate. So, in the absence of radical new strategies to close the gap between poorer and richer countries, this process will slow down the rate of convergence.

In terms of development pathways for poorer countries, some level of future manufacturing growth in specific sectors may still be possible for some time. Automation broadly works much better with hard materials than with pliable, soft materials like textiles. Clothing and apparel manufacture may continue to offer possibilities for growth based on abundant low wage labour — for a while at least. To give an idea of the significance, this is a sector that employs some 27 million people across India, Bangladesh and Pakistan, and accounts for 82 per cent of the export income of Bangladesh. Some put the time horizon for automation of textile manufacture at 20 years, others see it coming much sooner.⁴²

Many African countries aspire to strengthen their manufacturing base. Coulibaly⁴³ characterises the challenge as ‘Africa’s race against the machines’. Given the burgeoning cohort of young people and youth unemployment, will the continent’s anticipated demographic windfall be realised? Much, he argues, will depend on the capacity of countries to create jobs in labour-intensive manufacturing.

Recent research by Blattman and Dercon⁴⁴ provides intriguing resonance to Rodrik’s argument that, over time, industrialisation is offering increasingly small benefits at the macro level. Their work shows that industrial jobs in Ethiopia offer surprisingly poor returns for workers compared against alternative options, including in the informal sector. This does not mean, however, that industrial growth is not important. Formal sector growth provides markets and opportunities that in turn feed informal sector options.

The political disruption narrative

In theory, automation’s effects on rich country politics could be a significant channel for impacts on poorer countries. Essentially, the hypothesis is that disruption to the world of work in rich countries may lead to a surge in nativist, nationalist political sentiment that could in turn threaten the collective action between nations necessary to maintain progress for the world’s poorest people.

Ryan Avent's *The Wealth of Humans*¹³ compares disruption to the world of work and associated political turbulence in mid-19th century Europe to the present state of politics in advanced industrial economies. At the heart of the narrative is the observation that — due to technological change — work in industrialised societies is less remunerative, less certain, less good at filling our lives with a sense of purpose, and less good at underpinning our sense of identity and self than it used to be. This puts more and more pressure on government to step in, creating a 'more poisonous and less generous politics', where the vacuum of identity is filled with nationalism and people hope their lost income can be replaced by state welfare (in turn increasing fears of outsiders being able to access the pot).

Rapid technological change has driven these rich country trends in three ways. First, increasing automation means that more and more tasks don't need people. Second, digital communication has super-charged globalisation. As noted above, complex supply chains have created jobs in emerging economies and eroded them in the developed world. Third, digital technologies provide a huge boost to the productivity of some highly skilled workers, eroding demand for the less skilled (Avent gives financial fund managers as an example).

Avent argues that these trends can be expected to lead to decades of political disruption in advanced industrial societies. If middle and working class people in northern societies see no prospect for improvement in their own situation, then they will seek to disrupt the social order through the only means available — their vote. A particular risk is the rise of nativist, populist politics promising a return to a 'golden age' of national prosperity. The resulting political changes are unlikely to support an international order committed to multilateralism, global collective action and international solidarity.

At a broader and less direct level, Avent notes that the "abundance" of labour renders its political power "pitifully low." In the long run, there is a clear risk that if institutions representing workers lose influence, the broad political values in northern countries that support international solidarity for the poor and vulnerable on a global scale will be eroded.

This political disruption has a range of potential consequences that could increase global inequality over the coming decade. If, for example, increased nationalism and nativism in rich countries' policy priorities leads to decreased multilateral and international engagement, there could be knock-on damage to the poorest countries through the following routes:

- Failure to tackle global challenges, notably the climate crisis, which is already affecting the poorest countries and the poorest people in progressively more damaging ways⁴⁵

- Other potential impacts of a weaker multilateral architecture, such as a weakened capacity to both manage tensions that might lead to conflict and respond through humanitarian action to the human fallout of existing conflicts⁴⁶
- Breakdown in systems of multilateral trade (through growing protectionism) that could weaken access for poor countries to developed country markets
- Loss of access to developed country labour markets through strengthening of immigration and border controls designed to prevent migration
- Lower flows of international development assistance due to a loss of public support for aid.

At the time of writing, there seems to be enough fluctuation in the political fortunes of different ideologies in OECD countries to put the narrative of the right leaning 'populist wave' into question. Elections in Holland and France have seen nationalist, nativist movements polling more weakly than was expected. And, of course, the level of contribution that automation makes to the retreat into nationalism and nativism is hard to assess. The questions are: above the level of short-term reactions and counter-reactions to nationalist political movements is there a long-term trend, how powerful is it and how much is technological change the driver?

Automation and inequality within countries

There is a range of mechanisms through which accelerating automation and digital innovation might affect inequality within countries. These include: boosting the advantage of wealth over labour; hollowing out of the workforce (relative declines in mid- and lower-skilled employment share); weakening of labour institutions; and erosion of the tax base (thereby weakening state capability for redistribution). As a recurring caveat — all of these effects can be influenced and reversed by policy and social action, so speculation about impacts needs to take that into account.

The argument that *automation will increase the advantage of capital over labour* is simple and intuitive. Owners of robots will benefit more than workers they replace. This argument can also be seen as 'Piketty amplified', as the result is to boost returns to capital further ahead of returns to labour at the level of a whole national economy. In most industrialised countries, labour's share of national income has been falling since the 1970s. And the process is also visible in some middle income countries, with a particularly steep drop in China.¹⁷ Automation is likely to increase this process under most scenarios, further concentrating wealth and income in fewer hands.

The *hollowing out of the workforce* is already measurable in the manufacturing sector. Rodrik¹

demonstrates that automation has been taking out more low-skilled jobs than medium- or high-skilled ones, increasing inequality. The data underpinning this important observation are quite broad-based, drawn from 40 countries (with a bias towards Europe) over the years 1995–2009, and providing a breakdown of manufacturing employment by three worker types: low skill, medium skill and high skill. Rodrik found that not only was there a steady reduction in manufacturing employment across the cohort, but also that virtually the entire reduction in employment over time comes from the low skill category. At the economy-wide level, however, this trend is not yet clear in many developed countries. The UK's 'Taylor Review',⁴⁷ for example, concludes that wage data in the UK labour market as a whole shows no evidence of 'hollowing out'.

Low income countries are also not yet seeing this kind of effect at an economy-wide level.⁴⁸ When automation affects agricultural production at scale, however, this may change.⁴⁹ UNCTAD⁵⁰ anticipates that automation in developing countries will exacerbate inequality through creating more high-skilled and fewer less-skilled jobs. And it is worth noting that these developments are not, as of now, restricted to high-income OECD countries. China has led investment in, and importation of, industrial robots by a clear margin since 2013.⁵¹

The *institutional fabric of labour markets* is a critical factor in promoting equity. Labour unions' strength in industrial economies has been declining both in terms of workforce participation and strategic leverage for many decades. Automation, and what Avent calls the resulting "abundance of humans", clearly does not help. While narrow labour market effects are significant, perhaps the biggest and broadest impact on inequality comes at the level of political society. The notion that electoral politics functions effectively when politics is 'issues based' and driven by horizontal alliances of class underpins the democratic political cultures of industrialised countries. Losing the historic element of political society built on representative labour institutions clearly leaves a very large hole, with implications for the functionality of the state, democracy and political society.

The *possible erosion of states' tax capacity* by automation and digital technology is both broad-ranging technically and potentially immensely disruptive to conventional state structures and conventional modes of redistribution (the implications will be explored in the next section). Digital technology can erode the state's capacity to generate tax revenue in the following ways:

- *Digital amplification of tax avoidance.* The OECD's project on *Base Erosion and Profit Shifting* is the main global initiative to tackle the growing effectiveness of tax avoidance practices by individuals and firms. These are estimated to cost states as much as US\$240 billion a year on a global scale.⁵² According to the OECD,⁵³ the digital

acceleration amplifies tax avoidance via the following drivers: "an unparalleled reliance on intangible assets, the massive use of data (notably personal data), the widespread adoption of multi-sided business models capturing value from externalities generated by free products, and the difficulty of determining the jurisdiction in which value creation occurs. This raises fundamental questions as to how enterprises in the digital economy add value and make their profits, and how the digital economy relates to the concepts of source and residence or the characterisation of income for tax purposes."

- *Loss of income tax revenue due to automation replacing jobs.* If employment or wages are reduced by automation then a source of reliable and easy to implement tax revenue is also reduced. This has led to a debate about the options for taxing 'robots' as a substitute — possibly as a transitional measure in order to directly finance adaptation costs for workers.⁵⁴
- *Lower tax revenues as digital work-winning platforms increase self-employment.* The UK Parliament's Work and Pensions Committee has noted that the way 'gig economy' platforms enhance self-employment is a factor undermining tax revenues and eroding the welfare state.⁵⁵ There is in theory no reason why self-employment should render less tax than regular employment — but in practice it tends to do so (as in the UK). The global 'gig economy' platforms are clearly going to be very challenging for poor country governments, in terms of the administration needed to track 'gig economy' workers and derive income tax revenue.
- *Transactions in crypto-currencies.* Transacting value through reliable new financial technologies that operate distributed ledgers with shared control (ie blockchain systems such as Bitcoin) potentially takes such transactions outside existing regulatory frameworks of central banks, national legal systems, contract law etc. However, it is not impossible to tax such systems, especially given their embedded provisions for transparency, and some countries are starting to experiment with national variants.⁵⁶ Nevertheless, they are clearly going to raise an entirely new set of challenges, especially for poor countries with relatively weak tax administration systems. Blockchain systems are designed to provide user anonymity, posing an obvious challenge for tax collection.

Automation and the agricultural sector

The issue of automation disrupting agricultural employment is scarcely new. But, given the pace of change and the extraordinary possibilities for a

range of emerging technologies to alter farming, food processing and marketing, the potential impacts on developing countries (where agriculture is a huge portion of the labour force) are significant.

It is important to separate the impacts of communications technologies from robotics and automation. The transformative benefits of digital communications have been apparent for a decade or more through mobile telephony in much of the agrarian South. Enhanced access to news, market or weather information, and ability to communicate with family members at distance, have benefited rural households enormously. The 2016 World Development Report *'Digital Dividends'*³⁰ provides numerous examples. In rural Peru, to give one example, access to mobile phones boosted households' real consumption by 11 per cent between 2004 and 2009, reducing poverty by eight percentage points.

By contrast, robotics' and automation's effects on agricultural households are not yet a consolidated phenomenon. The odd semi-automated hydroponic lettuce factory aside, automation and robotics are not yet having broad impacts on agricultural production systems in most of the developing world. But, given the exponential character of digital change, you would not bet against that becoming reality within a decade. The biggest channel for change may be helping agribusiness to develop production models that work well in environments where such enterprises have tended to fail up to now. That could easily lead to another wave of commercial land acquisitions in developing countries. Such transactions might work out worse for the customary landholders than previous waves if the business models essentially do not require local labour. Businesses that do not need labour lack the incentive to engage with communities and consult with local rights-holders.

It is also inevitable that computerised supply chains will create new conditions for workers, not just in agricultural production but also in marketing and processing. Small informal producers (and processors and marketers) may find changing value chains difficult to join — and at the very least may need help to do so.⁵⁷ It seems likely that these trends will create widespread social and economic change more rapidly than, for example, farm robotics.

Intersecting inequalities

Like any other form of rapid change, the impacts of automation, AI and enhanced ICT will be different for different social groups. Impacts will be specific to

different sectors and forms of technological change. Initially, for example, self-driving vehicle technologies are likely to disadvantage predominantly male workforces in the global North. By contrast, if automation brings industrial garment manufacture back to the North, the workforce affected will be largely female and from the global South. Likewise, digitised call centres using AI and voice recognition software could displace women's jobs — 89 per cent of call centre staff in the Philippines, for example, are female.⁶

Intriguingly, the progress of AI-driven automation undermines the common (if clearly wrong) notion that tasks are remunerated according to their level of difficulty (at least if you assume ease of automation is a proxy for difficulty of the task). A reasonably well-paid job associated extensively with men from the global North (drivers) seems likely to be automated at scale rather earlier than a poorly paid skill largely associated with women from the global South (industrial sewing machinists).

Hunt and Machigura⁵ provide a detailed look at how 'on demand' digital work platforms are affecting domestic labour in South Africa, as well as a broader review of how such platforms affect the sector. They find that these platforms are small at present (supplying less than one per cent of the domestic labour market in South Africa) but growing exponentially, with some companies in India expanding up to 60 per cent month by month. 'Gig economy' platforms have some advantages for workers, including more ability to choose when to work and potentially better remuneration. But all the risks are shifted to the worker (if travel time is more than anticipated, for example, they will lose the 'gig' and still pay their transportation costs). Platforms allow for subtle discrimination by would-be hirers and because the customer 'rating' is so important for the worker's future employment, there is scope for subtle and pernicious exploitation, such as clients expanding the scope of the job without paying more — 'while you are about it, could you just also...'. And workers — classified as self-employed — have no entitlement to sick pay or other protections of formal full-time employment.

Discriminatory behaviour on global digital work platforms may be more complex and nuanced. Workers may be able to disguise characteristics that might otherwise lead to discrimination against them, for example. But it is hard not to conclude that the weaker and more powerless segments of the workforce (such as domestic workers who globally are 80 per cent women and 17 per cent migrants⁵) will be most at risk of deteriorating conditions if national policy does not step in to protect them.

Social policy responses for sustainable development

The issues and potential connections between automation, technological change and inequality rapidly lead to questions of policy and politics. There is nothing inevitable about increasing inequality. But the political and policy frameworks that might emerge to shape different outcomes are not yet clear. Left unchecked, changing labour markets are likely to lead to increasing inequality and insecurity for those without wealth. This section examines a range of policy proposals to meet this challenge.



The major narratives shaping the evolving public debate on automation and rapid technological change have an interesting commonality. Whether by business school academics like Brynjolfsson and McAfee¹⁵ or economists like Aven³ and Ford¹⁷, their proposed solutions are almost all, basically, tax and spend. These authors display a striking lack of confidence in any market-based equalisation that could make the emerging world socially functional. They see state intervention as fundamental to ensuring good social outcomes, but are rather vague about plausible political pathways that could lead to this.

The question of plausible politics to underpin good social outcomes from these processes is discussed in Section 4. The rest of this section will examine a range of proposals for policy change to adapt to changing labour markets that, unchecked, would be likely to lead to increasing inequality and insecurity for those without wealth.

Social transfers and precarious work

The evolving nature of work has clear consequences for how social policy instruments will need to change in order to be effective and politically sustainable in an era of rapid technological change.

The 'Basic Income' family of proposals speaks to a perception of increasingly insecure work or insufficient employment, though its origins can be traced far back.⁵⁸ It is based around the notion of a universal (within a given polity) and unconditional grant to individuals or households that acts as a baseline income. People are free to work and earn whilst receiving this. The principle of universality can be simple (everyone can claim the basic income regardless of economic status) or nuanced (as in the notion of a 'basic income guarantee' — which implies that the option of claiming is universal but only if individuals or households fall below a given level).

It is perhaps best viewed as a social movement, crossing researchers, and civil and political society. There is a strong strand of the libertarian right in its origins, based largely around the notion that it would be cheaper to administer than other social protection options and would offer individuals more autonomy and choice. Basic income is therefore seen as offering a reduced state with a less intrusive presence in people's lives. Notions of liberty and freedom from bureaucratic control remain a powerful theme whether basic income is supported from the right or the left. A degree of conscious and deliberate utopianism underlies much argument for the concept from the political left.⁵⁹

The debate is wide-ranging and any summary is necessarily partial. All the texts that deal with the interface between automation, technological change and the labour market reference the 'Universal Basic

Income' as a significant policy option, whether they are for it⁶⁰ or against it.⁶¹

Guy Standing's work is a useful reference point. He has been both a leading analyst of changes in the world of work and one of the most significant advocates of basic income approaches, since co-founding what is now known as the 'Basic Income Earth Network' in 1989. In *The Precariat*⁶², he makes the case for the basic income on the grounds that it enables citizens to regain 'control of time'. One of the characteristics of precarious, casualised work is that it requires people to spend large amounts of time seeking work, maintaining and upgrading skills and knowledge and networking. The basic income provides enough security to enable retraining and work winning. It can also, Standing argues, provide a basis for social and environmental work, for creative labour and for local democratic participation.

Several pilots of basic income variants are being carried out.⁶² In India, UNICEF and SEWA (the Self-Employed Women's Association) teamed up to carry out an 18-month programme of unconditional basic income in eight villages in Madhya Pradesh starting in 2011. An accompanying randomised control trial assessed a control group of 11 villages where people did not receive income.⁶³ The results demonstrated that the basic income payments improved child nutrition, improved ability to invest in household assets and public goods, accompanied growth in productive work, and raised investment in education, particularly for girls. Poorer groups (tribal villages, women and girls) benefited more than non-poor.

India's influential annual economic survey,⁶⁴ drafted by the government's chief economic adviser, Arvind Subramanian, and published in November 2016, discusses in detail the practicalities of implementing a nationwide Universal Basic Income. The calculations suggest that it is in principle feasible. Modelling the proposal on a payment of US\$113 per year, the report calculates that it could reduce absolute poverty from 22 per cent to less than 0.5 per cent. Assuming that such a scheme would reach 75 per cent of India's population, the report calculates that it would cost roughly five per cent of GDP — a sum which could be found by wrapping up all of India's current 950 public social welfare schemes (many of which are inefficient and poorly targeted subsidies on commodities) and putting the money saved into the Universal Basic Income. India's system of biometric identification cards would facilitate implementation. The report weighs the case against (particularly the concern that a basic income might reduce the incentive to work) as well as the case in favour, and concludes that the issue is "ripe for discussion" if not yet implementation.⁶⁵

The relevant section of the 2016–17 Economic Report ends by asking "what would the Mahatma have done?"

The conclusion is that “on balance he may have given the go ahead... or so one might tentatively infer”.⁶⁶ In practice, the political headwinds would be strong. Aside from the myriad vested interests in India’s subsidy schemes, the budget calculations also assume the Mahatma Gandhi National Rural Employment Guarantee Scheme would be wrapped into the funding envelope. This is a radical and transformational policy experiment that has demonstrated strong results at least in some states (and has established status in national law).

One of the greatest obstacles in moving from ‘tests’ to national scale implementation of basic income models is social policy’s tendency to inertia. Existing schemes are always politically difficult to wrap up — perhaps particularly where they bring major benefits to the non-poor.

One element of the basic income concept that seems radical in rich industrialised countries is now routine and familiar in much of the global South. It is delivering social transfers in ways that do not rule out, criminalise or stigmatise working while receiving social assistance. This restriction still applies in most developed countries to most social security payments. In developing countries, however, for decades workable policy models for social transfers have been rolled out that allow recipients to earn freely on top of the baseline income received. Hanlon and colleagues summarise these in the book *Just Give Money to the Poor: The Development Revolution from the Global South*.⁶⁶

“In Brazil, 18 million households (74 million people, or 39 per cent of the population) benefit from cash transfers – a family grant (Bolsa Familia) or pension. South Africa’s child benefit reaches 8 million children (55 per cent of all children) and a social pension reaches two million older or disabled people (85 per cent of all older people). In Mexico, a family grant (Oportunidades) goes to over five million households (24 million people, or 22 per cent of the population); in the three poorest states it reaches more than half of all families). In Indonesia a grant went to 19 million poor families (40 per cent of the population). In India, over 42 million households benefit from an employment guarantee scheme.”

The initiatives are of different types (conditional transfers, unconditional transfers, employment guarantees) but all have two characteristics which are helpful in an era of insecurity: they do not rule out working to augment income — and therefore co-exist functionally with informal work; and they operate at scale and reach broad swathes of the population, usually on a guarantee or entitlement basis. The fact

that they are well adapted to shifting formal economic relations is not surprising. The vast majority of poor people in developing countries have long lived under ‘gig economy’ conditions, in the shape of what is usually termed the ‘informal sector’. In the short run, building out from these experiences is probably going to be the route that most countries take to adapt social policy as technological change brings further disruption.

Social payments for environmental public goods

Given the likely evaporation of the ‘export-led manufacturing’ pathway to rapid economic growth (see Section 2), poor countries will have to find other strategies for sustainable economic development. Natural capital can provide an answer under some conditions and many poor countries have good endowments. Costa Rica, for example, has used imaginative policy instruments to promote forest regeneration. Following decades of clearance for agriculture and livestock production, Costa Rica implemented protective policies in the 1980s that allowed forests to make a remarkable comeback. Today, Costa Rica is the first tropical country to have stopped and reversed deforestation: over half of its land is covered by forest, compared to just 26 per cent in 1983. At the same time, Costa Rica has seen significant growth in sectors like sustainable tourism and hydropower generation.⁶⁷

While Standing (2011) makes a case for unconditional transfers providing a basis for people to volunteer for collective action that supports environmental public goods, in practice most of the examples demonstrating environmental outcomes (as in the Costa Rica case) involve paying people to undertake environmental work — usually termed ‘payment for ecosystem services’ (PES).

Many programmes balance social and environmental objectives. PES schemes may hope to achieve social benefits and poverty reduction, while some social protection schemes also hope to incentivise labour for local environmental public goods. In practice, combining these goals is often challenging.⁶⁸ Programmes designed to focus on ecosystem benefits, as in Costa Rica, have to target those effectively controlling land management (whether owners or tenant farmers). So they are unlikely to effectively reduce poverty as they are not designed to reach those with few assets. Programmes focusing on providing work to the poorest, on the other hand, may struggle to achieve effective environmental action, due to programme features that maximise social impact but constrain the effectiveness of infrastructural or soil and water conservation works (small scale action, dependence on human labour and focusing on need to provide work in the lean season).

But it is worth noting the scale and impact of some of these programmes. The *Sloping Lands Protection Programme* in China is the largest PES initiative in the world, running from 1999 to 2020 with a total budget of US\$69 billion. It aims at reducing soil and water erosion by converting marginal farmland to forest and grassland, while helping poor households diversify livelihoods and generate higher incomes. The programme claims over 15 million hectares afforested from cropland by 2015, and dramatic improvements in rural incomes of 32 million households through off-farm employment and subsidies.⁶⁹ Other PES-type examples include: the *Payments for Hydrological Services Programme* in Mexico, which has reduced deforestation risk over more than four million hectares, and the *Jakta Conservation Programme* in Bangladesh, which has succeeded in improving the stocks of hilsa, a fish that is important for coastal livelihoods.

Labour-intensive public works schemes have been successfully implemented at scale in some developing countries and generally involve environmental works as part of the range of local public goods to which the labour contributes. The Mahatma Gandhi Rural Employment Guarantee Act in India offers all citizens a notional right to claim 100 days of wage employment, backed by legal provisions. Operating on a national scale, but implemented by states according to the provisions of accompanying legislation, the scheme reaches over 50 million households. A review of evidence to be published shortly suggests that the programme is effective at helping households deal with climate change effects, as well as supporting livelihoods and developing local infrastructure and institutions.⁷⁰ South Africa used its *Expanded Public Works Programme* umbrella to provide 95,000 jobs in the 2015–16 financial year, working on a range of environmental protection programmes. The *Productive Safety Net Programme* in Ethiopia reaches over six million people a year, focusing on food-insecure individuals. Public works include watershed management but the scheme also allows for unconditional transfers for households unable to work during the lean season.

These experiences are remarkable for the scale at which they operate (vastly beyond the pilot level that characterises Universal Basic Income testing up to now) and for their outcomes. They provide a solid basis on which to deploy public payments to preserve and grow natural capital and achieve social ends. Balancing social and environmental objectives is never straightforward. The importance attached to each set of objectives will depend on the political economy context and how well the claimed outcomes play with non-poor political constituencies.

The other limiting feature of the examples provided here is that they are all drawn from countries with

strong implementation capacity (India, China, South Africa, Ethiopia etc.). Many low income or fragile countries do not have strong enough public institutions to take on the models outlined here. Technology can play a role in strengthening the institutional infrastructure. Mobile money creates multiple possibilities for accountable and reliable delivery of payments. This has potentially transformational effects, for example paying women rather than the household heads.⁷¹ Again, at present, the reach of mobile money systems to broad populations is uneven. Kenya's mobile money system, M-PESA, is now used by over 17 million Kenyans, equivalent to more than two thirds of the adult population. Around 25 per cent of the country's gross national product flows through it.⁷² This is by far the leading example globally, and many countries still do not have operational mobile money systems (although they are more common in developing countries than in developed).⁷³

Education and skills

The implications of increasing automation and the digital economy for education systems and skills development are profound. An important dimension of the changing context is that AI applications can perform many tasks in today's labour market up to now performed by professional or white-collar workers (for example, AI programmes are now as good at diagnosing skin cancer as the best human specialists⁷⁴). Workers throughout the labour market, therefore, may need to upgrade their skills regularly throughout their lifetimes to adapt to changing requirements.

At the same time as the requirements of education systems change, the delivery of education will be transformed — with complex implications. Globalised online education delivery will intersect with traditional 'brick infrastructure' public delivery in developing countries, and private providers may fill emerging spaces in ways that are difficult to envisage at this point.

In terms of policy priorities, there are two different but complementary capabilities that education and skills development systems across public and private institutions will need to deliver. There will be a premium on skills and human capabilities that automation complements rather than replaces — social skills, problem-solving, creativity and empathy, for example. This points to a need for high quality general education systems, with a particular focus on the quality of early years education including pre-school.⁷⁵ At the other end of the spectrum, advanced technological skills will be at a premium, even if only among a small segment of the workforce. Between these poles, it will be important to distribute opportunities for skills development equitably by social group and by gender.^{30,76}

Social policy and the issue of tax

All of the above loops back to important questions about the evolution of tax systems under conditions of rapid technological change, given the heavy dependence of most of our social policy models on public spending. Our ability to fund public institutions at the scale we are used to cannot be taken for granted when economic systems suffer rapid disruption. Yet the way we currently ensure equity and fairness in a changing world depends on it. Urgent priorities arise: making sure that national taxation systems continue to work in low

income countries; finding new forms for revenue raising that promote sustainable development (carbon taxes and other 'Pigovian' tax forms⁷⁷ have advantages); and promoting non-tax-based ways to achieve some of the goals outlined here (private, philanthropic or civil society actors can disseminate valuable skills to excluded groups, for example).

The question of who pays, and how, for the costs of ensuring equity and sustainability in an era when familiar institutions and systems are disrupted is critical, particularly for poor people in poor countries, and will be addressed in the final section of this paper.

Rethinking politics for an era of disruption

Both the basis of political aggregation and the means of influence and social mobilisation are changing. The changes are affecting the relationships between capital, citizens, workers, and civil and political society in complex ways. National public institutions' capacity to regulate a range of arenas, including labour markets and political action, is being challenged and the implications for political change are profound.



The possibility that stagnant living standards in industrialised nations, combined with an erosion of working identities, will feed nationalist, nativist politics is widely envisaged in the literature on both inequality³¹ and automation.³ As previously noted, there are many potential linkages between such a direction of political change and a more unequal world. Nationalist, nativist politics could undermine collective action between nations and multilateralism. Among the plausible (and increasingly observable) results are: global challenges such as climate change may not be effectively addressed, and poorest people and countries will suffer most; a reaction against immigration and free movement of labour will diminish the impact of this effective channel for global poverty reduction; trade protectionism, if directed against poorer countries, could reduce economic opportunities; resentment at public spending on foreign aid could reduce resources for poorer countries.

Rodrik¹ also raises the prospect that, without the option of industrialisation, developing countries may be more at risk of “political instability, fragile states and illiberal politics” if they cannot develop labour movements that underpin a coherent politics of class. The erosion of labour institutions (particularly trade unions) has implications for political society, well beyond the domain of labour markets.

Ferguson,⁹ however, notes that the erosion of labour institutions and formal sector jobs does not necessarily erode the strength of norms and beliefs in favour of social justice. Citing how the politics of Southern African countries has evolved alongside non-contributory transfers (of the kind described in Section 3), he argues that a new kind of distributive politics is emerging, involving new forms of claim-making and mobilisation. In both South Africa and Namibia, claims for social transfer systems are often referenced against the need to distribute the countries’ mineral wealth fairly to all citizens.

Standing’s⁸ case for providing a basic income as the foundation of a more generous politics is based on the notion that security enables empathy, solidarity and social engagement. Citing work by Frohlich and Oppenheimer,⁷⁸ he argues “psychological experiments found that those with basic economic security are more altruistic, tolerant and egalitarian than those who are economically insecure, and that group deliberation around related propositions led to even more support for providing people with a guaranteed floor of security.”

The ‘politics of distribution’ that Ferguson⁹ argues for is not without political risks of its own. Social welfare transfers directed on the basis of national or local citizenship can fuel exclusionary and xenophobic politics as much as a desire to exclude non-nationals from labour markets. The growth in non-contributory transfers at scale in many middle income countries

however, alongside other huge redistributive public programmes such as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in India, suggests that there is a space for a viable new politics to emerge with an emphasis on social and environmental justice. Allowing informal work and the informal economy to co-exist with public social transfers is a key lesson that developed countries can learn from the global experience.

Social transfers alone do not seem, however, an adequate answer. On top of social transfer programmes that seek to underpin security for all, we will still need public and private action that supports people to maximise their potentials and to develop work-based identities (even as ‘work’ changes), because these drive engagement in the world. The social interactions on which cohesive communities and social groups are based seem unlikely to happen without work-based relationships of some form.

The politics that has given rise to large-scale social transfer and social guarantee programmes in many developing countries provides a useful pointer to the ways societies can move towards a basic income approach. From the large-scale social transfer programmes of Latin America to the employment guarantee movement in India, a common element of success at scale is a political ‘offer’ based on citizens’ rights or guarantees.⁷⁹ Embedding such approaches in national legal frameworks (as with India’s MGNREGA) enables social guarantees to move from the political fringes to becoming an embedded element of the social contract.

An inclusive politics can be built in the midst of insecurity: the evidence comes from societies where the so-called ‘gig economy’ is nothing new, but has long been the reality for most people. But the politics of change is unlikely to take a single big leap to the utopian world of universal basic incomes. Rather, a new politics of redistribution through social mobilisation will probably be constructed on the basis of citizenship, and through imaginative political leadership that responds to the opportunities created. It may not always be pretty and there will be social risks. Those pursuing the claims have motivation to exclude as well as include.

Engagement with digital media is also profoundly altering the nature of political mobilisation. There has been extensive media coverage of new forms of campaign advertising, enabled by a critical change in Facebook’s policies on data privacy.⁸⁰ Until 2012, Facebook kept advertisements separate from user content and shared little user data with marketers. Following its flotation on the stock market, investors demanded more advertising revenue. Now ads appear in the user’s feed amid media news items and updates from friends. Data sharing enables advertisers (both commercial and political) to target users using

algorithms with varying levels of sophistication. Advertisements are not public, are often not clearly advertisements and are therefore capable of outright deceit. The suggestion has been that this has had a profound influence on a range of elections — some better known than others. Cambridge Analytica, the firm engaged to work for the Trump campaign in the 2016 US presidential election, has a long track record of engagement in political campaigning globally and has reportedly been engaged to act on behalf of a campaign in Kenya's upcoming election.⁸¹

Initial coverage focused on how right-wing nationalist candidates and campaigns use targeted political advertising. However, in recent elections in France and the UK, extensive campaigning on Facebook has appeared to benefit left or centrist campaigns (though there seems to be little way of knowing that, apart from rationalising 'who won' the social media war by the end result).

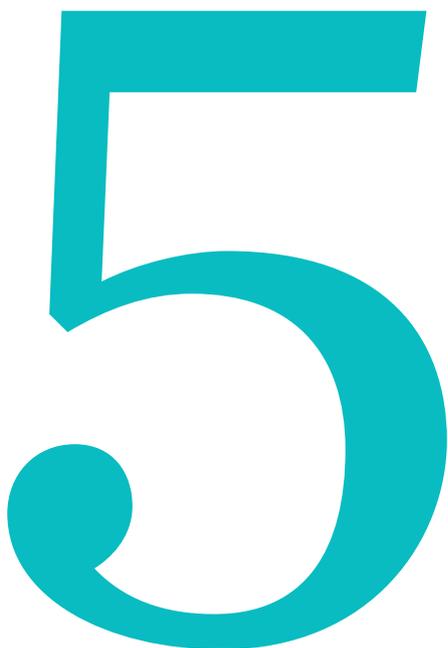
Given the evidence that such campaigning has been effective, at least in some instances, the question is how it might be regulated and governed. National or regional legislation can make a difference. The digital

campaign for 'En Marche' in France's presidential and legislative elections in 2017 is credited with being highly effective. Due to a legislative framework that restricts targeting of individuals (unlike the US), the campaign used voting districts as the unit of analysis and action.⁸² However, much of this kind of work is done on behalf of candidates covertly, paid for by third parties and executed from outside the jurisdiction where the election is taking place. An anonymous 'political operative' interview in the *Financial Times* stated that the only regulator with any de facto power is Facebook itself.⁸⁰

Graham and colleagues⁴ review the options open to digital workers engaged in global service markets for collective action to secure better conditions. They conclude that traditional organisational forms will have limited effectiveness. Perhaps the strongest option they come up with involves mobilising digital action to disrupt the business models of the most abusive online platforms. More work is certainly needed to understand the options for maintaining transparency, accountability and equitable voices in political arenas, from the local to the global.

Towards futures that work

These discussions bring us back to practical policy questions. How will automation and rapid technological change affect development pathways of poor countries? What could countries do to confront a world of exponential technological change? And what can be done to address the risk that rapid disruption in the world of work will lead to increasing inequality?



The evidence suggests that automation will, in time, erode the engine of ‘convergence’ between poorer and richer countries — the low-end export manufacture in countries with abundant cheap labour. This suggests the following priorities: if the context works, industrialise while it is still possible; seek new forms of economic transformation (like access to global services markets); make the most of existing assets (for many poor countries, this will mean the dynamism in the informal economy and large stocks of natural capital); improve development’s distributional pattern (if the pie will grow less fast, how can it be distributed more evenly?); and foster the state’s capacity to watch labour market changes, identify social risks and innovate to deal with them. These are briefly explored below.

Get there while you can

Over the short term (a decade or two?), the export manufacturing route will continue to be viable in some sectors where countries have the right conditions of labour supply and market access. As yet, automated manufacturing is much more challenging for soft materials (eg fabrics) than for plastics or metals. Cheaper labour will retain advantages over heavily automated production for some time in sectors such as textiles and apparel.⁸³ So, despite the challenges ahead, the evidence does not stack up right now for all poor countries to give up on the notion of growth through ‘structural transformation’. Many will be tempted to follow others on the path to middle-income status before ‘the ladder gets pulled up’. Countries will hope wealth levels can be maintained once gained and that an expanded revenue base from a growing formal sector will provide options for dealing with challenges such as climate adaptation.

Improve digital infrastructure

Making internet universal, affordable, open and safe is an obvious priority for the future for developing countries. The World Bank³⁰ offers a framework for strengthening both material and institutional infrastructure. There are multiple potential benefits to getting this right and corresponding risks to weak digital development.

In terms of benefits, the growth of global platforms for services (accountancy, writing, translation etc.) has at least one similar characteristic to the ‘productivity boosting’ effect of export manufacturing: it connects workers in poor countries to consumer markets in richer countries, opening the possibility for improved incomes. Equitable access at every level will matter. If poor women, for example, do not have access to smartphones, then they will not benefit from extensions in the infrastructure for access.⁶

A dynamic digital infrastructure can open many possibilities for expanding access to low-cost, low-carbon energy infrastructure. These include purchaser platforms that enable household energy access (such as M’kopa in Kenya), as well as using enhanced control technologies to efficiently distribute renewable energy through ‘smart’ micro-grids. Providing simple systems that let poor and marginalised people engage with a wider economy — for example, making it easier to have a ‘digital identity’ or easing access to new forms of financial services such as mobile banking — can have transformational impacts. Digital communication systems are already deployed at scale in many vulnerable geographies to help farmers and fishers to manage weather and market dynamics. Using mobile phone information platforms to support enhanced resilience is now routine in development programming and is expanding to numerous other areas (eg watershed management, livestock health). The possibility of using distributed ledger systems (blockchains) to provide supply chain transparency (particularly where certification systems such as fair trade are concerned) could boost rural livelihoods in the longer run.

If poorer countries get left behind in digital development, there are risks of increasingly concentrated power and control — and thereby inequality. However, Kenya, which piloted the key global innovation of mobile money, is a heartening example. It shows developing countries can drive significant digital innovation under the right conditions.

Build on what you have

Natural capital is abundant in many developing countries and can underpin a sustainable development strategy under the right conditions. Costa Rica’s sustained healthy comparative growth rates have drawn substantially on the success story of forest regeneration described in Section 3. This has provided a basis for a thriving market in ecotourism, as well as sustaining ecosystems that provide support for a range of agricultural exports and enhance human wellbeing in numerous ways. Valuing ecosystems correctly in national accounts would provide metrics that incentivise better stewardship of natural capital. For example, taking into account a broader range of benefits than just timber extraction, the contribution of Costa Rica’s forests to GDP should be assessed at two per cent rather than the official figure of 0.2 per cent.⁸⁴ If the full value of forests for local ecosystems and global climate stabilisation were fully remunerated, their contribution to national income would be much greater.

In the absence of rapid formal sector growth (of the kind provided by manufacturing), the alternative for most countries is the informal sector (in what is a very limited dualism). It is important to recognise

that activities generally described as in the informal economy are best seen as ‘unregulated micro-entrepreneurialism’ and can be very dynamic.⁸⁵ Certainly, they tend historically to lack direct access to export markets (unless informally, as in the large amount of agricultural produce that crosses borders unrecorded). By definition, an enterprise exporting legitimately from Africa to Europe is likely to have a high degree of formality. But if we consider the exponential spread of mobile telephony through Africa, for example, it is clear that this depends on a complex hybrid of formal and informal retail networks, particularly kiosks that supply or top-up SIM cards. Formal companies depend on informal retailing at least as much as the retailers depend on the formal telecommunication companies.⁸⁶ And in the future, as global work-winning platforms continue to grow, it is likely that a class of professional service providers will exist in a grey zone between the formal and informal sector. It seems likely that dynamic innovation will depend increasingly in poor countries on formal-informal hybrids. The low level of capital in relation to labour in the bulk of informal sector micro-enterprises also suggests that employment will be quite resistant to automation.

Address inequality

Public action to reduce inequality, or contain rising inequality, in an era of rapid disruption can be divided into three stylised types: pre-distribution (increasing poor people’s assets and so increasing equality of opportunity); distribution within the labour market (measures to shape income opportunities to favour the non-rich); and redistribution (see box to right).⁸⁷ Options in all three areas can be shaped in ways that support sustainable development as well as enhancing inclusion. Technological change could lead to dramatic progress towards a sustainable and inclusive low-carbon future. It could also lead to continuing increases in inequality. The balance will depend on the policy choices taken and the political dynamics that determine them.

A watchful, proactive and innovative state

Modern states have always played a central role in shaping transformative innovations, from the railways to the internet. Mazzucato⁷ stresses that this goes beyond research and development, to supporting ‘patient’ capital for diffusion, as well as shaping demand through regulation. States in advanced economies have not done a particularly good job at protecting those who have seen major social disruptions from rapid technological change. The capacity to keep a watching brief on those who are disadvantaged by technological change (alongside other stressors) will be important. Short-term reactions may mostly take social protection

In summary, the measures needed include:

Pre-distribution

- Active and far-sighted *education* policy that gives future and present workforces marketable skills, and the cognitive and social capacities people will need in rapidly changing labour markets
- Protection for local *rights in land and natural resources* through enhanced land governance and empowerment activities — to enable people with customary land rights to engage with a changing market and increasingly automated agribusiness.

Distribution within the labour market

- Enhancing *digital infrastructure* to give people opportunities to engage with global work platforms, and to provide more people with work-enhancing services (eg affordable renewable energy)
- Maximising opportunities for landholders to earn income from effective land management that provides *ecosystem services*
- Promoting micro-automation innovations (eg drip irrigation, processing technologies) to help smallholder household farming to remain viable in the face of increasingly productive agribusiness
- Supporting smallholder farmers to engage with changing supply chains as buying, processing and distribution is increasingly managed through automated digital platforms
- Labour guarantee/public works schemes that develop local level infrastructure to boost communities’ resilience to climate change (eg by building drainage works) and to protect local natural capital (eg watershed management).⁸⁸

Redistribution

- A range of ‘social transfers’ can deliver the social protection people need to navigate rapid changes in the world of work. At the extreme end are proposals for a universal basic income (discussed in Section 3). Most importantly, social protection should not penalise people for working while claiming if it is to co-exist with casualised, disruptive and informal labour markets. It is worth noting that a range of schemes in southern (predominantly middle income) countries already meet this criterion. The quasi-utopian models of basic income are not the only way to go and there is much solid practice to build on from environments where the ‘gig economy’ is nothing new.

forms. But the ability to shape markets so that innovations enhance livelihoods and empower workers is a potentially more valuable asset.

The taxation challenge

Countries will need to find simple, intuitive ways of implementing taxes that are fair and will be workable in the context of rapid technological change. Many dynamics are reducing nations' potential tax take. These include reduced formal sector employment due to automation (implying reduction in income tax); reduced trade taxes due to transfer mispricing practices by multinational corporations; and rising transactions in crypto-currencies (which are difficult for national institutions to track and tax). A great deal of this can be offset in the short term by diligent work to increase the capacity of national tax authorities in developing countries.⁸⁹ Developing country governments collect much lower proportions of GDP in tax revenue than do governments of OECD countries: 10–20 per cent rather than 30–40 per cent.⁹⁰ Their tax effort indices — revenue collections relative to estimated revenue potentials — are also lower. Experts agree that there is considerable potential to increase tax revenue in developing countries. In the longer term, there would be great advantages to shifting taxation in two directions.

First, there is a strong argument for Pigovian taxes, which are calibrated to disincentivise environmental damage and pollution: carbon taxes being a case in point. Establishing a realistic carbon price on a global scale would be arguably the most effective measure to tackle the climate crisis — which tends to cause the most extreme damage to the poorest countries. Carbon taxes are a strong mechanism.

Second, there is a strong case — particularly in countries with relatively weak administrative capacity — for making much more use of taxes on property and land. Monkam and Moore⁹¹ make the case well. Developing countries are over-dependent on revenues from aid and natural resources, they argue, while bargaining over taxes between states and citizens plays a critical role in building effective, accountable and responsive states across the developed world. Property tax has special characteristics, which make it potentially extraordinarily valuable. It is progressive, unlike consumption taxes. And it offers the potential to construct effective, independent revenue streams for local authorities, thus increasing local autonomy, which in turn has great benefits for building resilience to climate change and other drivers of environmental degradation. Furthermore, it is remarkably fair. As various authors point out, land values in cities are socially constructed. They depend on the vitality and social capital of the city.³ There is a strong case that those who benefit privately from that socially constructed value should make a tax contribution.

Both Pigovian and property taxes also have the advantage of being based on material realities that administrations can easily identify, so they work when crypto-currencies may make financial transactions increasingly difficult to track and identify.

Rich country futures and their implications

Rapid unchecked disruption to communities built on working identities can lead to poisonous, xenophobic and nationalist politics in rich countries — if not countered with effective policies. As argued above, there is a set of ways through which resurgent nationalism in rich countries could damage global equity by: weakening multilateral action on global challenges; undermining support for international development; reducing migration opportunities; and supporting resurgent protectionism. Finding a new politics for rich countries therefore matters too. Developing a green industrial policy that targets employment into areas where old industries are fading is an important future direction. Keeping tax revenues viable, and developing new forms of social policy that support people through painful transitions, are also vital. Developed countries can learn much from the global South on social transfers that support people in insecure 'gig economy' conditions — from the big Latin American cash transfer schemes in particular.

A changing politics

Envisaging a politics that will support an equitable global labour market in a sustainable global economy raises challenges in many geographies and at many levels. Workers' institutions of collective action have underpinned our notions of democratic change and provided some basis for a politics of global solidarity — to the limited extent that has been achieved. If workers become increasingly isolated, and their work increasingly precarious, where will alternatives for a politics of social justice be found? Perhaps mobilisation can already be seen in both the global movement calling for a universal basic income and in the claims for non-contributory social transfers in large parts of the global South. Early ideas and forms of collective action that suit the on-demand 'gig economy' (both global and local variants) are emerging. But however the lines of political aggregation develop, the models of engagement will be very different and will reflect the impact of digital communications on social action.

A policy research agenda

The territory covered in this Issue Paper is broad, and it would be possible to pick out many directions for further work. Understanding how tax systems need to evolve, and the risks and opportunities for green transitions, are both important areas. We will need frameworks for

understanding the transformations described here, and disaggregating their effects by gender, location and social groups.

Emerging impacts on developing countries' rural societies will need to be tracked. For example, will increasingly integrated supply chains increasingly exclude informal producers? Will technologically enhanced agribusiness lead to another wave of commercial land acquisitions? Can smallholder farms be helped to keep pace with changes? How can policy interventions shape a future that does not leave rural

workers behind, while ensuring safe and affordable food for growing urban populations?

For the poorest countries, access to rich country service markets via the global online 'on demand' economy could provide livelihood opportunities and a route to increasing prosperity, if such markets can work in fair ways. Above all, there will be a need to understand and document political change, as both the fault lines and the means for political mobilisation continually transform.

Notes

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3. Avent, R (2016) *The Wealth of Humans: Work, Power and Status in the 21st Century*. St Martin's Press.
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5. Hunt, A and Machingura, F. (2016) A good gig? The rise of on-demand domestic work. ODI, London. www.odi.org/publications/10658-good-gig-rise-demand-domestic-work
6. Faith, B (2017) Automation and the future of work: bringing women into the debate. IDS. www.ids.ac.uk/opinion/automation-and-the-future-of-work-bringing-women-into-the-debate
7. Mazzucato, M (2015) The green entrepreneurial state. In: Scoones *et al.* (eds) *The politics of green transformations*. Routledge.
8. Standing, G (2011) *The Precariat: The New Dangerous Class*. Bloomsbury.
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10. In a review of the literature on technology and the future of work focusing on the US in 2015, the Roosevelt Institute identified some clear fault lines, of which the most striking is between technology optimists (work will survive and improve) and pessimists (humans will be increasingly redundant). They conclude that evidence does not yet show large-scale aggregate, economy-wide job loss. But data does show declining living standards and median wages (also true for other developed countries), and it is reasonable to conclude that technological change has played a role in undermining workplace power of US workers. They conclude that the biggest question for the future in the US is not the number of jobs but their nature.
11. Helpman, E (2016) *Globalization and Wage Inequality*. NBER Working Paper No. 22944.
12. In the UK, for example, the Taylor Review of Modern Working Practices (July 2017, UK gov) indicates that employment is at historic highs and unemployment at historic lows. However, like other advanced economies, median wages and living standards have stagnated, and there is evidence of an increasingly disempowered workforce.
13. For example, World Bank (2016) laments that: "Although there are many individual success stories, the effect of technology on global productivity, expansion of opportunity for the poor and the middle class, and the spread of accountable governance has so far been less than expected" (p2).
14. *Financial Times* (2 December 2016) "Most US manufacturing jobs lost to technology, not trade", quoting research from Brookings (Mireya Solis) and Ball State University arguing that automation is responsible for 85 per cent of the 5.6 million jobs lost in US manufacturing between 2000 and 2010. The same article references the work of the Economic Policy Institute in Washington DC for the view that most jobs were lost to trade (a view it disputes). www.ft.com/content/dec677c0-b7e6-11e6-ba85-95d1533d9a62
15. Brynjolfsson, E and McAfee A (2014) *The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies*. W.W.Norton.
16. *The Economist* (25 February 2017) pronounced the end of Moore's law ('Silicon Crumble'): "The architecture of computing is fragmenting because of the slowing of Moore's law, which until recently guaranteed that the power of computing would double roughly every two years, and because of the rapid rise of cloud computing and AI." However, the article does not give any evidence for the slowing — and is not convincing that the pace of change is slowing — indicating more a fragmentation of technology that makes the simple metric redundant.
17. Ford, M (2015) *The Rise of the Robots: Technology and the Threat of Mass Unemployment*. Basic Books, New York, USA.
18. Acemoglu, D and Restrepo, P (2017) Robots and jobs: evidence from US labour markets. <https://economics.mit.edu/files/12763>
19. See "Robots and Jobs: Evidence from the US", Vox 10 April 2017 (<http://voxeu.org/article/robots-and-jobs-evidence-us>). The article ends: "there is nothing here to support the view that new technologies will make most jobs disappear..."

20. Executive Office of the President of the United States (2016) Artificial Intelligence, Automation, and the Economy. Washington DC, USA.
21. McKinsey Global Institute (2017) Harnessing automation for a future that works. www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works
22. The question of how people will 'work alongside machines' to earn a living and produce value is — like much of the debate — polarised between positive and negative visions. On the one hand a man on a bike responding to an algorithmic set of demands and incentives to deliver takeaway food, on the other hand a woman designer with enhanced productivity working with 3D printing technology. The McKinsey (2017) report argues that occupations where a portion of the workload can be automated are far more common than those which will be susceptible to complete automation in the next 50 years.
23. Frey, CB and Rahbari, E (2016) Do labour-saving technologies spell the death of jobs in the developing world? Report prepared for the 2016 Brookings Blum Round Table. www.brookings.edu/wp-content/uploads/2016/07/Global_20160720_Blum_FreyRahbari.pdf
24. Frey, CB and Osborne, MA (2013) The future of employment: How susceptible are jobs to automation? www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf
25. Oxford Martin School (27 January 2016) Impact of Automation on Developing Countries puts 85% of Jobs at Risk. www.oxfordmartin.ox.ac.uk/news/201601_Technology_at_Work_2; and TECHNOLOGY AT WORK v2.0 The Future Is Not What It Used to Be (2016) Oxford Martin School. www.oxfordmartin.ox.ac.uk/downloads/reports/Citi_GPS_Technology_Work_2.pdf
26. Chandy, L and Seidel, B (2017) How much do we really know about inequality within countries around the world? Adjusting Gini coefficients for missing top incomes. Brookings. www.brookings.edu/opinions/how-much-do-we-really-know-about-inequality-within-countries-around-the-world/
27. In some cases in Latin America the income of the richest survey participant fell short of the local salary of a manager in a medium- to large-sized firm — ie vastly short of a global plutocrat.
28. *The Independent* (16 June 2017) Official estimates of inequality only take into account the money the taxman sees. www.independent.co.uk/news/business/news/global-inequality-worse-richest-poorest-developed-west-tax-evasion-wealthy-panama-switzerland-a7793801.html
29. Lakner, C and Milanovic, B (2013) Global income distribution: from the fall of the Berlin Wall to the great recession. World Bank Policy Research Paper 6719. <https://openknowledge.worldbank.org/handle/10986/16935>
30. World Bank (2016) World Development Report 2016: Digital Dividends. Washington DC, USA. www.worldbank.org/en/publication/wdr2016
31. Milanovic, B (2016) Global Inequality: A New Approach for the Age of Globalisation. Harvard University Press.
32. It is clear that policy makes a difference to within-country inequality. Falling inequality in Latin America in recent decades has been attributed to a range of policy initiatives including cash transfer programmes and minimum wage legislation. But there is no one formula for policy that works in context to curb or reduce inequality.
33. Private wealth was worth about two to three years of national income in France, Germany and Britain in 1950, and rose to between four and six years in 2010 (Piketty, 2014 p26).
34. In principle this effect can be offset by falling interest rates, though in practice rates rarely fall enough for this to happen.
35. Alvaredo, F *et al.* (2016) Global Inequality Dynamics: New findings from WID.world. www.aeaweb.org/conference/2017/preliminary/paper/en6b6859
36. Oxfam (2017) An Economy for the 99%: it's time to build a human economy that benefits everyone, not just the privileged few. www.oxfam.org/sites/www.oxfam.org/files/file_attachments/bp-economy-for-99-percent-160117-en.pdf
37. Of course measurement of wealth has counter-intuitive characteristics. Many people with a very high standard of living have no net wealth at all, due to mortgage or other forms of debt.
38. OECD (2012) Perspectives on Global Development 2012: Social Cohesion in a Shifting World. OECD Publishing. www.oecd.org/site/devpgd2012/49067954.pdf
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40. According to Baldwin (2016), the number of countries that have been able to industrialise effectively is rather limited (what he terms the 'I6' — China, Korea, Indonesia, Poland, India and Thailand captured the bulk of the share of global manufacturing that the G7 countries lost between 1990 and 2010). Much of the kick to growth in many other developing countries was

driven by the huge surge in demand for commodities that accompanied the growth of the rapid industrialisers.

41. Norton, A (20 September 2017) Automation will end the dream of rapid economic growth for poorer countries. *The Guardian*. www.theguardian.com/sustainable-business/2016/sep/20/robots-automation-end-rapid-economic-growth-poorer-countries-africa-asia

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44. Blattman, C and Dercon, S (2016) Occupational choice in early industrializing societies: experimental evidence on the income and health effects of industrial and entrepreneurial work. SSRN. <http://dx.doi.org/10.2139/ssrn.2843595>

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46. There are strong signs that this state of global relations is already emerging. UN Secretary General Antonio Guterres announced on 22 February 2017 that there were four impending famines developing — in Nigeria, South Sudan, Yemen and Somalia. In only one of these (Somalia) was drought a driver. The other three are entirely driven by conflict. Between 2000 and 2016 there has only been one famine — also in Somalia — so the situation of four simultaneous emergent famine crises is unprecedented in this century.

47. UK Government (2017) Good work: the Taylor review of modern working practices. www.gov.uk/government/publications/good-work-the-taylor-review-of-modern-working-practices

48. Maloney, WF and Molina, C (2016) Are automation and trade polarising developing country labour markets too? Policy Research Working Paper 7922. World Bank. <https://openknowledge.worldbank.org/handle/10986/25821>

49. The agricultural sector still accounts for over half the workforce in Africa and South Asia as of 2010. (FAO: www.fao.org/docrep/015/i2490e/i2490e01b.pdf).

50. UNCTAD (2016) Robots and industrialisation in developing countries. Policy Brief No. 50. http://unctad.org/en/PublicationsLibrary/presspb2016d6_en.pdf

51. UNCTAF (2016) anticipates that China will successfully fight the erosion of its comparative

advantage in labour-intensive manufacturing threatened by the ageing of its workshop through heavy investment in robotics.

52. Erik Solheim (10 May 2016) We're losing \$240bn a year to tax avoidance: Who really ends up paying? *The Guardian*.

53. OECD (2014) Public Discussion Draft: BEPS Action 1: Address the Tax Challenges of the Digital Economy.

54. Robert Shiller in "Robotization without taxation?" (Project Syndicate March 22 2017, www.project-syndicate.org/commentary/temporary-robot-tax-finances-adjustment-by-robert-j--shiller-2017-03) makes the case for this proposal (originally floated by MEP Mady Delvaux in May 2016). There are real questions about the feasibility of this proposal, although that applies to many ideas about maintaining an effective tax base in the digital era.

55. *Financial Times* (1 May 2017) MPs slam free-riding 'gig economy' companies. www.ft.com/content/2ee5d986-2da7-11e7-9555-23ef563ecf9a

56. Ward, T (2017) China becomes the first country in the world to test a national crypto-currency. *Futurism*. <https://futurism.com/china-becomes-first-country-in-the-world-to-test-a-national-cryptocurrency-to-test-national-cryptocurrency/>

57. Simon Maxwell, personal communication. June 2017

58. Tom Paine's proposal for capital grants to men at the age of majority in *Agrarian Justice* (1795) is often quoted as the first example of a basic income type proposal. Guy Standing (2011) cites the grant given to citizens of Athens in 403 BC as a token for participation in the polis.

59. As in Standing's appeal for progressive thought to embrace a 'politics of paradise' (2011).

60. Avent (2016) is cautiously supportive, describing basic income as 'promising' if it can be made politically feasible. Ford (2015) supports the notion of a 'basic income guarantee', and extending that to the bulk of the non-rich (although not on a universal principle — he implies means testing and focusing on a broad segment of the population including the middle class).

61. Brynjolfsson and McAfee are broadly sceptical of the basic income approach, concluding that people need work to support a sense of self worth (though this would be contested by advocates of basic income for the simple reason that receiving the transfer does not prevent people working).

62. Among the pilots currently approved or in implementation in OECD countries are examples in Ontario, Canada and Finland (www.thestar.com/news/gta/2017/03/16/pilot-project-to-introduce-a-basic-income-in-ontario-gets-strong-public-support.html;

- www.theguardian.com/society/2017/feb/19/basic-income-finland-low-wages-fewer-jobs.
63. SEWA Badhan (2014) A little more, how much it is... Piloting basic income transfers in Madhya Pradesh, India. SEWA Bharat, UNICEF. <http://sewabharat.org/wp-content/uploads/2015/07/Report-on-Unconditional-Cash-Transfer-Pilot-Project-in-Madhya-Pradesh.pdf>
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69. Ina Porras, personal communication. See also: Porras, I (2016) Policy workshop: Conditional transfers for poverty reduction and ecosystem management. Event Report. IIED, London. <http://pubs.iied.org/pdfs/16633IIED.pdf>
70. Agrawal, A, Rockowitz, D, Vikas, M, Kaur, N, Steinbach, D (forthcoming) Social Protection Programs and Climate Resilience: A Meta-Analysis. IIED, London.
71. World Bank Research Group *et al.* (2014) The opportunities of digital payments. A report to the G20 Global Partnership for Financial Inclusion. http://siteresources.worldbank.org/EXTGLOBALFIN/Resources/8519638-1332259343991/G20_Report_Final_Digital_payments.pdf
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77. Pigovian taxes are targeted on the 'polluter pays' principle, carbon tax being an example. They bring a double benefit of enhancing environmental health and sustainability and being practical to collect under conditions of technological change, as the point of taxation (like property taxes) is rooted in the material world — you can find it and it is not generally hard to identify the polluter.
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86. I am grateful to Alejandro Guarin, IIED for this observation.
87. This typology builds on a conversation with the chair of IIED's Board, Rebeca Grynspan, Secretary General of SEGIB (the Ibero-American SG).
88. Agrawal *et al.* (2017) forthcoming describe these impacts in detail for a range of social protection programmes with a focus on the huge Mahatma Ghandi National Rural Employment Guarantee Scheme in India.
89. Mascagni *et al.* (2014) note that the governments of developing countries collect much lower proportions of their GDPs in tax revenue than do the governments of the OECD countries: 10–20 per cent rather than 30–40 per cent. Their tax effort indices — revenue collections relative to estimated revenue potentials — are also lower than those of the OECD countries. Experts agree that there is considerable potential to increase tax revenue in developing countries.
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This paper examines the relationship between rapid technological change, inequality and sustainable development. It asks how development processes can be shaped to provide decent, sustainable and inclusive work opportunities in low income developing countries. In discussing this policy challenge, the paper seeks to stimulate thought and debate among a broad audience of researchers, civil society organisations and public practitioners.

IIED is a policy and action research organisation. We promote sustainable development to improve livelihoods and protect the environments on which these livelihoods are built. We specialise in linking local priorities to global challenges. IIED is based in London and works in Africa, Asia, Latin America, the Middle East and the Pacific, with some of the world's most vulnerable people. We work with them to strengthen their voice in the decision-making arenas that affect them — from village councils to international conventions.



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