Automation, digitalization and the future of work: A critical review

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Abstract

Purpose – The study aims to provide a critical review of the extent to which digital technologies are likely to replace human labour, the exponential rise in the amount of work to be done and how far distinctively human skills are future-proofed and therefore likely to be in short supply. It reviews the evidence for a permanent switch to home and remote working enabled by emerging technologies. It assesses the business, digital and labour strategies of work organisations and the promise and challenges from a dominant trend towards a digitally enabled flexible labour model.

Design/methodology/approach – A critical review of 1020 plus case studies and the extant literature was carried out.

Findings – The relationship between emerging technologies and work is widely misunderstood, and there are major qualifiers to the idea of an overwhelming tsunami of technology drastically reducing headcounts globally. Distinctive human skills remain valuable, the amount of work to be done is increasing exponentially and automation is becoming more a coping than a labour replacement mechanism. Moves to a hybrid digitalised flexible labour model are promising but not if short-term, and if the challenges they represent are not managed well.

Research limitations/implications – The main limitation is that we are making projections into the future, though we are drawing on a lot of different sources and evidence and past data projected into the future.

Practical implications – The problem is not labour displacement but large skills shortages that will slow down the speed of technology adoption. Skills development is vital, as is the taking of long-term perspectives towards the management of hybrid, flexible working based on human-machine interactions.

Social implications – Organisations need to revitalise their training and development and labour management models. Governments and intermediary institutions need to manage transition states if the skills required to gain economic growth are to be available, and to ensure that large labour pools do not get bypassed from not having requisite skills.

Originality/value – The study offers a more subtle and complex perspective on the emerging evidence about the future of technology and work.

Keywords Future of work, Digital transformation, Automation

Paper type Research paper

Introduction

There have been long-term fears of massive job loss globally from accelerating automation and digitalisation of work. Recently, we have seen transitions towards remote and home working induced by the Covid-19 pandemic. During 2022, a "great resignation" occurred, where many people in the developed economies were giving up work and not taking up new employment. Meanwhile, across 2023, organisations in the major economies regularly reported staffing and skills shortages even in the face of conditions of deflated economic growth. Building on this complex picture, during 2023, there was renewed interest in major labour and technology questions, especially taking into consideration the global attention being given to a new wave of artificial intelligence in the form of ChatGPT and generative AI.

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Would new advanced technologies, harnessed to improve productivity and cut costs, finally lead to large-scale job loss? How could skills shortages be ameliorated? Would extending the labour market ever further, virtually and globally, remedy labour problems? What policies towards different forms of labour would be optimal? In this critical review, we find evidence-based answers to these questions, and point to both an emerging way forward – a digitalised flexible labour model – and its inherent challenges. Taking the period to 2030, we investigate, first, the extent to which digital technologies are likely to replace human labour, the exponential rise in the amount of work to be done and how far distinctively human skills are future-proofed, and therefore likely to be in short supply. The evidence is then assessed for a permanent switch to home and remote working enabled by emerging technologies. The paper then assesses the technology and labour strategies of work organisations and points to the promise and challenges presented by a dominant trend towards a digitally enabled flexible labour model that is heavily dependent on new technologies, contractual arrangements and external labour.

The Willcocks thesis: automation does not mean job apocalypse

Since 2016, my research work has supported the view that automation and AI does not mean the end of jobs for human workers. My thesis suggests eight major qualifiers to that proposition. As I have pointed out many times, the misplaced notion of a jobs "robo-apocalypse" has steered the future of work debate for a very long time (Willcocks, 2020a). I use the terms "robo-apocalypse" here to refer to the thesis that automation will be rapid and overwhelming in its global impact, in particular leading to massive net job loss. Looking at the big picture, it is not easy to pick your way through the media representations of the debate. Sources and multiple studies are, in fact, very variable in quality, evidence and rigour. Media narratives appear to polarise around two storylines – hype and fear. "Hype" tells us that it is largely going to be fine, and most of us are going to live in a well-run technologised world – let us call it "automatopia" – with more than enough goods, services and leisure. Meanwhile, the other, "fear" vision of "robo-apocalypse" is essentially dystopian. This polarised narrative also assumes quick and pervasive adoption of the technology, but sees it as displacing a huge number of physical and cognitive-based jobs across industries, geographies and at most levels in the organisation.

Unsurprisingly, so-called artificial intelligence (AI) as job killer has been the focus of disproportionate media attention. It is, in my view, a story too good to be false. Unfortunately, an anchor study by Frey and Osborne (2013) is still used to support this narrative, with the often-quoted headline figure of 47% of US jobs highly automatable. However, in that study, the researchers did not try to specify the speed of technology development, nor a time period for the loss of jobs. They do not attempt to predict the number of jobs lost, nor how many jobs would be created through automation. The study also does not look at the key bottleneck of how commercially feasible, viable and organisationally adoptable the emerging technologies would be, that is, the long road to diffusion of innovation dilemma is ignored. These self-confessed omissions are all but factored out in media representations of the findings.

The media have also been slow to pick up on later studies richer in data, and more fine-tuned in their analysis. For example, Forrester Research (2017) suggested robots would take 24.7 million US jobs, but create 14.9 million new jobs by 2027, leading to a net loss of 9.8 million jobs, about 7% of the US workforce. An OECD study by Arntz, Gregory, and Zierahn (2016) suggested that 9% of US individuals faced high job automatability, and, on average, 9% of OECD jobs (UK 10%) would become highly automated within a decade.

By 2019, the picture of high job loss had changed dramatically, though not necessarily in the headlines. The World Economic Forum (2020), for 2018–2022, found automation replacing 0.98 million jobs, while creating 1.74 million new ones. The Asian Development

Bank (2018) came out as positive on net job creation from automation. Price Waterhouse Coopers (2017) estimated that the net job effect of automation in the UK in the period 2017–2037 would be a slight gain of 168,000 jobs (7.176 million created, 7.008 million displaced). MGI (2018a, b) suggested that: "*overall, the adoption of AI may not have a significant impact on net employment in the long term. . . Our average global scenario suggests that total full-time equivalent employment may remain flat at best compared with today*" (pages 44 and 45).

Then, Covid-19 was meant to see a wave of job-killing automation. But by end of 2023, there was little evidence of this. In practice, OECD countries generally were experiencing an abnormally large number of unfulfilled vacancies, even as near recessionary conditions loomed. The rate of decline in the supposedly more easily automatable jobs actually slowed during the pandemic. In mid-2023, *The Economist* was reporting that in the previous decade the average rich-world unemployment rate had halved, and the share of working-age people in employment was at an all-time high. Countries with the highest rates of automation and robotics, such as Japan, South Korea and Singapore, had the least unemployment. *The Economist* calculated that if more than 50% of jobs were automated or jobs were eliminated as they were automated, this could mean a net loss of 15% of US jobs. But this, *The Economist* suggested, was unlikely to happen, as historically job destruction happens far more slowly (The Economist, 2023; see also Willcocks, 2020a).

What is startling here is that as time has gone by, the estimates for net job loss from automation have been disappearing to the point of being negligible – though of course, the net figures mask considerable disruption and skills shifts. There have to be serious qualifications to the robo-apocalypse and job loss narrative.

In a comprehensive review, Willcocks (2020a) showed that many assumptions embedded in the robo-apocalypse narrative are highly questionable: that automation creates few jobs short or long term; that whole jobs can be automated; that the technology is perfectible; that organisations can seamlessly and quickly deploy AI; that humans are machines that can be replicated; that it is politically, socially and economically feasible to apply these technologies. Then there are the macro factors. With ageing populations, productivity gaps and skills shortages predicted across many G20 countries, the danger might be too little, rather than too much labour. Thus there are eight major qualifiers to the proposition that automation will lead to massive net job loss. Ironically, far from taking over, automation will be, most likely, just helping organisations to cope.

Finally, let us return to the issue of speed of adoption of these technologies. The most recent studies suggest that the pandemic and ensuing economic crisis will accelerate automation and digitalisation. However, this does not mean that the eight qualifiers outlined in Willcocks (2020a) suddenly become redundant. In particular, the third qualifier (technology is never a fire-and-forget missile), the fourth qualifier (technology is never that perfectible) and the fifth qualifier (distinctive human strengths are needed at work) present considerable challenges to those embarking on accelerated digital and automation programmes. Somewhere among these is a much under-rated factor – the limited organisational capacity to change, adopt and institutionalise digital technologies. In practice, organisations have a great deal of information technology legacy and are also heavily siloed. In research into over 400 organisations, Willcocks, Hindle, Stanton, and Smith (2023) found all too many enterprises lagging behind their automation intentions due to some or all eight inhibiting siloes – structure, process, data, technology, culture, managerial mindsets, strategy and skill sets.

As digital transformation efforts have demonstrated over the last 10 years, this is a difficult series of challenges to navigate, at a time when many organisations have declining absorptive capacity to innovate and do something new, in any major way. Moreover, after the pandemic, many organisations will have to return to the basics – re-establish finances,

recover customers, refresh products and services, re-engage the workforce. For many, this will distract them from big investments in technology for some time to come. McKinsey and Company (2020) surveyed major clients and found them suggesting that COVID-19 had accelerated digitalisation on a number of fronts – notably remote working, migrating assets to the cloud, data security, responding to changing customer expectations and demand for online purchasing and services and more advanced technology use in operations and decision-making. A majority were convinced that remote working, online purchasing and changed customer expectations were the most likely to persist after the pandemic. Our own research suggests that only about 20% of enterprises lead in digital transformation. Indeed, these are likely to move even faster, not least because they have a better starting point, the experience and usually the better financial performances to do so. But this means that some 80% of organisations are not, and probably will not be, great performers on digital transformation (Willcocks, 2021; Willcocks *et al.*, 2023). All this is likely to slow job loss (and gain) from automation and digitalisation, and slow skill changes as well.

Hidden in plain sight: the amount of work to be done

Willcocks (2020a) and Willcocks *et al.* (2023) reinforce immensely this contention by identifying a critical factor neglected by all previous studies. Despite assumptions, and hidden in plain sight, the amount of work to be done is not remaining stable; it is growing across sectors, year on year, dramatically and inexorably. Work intensification would seem to have been increasing, especially since the financial crisis of 2008. Organisations have sought to increase productivity and the amount of work done by "sweating the assets" and attempting to do more with less using the same labour base and partly through applying digital technologies. This phenomenon is very under-researched. However, some studies are indicative.

Thus, Felstead, Gallie, Green, and Inanc (2013) found that the percentage of UK jobs needing hard work moved from 31.5% in 1992 to 45.3% in 2012 (Felstead *et al.*, 2013). Since 2006, the speed of work has quickened, and the pressures of working to tight deadlines have also risen to record highs. Korunka and Kubicek (2017) collected a range of research papers recording work intensification over the last ten years across several economies. In our own research, we very frequently found that, apart from the many other benefits, a major reason for automation was a range of stakeholders experiencing a rising tide of work to be done (Lacity & Willcocks, 2017, 2018; Lacity, Willcocks, & Gozman, 2021; Willcocks & Lacity, 2016; Willcocks, Hindle, & Lacity, 2019). The limits to working smarter and of high-performance practices were being tested, and the practices often found wanting. ServiceNow's 2017 multi-country survey found 70% of some 1,874 corporate respondents registering that the pace of work grew by at least 10% in 2016; nearly half said it grew by 20% or more (Service Now, 2017). It found that by 2018, 46% of companies were going to need greater automation to handle the volume of tasks being generated. By 2020, without more automation, 86% of organisations believed they would reach their break point soon, and dealing with the volume of work would no longer be sustainable.

But where is this dramatic increase in the amount of work coming from? Almost all studies to date routinely leave out three key factors. Willcocks *et al.* (2023) suggest that, combined, these factors probably account for as much as a 10–12% annual growth in the amount of work to be done, depending on sector and country.

The exponential data explosion. Service Now (2017) found, for example, that nearly 80% of respondents reported that data from mobile devices and the Internet of Things were accelerating the pace of work. Some estimates suggest that 90% of the world's digital data that we try to process were created in the last two years, and that the amount of digital data grows by 50% a year. Ganz, Reinzel, and Rydning (2017) estimated that by 2025, there would

be ten times the data generated in 2016. Even if these are only ball park figures, they still raise the fundamental question: how are we going to collect, store, process, analyse and use data arriving in such colossal volumes? It implies a massive explosion of work, especially as data seem to create more data. Maybe we really do need more automation just to cope.

Cross-sectoral growth of audit, regulation and bureaucracy, amplified by the data explosion and the application of modern information and communication technologies. We have been creating, we would argue, a veritable witches brew of data, technology and bureaucracy. Graeber (2015, 2018) had been one of the few to pinpoint the importance of this development for the future of both work and the capitalist system itself (Graeber, 2015, 2018). But even he probably understated the degree to which audit and regulation inevitably accompany high levels of distrust, the likelihood of market failure and increased demands for transparency. Such work may not be seen as particularly productive, but it is dramatically increasing across government agencies, business sectors and economies almost everywhere. The Economist (2023) adds to the picture by pointing out that generative AI could act as a drain on productivity, being able to generate objections and counter-arguments to, for example, planning applications, in minutes. In an AI-heavy world, lawyers and legal actions are likely to multiply. Also most of the jobs at risk from AI are in heavily regulated sectors, often with much state involvement such as education, healthcare, housing and policing. One can envisage multiple ways in which audit, regulation and bureaucracy could slow down productivity, enhancing impacts of automation, and indeed how automation could enhance the ability to extend audit, regulation and bureaucracy even further, thus creating more work.

Technology: both solution and problem. A third source of more work is technology's double-edged capacity to provide solutions that also create additional problems. If you create more data, that then is the work-creating problem of how to process, store, analyse and then use it. Then, there are unanticipated work-making consequences. For example, the Internet has created cybersecurity issues. The cost of cyberattacks was estimated at $445 billion in 2013, and continued to rise dramatically to beyond $600 billion into 2018. This has led to further technology solutions, of course, with the cybersecurity market being $75 billion in 2015, and also growing much faster since then to reach $US 223.7 billion in 2023 and potentially $US 338.84 billion in 2027 at a CAGR of 10.9% (Research & Markets, 2023) [1]. As another example, concerns about fake news through social media had, by 2019, led to Facebook employing fact checkers in 20 countries.

There is also increasing evidence for the addictive properties of mobile devices, games, the Internet, email and related technologies and applications (see, for example, Alter, 2017; Aiken, 2016). Much has been made of the productivity enhancing the potential of these and "AI" technologies. But such technologies are often deliberately designed to support multitasking and constant interruption at considerable cost to real productivity at work.

The emerging evidence is that task switching, being constantly interrupted and multi-tasking result in substantial performance costs. For peak performance, the goal should be sustained, focused and singular attention. But the modern worker is all too easily distracted from task performance by irrelevant information and suffers interruption by attempting to pursue simultaneous multiple goals, aided and abetted by technologies such as email, social media, the Internet and mobile devices. These distractions and interruptions can come from outside or be self-generated.

Modern technologies also allow a worker to easily elide work and non-work, while ostensibly at work. A CareerBuilder survey found the smartphone, the Internet, social media and email amongst are the five most cited workplace disrupters and productivity killers [2]. A 2018 Udemy survey found a third of Generation Z employees admitting to using their smartphones for personal activities up to 2 hours in a work day [3].

Alter (2017) cites studies showing that 70% of office emails are read within six seconds of arriving. This is hugely disruptive; on one estimate, it can take up to 25 minutes to become re-

immersed in an interrupted task. Gazzaley and Rosen (2016) found that multi-tasking and task switching incur notable performance costs in disengaging from a task, focusing on the new task, then disengaging and re-entering the original work. A pre-smartphone study they cite found that when office workers are interrupted as often as eleven times an hour, it cost the USA $558 billion a year in lost productivity. Wajcman and Rose (2011) found workers spending only half their day on actual "work episodes", with two thirds of interruptions self-generated and most involving a mediated communication through a technological device. Meanwhile, most workers have access to email and other communications networks, and about 45% of the world's population own a mobile phone (Gazzaley and Rosen, 2016).

In these ways, more technology is undoubtedly having complex, even contradictory, effects, including a significant, if largely unresearched, adverse impact on productivity and on the time required to accomplish work tasks. While more technology is the frequently touted answer to personal, social and business problems, we can find ourselves on an endless treadmill of technological solutions and the new problems they also generate.

The changing skills base

Recent research, by the author and others, suggests that dramatic skills shifts and shortages will be the most impactful challenges to productivity, technology adoption and economic growth through to 2030.

The dominant trend emerging from recent research is shown in Figure 1 (Willcocks, 2021; Willcocks *et al.*, 2023). There will be a move away from low skills – physical, repetitive, non-technical, non-cognitive basic human skills – towards digital, technical cognitive, distinctively human, medium/high skills. On several estimates, low-skilled workers will go from 44% to 32% of the global workforce in the 2019–2030 period. By the early 2020s, the global labour force probably had 95 million surplus low-skilled workers, but a 90 million shortage in medium-/high-skilled workers (Willcocks *et al.*, 2023).

These major skills gaps will widen without government, corporate and individual intervention, and it is fairly obvious that the inequality divides arising from automation and digitalisation will require labour market institutional changes. An overlooked aspect is that if

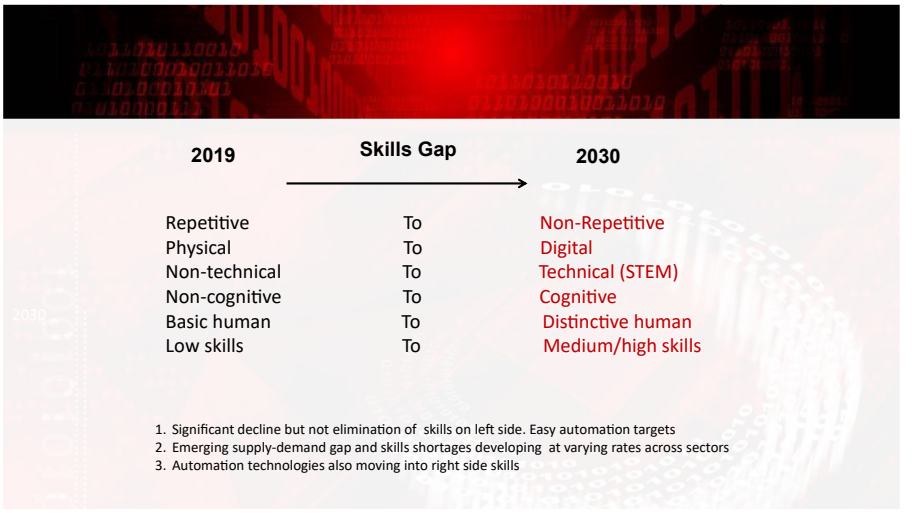


Figure 1.
The skills demand shift, 2019–2030

Source(s): Author

the requisite skills to support and complement automation and new technologies are not forthcoming, the much touted technological changes will be further delayed.

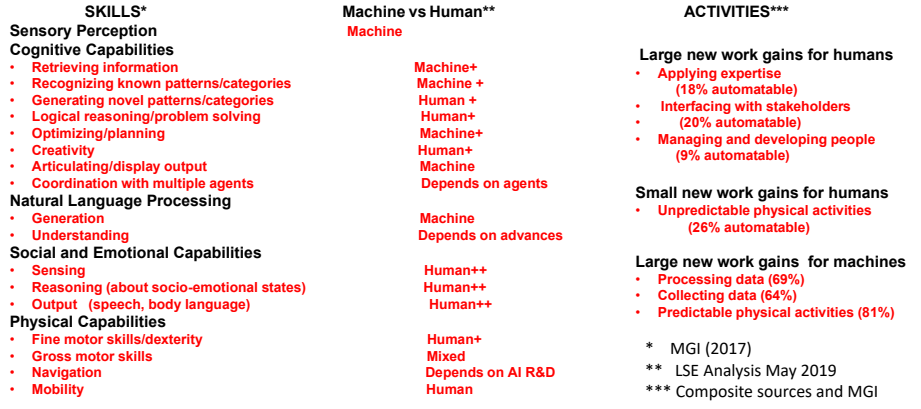
An under-appreciated factor remains how limited the applicability of the technology might be. The analysis here builds upon the work of MGI (2017), Lacity and Willcocks (2018), Willcocks, 2021) and composite sources. MGI identified 18 generic sets of skills used in the workplace (see Figure 2).

Looking ahead to 2030, it is likely that some eight skill sets will remain as largely human capabilities in the workplace, three are dependent on choices or technological advances and some seven skill sets are automatable (though that does not mean they will be). Distinctively human skills like empathy, team-building, leadership, critical thinking, imagination are both valuable in work organisations and exceedingly difficult to replicate or replace. Looking at Figure 2, over the next 10 years, there will probably be large and small gains for human work in some areas, and some large, new work gains for machines. This would suggest that the Frey and Osborne (2013, 2017) study, together with Frey (2019), has considerably overestimated the automatability of jobs and work to be done, at least for the 2019–2030 period.

The digitally enabled flexible labour organisation

How to makes sense of all these complex trends? How have employers been responding? According to an MIT/Deloitte 2021 report, a pre-Covid and, we find, continuing trend is "workforce eco-systems" – trying to find multiple sources of internal and external skills by using various contractual arrangements, global markets and reward systems, and by forming communities of connected and interdependent workforces and organisations. Not only are organisations placing significant value on gaining ideas and skills from contributors who do not work for the organisation, they intend to rely increasingly on external participants and draw on online platforms to secure talent (Altman *et al.*, 2021).

However, this approach has been insufficiently conceptualised and needs a lot more detail if it is to be represented as a strategic approach. Research at the LSE together with Knowledge Capital Partners shows most organisations are adopting key elements of a "core-peripheries" model for organising labour, though they tend to do this on an ad-hoc basis, mainly in response to short-term factors (Willcocks, 2023a). These include labour shortages, need to keep costs low and attempts to harness digital technologies productively, for example to support home working during the recent pandemic. Willcocks (2023b) found some 65% of



Source(s): Author

Figure 2.
Automatable and human work skills, 2019–30

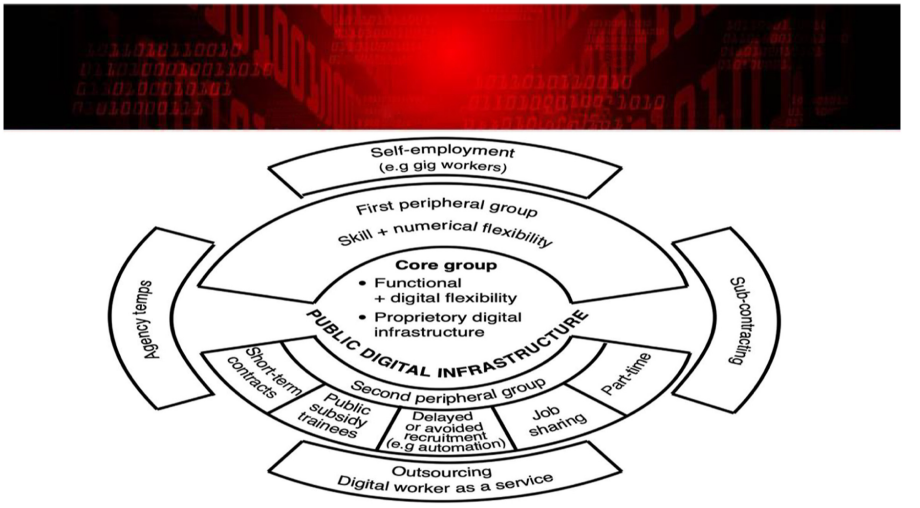
organisations surveyed in January 2023 adopting short-term tactical approaches to digital investments, either "sweating the assets" in order to focus on cash flow, customer retention and cost cutting, or investing limitedly in digital technologies to "underpin today's business". Some 35% of organisations had longer-term plans for digital investments and developing their business strategies, though over half of these were delaying strategy in order to respond to 2023 economic conditions.

This is useful background for framing how different enterprises are following a major trend towards the digitalised flexible labour organisation (see Figure 3).

As long ago as 1984, John Atkinson posited a core/periphery model to provide an organisation with functional, numerical and financial flexibility. With the addition of much more enabling technology, the model is uncannily representative of how businesses and government agencies intend to utilise labour over the next two decades (Atkinson, 1984; Willcocks, 2021). Overall, we will, in the author's view, see accelerating, more strategic moves towards what has already been done on this in the last 35 years.

The overall objective is to achieve responsiveness and agility through creating three types of flexibility – *functional, numerical and financial.* The core workers represent the key skills, and are viewed as long-stay employees with favourable terms and conditions in exchange for which they will be functionally flexible, supported by training, development and new technologies. The first peripheral group may also be full-time or part-time but do less key work and tend to have less good terms and conditions.

Then there are multiple, other, more transactional relationships as the organisation draws on agency workers, sub-contractors, outsourcing firms, self-employed workers, including the technologically enabled "open talent" economy and "ghost workers" making high, medium and/or low skills available globally depending on requirement, on more or less favourable labour contracts (see Gray & Sun, 2019; Winsor & Paik, 2024). These relationships give some functional flexibility, but mainly numerical and financial flexibility. In recent years, digital technologies have given three more types of flexibility – *locational* (think remote working), *temporal* (think 24 × 7) and *labour replacement/enhancement* flexibility (through automation and online "robo-sourcing".



Source(s): Author; Willcocks (2023), extended from Atkinson (1986)

Figure 3.
The digitalised flexible labour organisation

This means there will continue to be core full-time primary, internal workers who are integral to the functionality of the organisation. These will be functionally flexible and difficult to replace, due to high-level skills, knowledge and experience. These workers will have a big say in the degree to which they move to remote working, and how digital technologies will be utilised in their work. Meanwhile, there will be different types of peripheral workers. One (first peripheral) group will be low skilled, often part-time and flexible. A second peripheral group will experience a mix of short-term contracting, being public subsidy trainees, job sharing or be part-time. Another group will comprise large volumes of agency staff, self-employed, outsourcing vendor staff and subcontractors. We can already see many such external market-based workers operating in traditional functions such as cleaning and catering, but also in the gig economy and remote work contracting. Although not direct employees of the organisation, they are important to its functioning. However, these and the first and second peripheral groups of workers have little bargaining power, not least over whether technology will be controlling, "informating" or displacing in their workplaces. Where it makes economic sense to the organisation, managers will use remote working as the cheapest, optimal alternative for harnessing these "peripheral" and market-based labour pools. In so doing, managers will have to take into account some real challenges – on modes of control, security issues, motivational challenges and also corporate social responsibility concerns.

A side note on home and remote working in this model. Working from home is a subset of remote working – working potentially from any location. Will remote working become the dominant mode, as many have suggested? Not surprisingly, we have seen a rising uptake in both remote and home working over the last 10 years, not least because of improvements in enabling technologies. MGI (2020b) noted that the potential for remote work is highly concentrated in a handful of sectors, such as information and technology, finance and insurance and management, and executives surveyed from those sectors show greater intent to deploy their employees remotely. But the study also pointed out that more than 60% of workers in the US economy, for example, cannot work remotely, particularly blue-collar workers, but many "knowledge workers" as well. Their jobs require at least some physical presence. In less developed economies, the share of workers unable to work remotely is even higher. There is also the role of executive decision. McKinsey found some support for allowing a minority of workers to work remotely for two days a week post Covid-19, but from late 2022 across 2023, many executives became more cautious about the challenges and economics, and productivity implications of managing home and remote working. (Forsdick, 2022; McKinsey, 2023).

Clearly home and remote working fit easily into the model represented in Figure 3, but question marks are increasingly being raised about the productivity of virtual working. Apart from distractions and social conditions at home, several studies showed that virtual communication could curb ideas generation, and that firm-wide remote work caused the collaboration network of workers to become more static and siloed, with fewer bridges between disparate parts. Furthermore, there was a decrease in synchronous communication and an increase in asynchronous communication. Together, these effects made it harder for employees to acquire and share new information across the network (Brucks & Levav, 2022; Yang *et al.*, 2022). After the necessary remote working during the pandemic years, Forsdick (2022) found that less attractive economic conditions raised concerns over remote worker productivity, and restricting home working became a symptom of executives re-asserting control. McKinsey (2023) estimated that 20–25% of workforces in advanced economies could work from home in the range of three to five days a week (which would be four times more remote work than pre-Covid-19). But not all work that can be done remotely should be, for example, negotiations, brainstorming and giving sensitive feedback. This supports the broader point that Brown and Duguid (2017) make about the social life of information – that we have to look beyond mere information to the social context that creates and gives meaning to it.

Remote working is not just a practical but also an economic and social issue. We already know that the net productivity from remote working has proven to be quite strong and is likely to be even better if done at greater scale. However, there is the chance that quite a lot of work will be included that is not suitable for remote working, and there may be some fallout when unanticipated costs arise. This is where social and cultural factors kick in. These can be societal (acceptable norms, social legislation), organisational (applicable to which kinds of workers, impact on culture, does work need more interpersonal contact) or individual (worker preferences, type of job, home situation) level. In the author's view, post-pandemic, economic factors are likely to win out, at least for a while, but remote working will only greatly accelerate if the social factors are fully supportive (Willcocks, 2020b). The following will be two key issues: Is it more productive? And does it cost less? One then has to add in some critical moderating social factors, for example, specific employee circumstances, social responsibility and legislation issues, childcare arrangements and impact on the firm's wider culture.

Challenges and ways forward

So the challenges of home and remote working do add in some wrinkles into the story of the digitalised flexible labour model. But there are some bigger issues inherent in this way of managing work, people and technology. Thus, a 2021 study reported that over three quarters of respondents were not sufficiently prepared to manage a workforce consisting mainly of external participants. Our ongoing research (Willcocks *et al.*, 2023) is more granular and is discovering emerging, unanticipated challenges.

(1) If the model is assembled through a series of short-term responses, sooner rather than later, organisations "run out of road". There needs to be a strategic intent to look after the sustainability of the business over a moving five-year time horizon.

(2) Core workers are key as they carry the culture, core skills and provide vital agility in today's volatile, uncertain environment. However, there are signs that the model in practice is eroding organisational cultures, and also that not only employees do not behave as core workers – too often they seek to leave the organisation in search of career progression – but also employers do not treat their employees as core – thus the renewed emphasis during 2023 on employee experience to right this trend.

(3) The peripheral arrangements tend to be transactional and contractual in character – this does not breed key cultural values amongst these workers. Furthermore, as we found when looking at outsourcing, the management and transaction costs of operating contractually can be surprisingly high.

(4) The model needs to be operated as a strategic approach to labour utilisation, with a core group responsible for ensuring that both core and peripheral workers are properly treated and trained to do the tasks allocated to them. There are indications that HR functions are not up to this task in most organisations. If not, then it is definitely an area to be worked on.

(5) Does this mode of operating respond sufficiently to skills shortages? Clearly, it makes labour utilisation more flexible, and can draw on a wider, even global talent base. It can also harness the expanding possibilities of automating work, human-machine work design and cloud-sourcing a digital workforce. In the best versions, core workers will receive substantial training and development. But old habits of cutting training budgets first die hard, especially when the organisation is struggling, or at least acting early to lower costs, protect the balance sheet and spending more on resilience, for example in cybersecurity and supply chains. Historically, "peripheral"

> workers have been left to fend much more for themselves, while "the war for talent" has been less about training and development, and much more about competitive hoovering up skills at the market price. That tends to create winners and losers, not skills surpluses.

There are some constructive ways forward. One view amongst our research respondents is that retaining and building the core workforce has to be the priority target. There has to be strategic clarity around that objective. One part is defining a core worker in the light of strategy and changing contexts. This is, in practice, by no means easy to do if organisations do not have great clarity about their purpose, operating model and values. And our recent research suggests that all too many lack such clarity (Willcocks *et al.*, 2023).

Internal labour markets and high-velocity horizontal fast-tracks can do much to encourage and develop core workforce members. This was a big practice amongst major Japanese companies in the 1980s, when they were at the height of their success.

There is a lot of evidence that organising into small cross-functional teams and being given discretion on how to achieve measurable goals and performance are productive uses of core labour, and indeed some other peripheral workforce members.

Peripheral workers need to be drawn closer into the main organisation and its culture. For example, adopting across the organisation principles of economic integrity, societal equity and environmental integrity and fair reward might help here. One of the important findings on remote workers is that they experience work-home interference, poor communication procrastination and loneliness. Closer monitoring and intensifying the work load tend to undermine rather than make such workers more productive. Meanwhile, much more social support, including some 1–2 days in the work office, seems to have the most beneficial effects.

These are just some observations. Dramatic skills shifts require major actions and interventions by governments, educational systems, businesses and workers themselves, sustained over time. But how the flexible labour organisation is managed will have a lot of consequences for labour attraction, retention, building the skills base, the utilisation of technology and the levels of productivity achieved.

Research directions

This paper has put forward a review of the existing research to suggest where the technologies are leading, and what their work and skills impacts, and management implications, could be to 2030. But in an age of fast history, and uncertain, volatile business environments, the judgements made can only be provisional. Future research needs to continually revisit what emerging technologies are likely, for example 5G, quantum computing, generative AI, their speed of deployment and their likely impact on organisations and labour markets. Fortunately, a range of pertinent macro studies are regularly produced by academics, research arms of management consultancies, technology companies and banks (e.g. McKinsey, Infosys, Asian Development Bank), national governments and global institutions (e.g. World Economic Forum, OECD, the World Bank. However, their findings need to be critiqued and synthesised as they regularly use different methods and databases and exhibit different levels of research rigour.

Secondly, the Willcocks thesis that there are eight qualifiers to the assumption that automation and digital technologies will be deployed rapidly with massive impact on how work is done, job numbers and skills needs to be continually re-tested. A part of this is whether these eight qualifiers will be equally influential into the future. Also, whether other factors are emerging that might accelerate or slow the pace of technological change. It is also possible that the thesis only applies to early phases of technology adoption, and that a middle period will see much faster deployment as the technology "crosses the chasm". Research here could proceed by looking at the possibility that there are stages of growth for emerging

technologies. One could see researchers looking at each technology/application, for example generative AI, and plotting the likely growth path, and then seeing whether such a growth path was common, or not, for all emerging digital technologies.

Thirdly, this paper has suggested a novel thesis that virtually nearly every study predicting large-scale job loss as a result of the adoption of digital technologies assumes that the amount of work to be done remains stable. This paper has argued, based on the exponential growth of data, the increases in audit, regulation and bureaucracy, and the challenges these digital technologies are creating (e.g. cybersecurity, generative AI and intellectual property issues), that, in fact, the amount of work to be done globally increases annually by at least 10–12%, depending on the sector. Future research could usefully find the evidence for whether this is a valid conclusion, going forward, and if so, what difference making this assumption would make to the statistics regularly being produced on the future of technology and work.

Fourthly, there has been a long-standing conflation conceptually between the impacts of automation (robotic process automation, cognitive, intelligent automation, AI) and the impacts of other emerging technologies, for example, social media, digital fabrication, Internet of Things, augmented reality and blockchain. Further confusion arises where increasingly these technologies are being combined. Conceptual confusion does not help understanding or research efforts. Future research could helpfully carry out more disaggregated studies so that the impacts of each technology, and technologies in combination, are actually having.

Fifthly, this paper has put forward an emerging digitalised flexible organisation model which will shape how technologies are adopted, shape organisations and interact with the future of tasks, skills and job types. This paper has also challenged the potential effectiveness of this model as a mode of management. Future research could usefully investigate the applicability of the model – is this really happening in this way? Research will also be needed to verify whether the posited challenges actually emerge, and whether the model is an effective way of managing future organisations effectively.

Conclusion

On a broader front, Willcocks (2020d) aimed to provide the evidence that, beyond the "hype-fear" polarisation in media headlines and passing also into some academic studies, a much more complex and nuanced set of changes were underway under the headings of automation and "AI". Following Willcocks, Oshri, and Kotlarsky (2024), the paper suggests eight major qualifiers to the notion that automation will be rapid and global in impact, and will result in massive net job loss. The qualifiers are:

(1) Tasks and activities in jobs will be automated, rather than whole jobs.

(2) Many studies predicting job losses ignore job creation from automation.

(3) Organisations choosing automation technologies experience many development, implementation and use challenges.

(4) Automation technologies are never born perfect.

(5) Distinctive human skills and strengths remain necessary for many work-based activities.

(6) Ageing populations and lower birthrates impact adversely the workforce available.

(7) There are existing and predicted skills and productivity shortfalls.

(8) There are and will continue to be exponential increases in the amount of work to be done.

On the last point, we conclude that there may well be, from now to 2030, an exponential annual growth of 10–12% in the amount of work to be done, depending on sector and country. The growth arises from dealing with the exponential growth in data, increases in audit, regulation and bureaucracy, and from the challenges digital technologies bring with them.

One such challenge is the dramatic skills shifts required with digital technologies, not least to support their development and operation. But one conclusion here is that though the shift will be towards more cognitive, digital, non-repetitive kinds of tasks, distinctive human skills will continue to be valuable in the workplace.

Looking at the future leveraging of technology and labour, we conclude that, either for short term or strategic reasons, managers are moving towards adopting a digitalised flexible labour model that utilises the flexibilities of labour and technology using a core-periphery for of organising. We predict that managers enacting such a model will encounter at least five major challenges they need to deal with for the model to be truly productive.

Overall, the conclusion is that we need to move on from the rhetoric and reality of "robo-apocalypse". Willcocks (2020a) suggested that "robo-apocalypse" was neither likely, cancelled nor postponed, but a misdirected narrative framing. Robot myths form a persistent way of thinking about anxieties and machines very relevant to our rising dependence on information and communication technologies. From this perspective, it is interesting that automation as robotics and the automation of knowledge work have been conflated throughout the debate with the much bigger phenomenon of digitalisation, involving at least ten sets of major digital technologies. Robots represent a narrative, symbol and repository for our anxieties, fears and hopes when it comes to relating to our self-created machines (Willcocks, 2020c). As the technology becomes more virtual, opaque and less visible, so humans feel the need to make sense of the machines by rendering them in physical form. This appears to be a deep-set, human psychological need, not easily circumvented or substituted for. In the author's view, it is misleading to think in this way, and dangerous to allow such beliefs to inform policies. Covid-19 has clarified that there are much bigger anxieties to be had concerning the future of work, to which technology may contribute, but also help reduce.

The practical implications of this paper are that we should be focusing not on job loss but on the dramatic skills shifts needed in the next few years if the major economies are to exploit the potential of emerging technologies and improve on the likely serious shortfalls in productivity and economic growth. This has also training implications for governments, educational institutions, corporations and also for individual personal development and life-long learning. The paper has also suggested that while organisations tend to be moving in the direction of deploying a digitalised flexible labour model to take advantage of the flexibilities that emerging technologies can offer, they would be wise to deal with five inherent challenges if the model is applied as a series of short-term fixes, rather than in a strategic manner.

Notes

1. Bank of America Merrill Lynch report detailed in Cybersecurity Investing News, 9th September 2015. Other figures from composite news sources. As another example, concerns about fake news through social media have led to Facebook employing fact checkers in 20 countries.
2. Chad Brooks in Business News Daily, 16th April 2015.
3. David Shimkus in HR Technologist.com downloaded 6th April 2018.

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