



The Fourth Industrial Revolution

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global economy would return to its previous high-growth pattern was widespread. But this has not happened. The global economy seems to be stuck at a growth rate lower than the post-war average – about 3-3.5% a year.

Some economists have raised the possibility of a “centennial slump” and talk about “secular stagnation”, a term coined during the Great Depression by Alvin Hansen, and recently brought back in vogue by economists Larry Summers and Paul Krugman. “Secular stagnation” describes a situation of persistent shortfalls of demand, which cannot be overcome even with near-zero interest rates. Although this idea is disputed among academics, it has momentous implications. If true, it suggests that global GDP growth could decline even further. We can imagine an extreme scenario in which annual global GDP growth falls to 2%, which would mean that it would take 36 years for global GDP to double.

There are many explanations for slower global growth today, ranging from capital misallocation to over indebtedness to shifting demographics and so on. I will address two of them, ageing and productivity, as both are particularly interwoven with technological progress.

Ageing

The world’s population is forecast to expand from 7.2 billion today to 8 billion by 2030 and 9 billion by 2050. This should lead to an increase in aggregate demand. But there is another powerful demographic trend: ageing. The conventional wisdom is that ageing primarily affects rich countries in the West. This is not the case, however. Birth rates are falling below replacement levels in many regions of the world – not only in Europe, where the decline began, but also in most of South America and the Caribbean, much of Asia including China and southern India, and even some countries in the Middle East and North Africa such as Lebanon, Morocco and Iran.

Ageing is an economic challenge because unless retirement ages are drastically increased so that older members of society can continue to contribute to the workforce (an economic imperative that has many economic benefits), the working-age population falls at the same time as the percentage of dependent elders increases. As the population ages and there

What evidence supports this and what does it tell us about what lies ahead? The early signs point to a wave of labour-substitutive innovation across multiple industries and job categories which will likely happen in the coming decades.

Labour substitution

Many different categories of work, particularly those that involve mechanically repetitive and precise manual labour, have already been automated. Many others will follow, as computing power continues to grow exponentially. Sooner than most anticipate, the work of professions as different as lawyers, financial analysts, doctors, journalists, accountants, insurance underwriters or librarians may be partly or completely automated.

So far, the evidence is this: The fourth industrial revolution seems to be creating fewer jobs in new industries than previous revolutions. According to an estimate from the Oxford Martin Programme on Technology and Employment, only 0.5% of the US workforce is employed in industries that did not exist at the turn of the century, a far lower percentage than the approximately 8% of new jobs created in new industries during the 1980s and the 4.5% of new jobs created during the 1990s. This is corroborated by a recent US Economic Census, which sheds some interesting light on the relationship between technology and unemployment. It shows that innovations in information and other disruptive technologies tend to raise productivity by replacing existing workers, rather than creating new products needing more labour to produce them.

Two researchers from the Oxford Martin School, economist Carl Benedikt Frey and machine learning expert Michael Osborne, have quantified the potential effect of technological innovation on unemployment by ranking 702 different professions according to their probability of being automated, from the least susceptible to the risk of automation (“0” corresponding to no risk at all) to those that are the most susceptible to the risk (“1” corresponding to a certain risk of the job being replaced by a computer of some sort).²³ In Table 2 below, I highlight certain professions that are most likely to be automated, and those least likely.

This research concludes that about 47% of total employment in the US is at risk, perhaps over the next decade or two, characterized by a much broader

scope of job destruction at a much faster pace than labour market shifts experienced in previous industrial revolutions. In addition, the trend is towards greater polarization in the labour market. Employment will grow in high-income cognitive and creative jobs and low-income manual occupations, but it will greatly diminish for middle-income routine and repetitive jobs.

is a well-worn development pathway, allowing countries to accumulate capital, transfer technology and raise incomes. If this pathway closes, many countries will have to rethink their models and strategies of industrialization. Whether and how developing economies can leverage the opportunities of the fourth industrial revolution is a matter of profound importance to the world; it is essential that further research and thinking be undertaken to understand, develop and adapt the strategies required.

The danger is that the fourth industrial revolution would mean that a winner-takes-all dynamic plays out between countries as well as within them. This would further increase social tensions and conflicts, and create a less cohesive, more volatile world, particularly given that people are today much more aware of and sensitive to social injustices and the discrepancies in living conditions between different countries. Unless public- and private-sector leaders assure citizens that they are executing credible strategies to improve peoples' lives, social unrest, mass migration, and violent extremism could intensify, thus creating risks for countries at all stages of development. It is crucial that people are secure in the belief that they can engage in meaningful work to support themselves and their families, but what happens if there is insufficient demand for labour, or if the skills available no longer match the demand?

3.1.3 The Nature of Work

The emergence of a world where the dominant work paradigm is a series of transactions between a worker and a company more than an enduring relationship was described by Daniel Pink 15 years ago in his book *Free Agent Nation*.²⁶ This trend has been greatly accelerated by technological innovation.

Today, the on-demand economy is fundamentally altering our relationship with work and the social fabric in which it is embedded. More employers are using the "human cloud" to get things done. Professional activities are dissected into precise assignments and discrete projects and then thrown into a virtual cloud of aspiring workers located anywhere in the world. This is the new on-demand economy, where providers of labour are no longer employees in the traditional sense but rather independent workers who perform specific tasks. As Arun Sundararajan, professor at the Stern School

of Business at New York University (NYU), put it in a *New York Times* column by journalist Farhad Manjoo: “We may end up with a future in which a fraction of the workforce will do a portfolio of things to generate an income – you could be an Uber driver, an Instacart shopper, an Airbnb host and a Taskrabbit”.²⁷

The advantages for companies and particularly fast-growing start-ups in the digital economy are clear. As human cloud platforms classify workers as self-employed, they are – for the moment – free of the requirement to pay minimum wages, employer taxes and social benefits. As explained by Daniel Callaghan, chief executive of MBA & Company in the UK, in a *Financial Times* article: “You can now get whoever you want, whenever you want, exactly how you want it. And because they’re not employees you don’t have to deal with employment hassles and regulations.”²⁸

For the people who are in the cloud, the main advantages reside in the freedom (to work or not) and the unrivalled mobility that they enjoy by belonging to a global virtual network. Some independent workers see this as offering the ideal combination of a lot of freedom, less stress and greater job satisfaction. Although the human cloud is in its infancy, there is already substantial anecdotal evidence that it entails silent offshoring (silent because human cloud platforms are not listed and do not have to disclose their data).

Is this the beginning of a new and flexible work revolution that will empower any individual who has an internet connection and that will eliminate the shortage of skills? Or will it trigger the onset of an inexorable race to the bottom in a world of unregulated virtual sweatshops? If the result is the latter – a world of the precariat, a social class of workers who move from task to task to make ends meet while suffering a loss of labour rights, bargaining rights and job security – would this create a potent source of social unrest and political instability? Finally, could the development of the human cloud merely accelerate the automation of human jobs?

The challenge we face is to come up with new forms of social and employment contracts that suit the changing workforce and the evolving nature of work. We must limit the downside of the human cloud in terms of possible exploitation, while neither curtailing the growth of the labour market nor preventing people from working in the manner they choose. If we

ethics.

New frontiers in global security

As stressed several times in this book, we only have a limited sense of the ultimate potential of new technologies and what lies ahead. This is no less the case in the realm of international and domestic security. For each innovation we can think of, there will be a positive application and a possible dark side. While neurotechnologies such as neuroprosthetics are already employed to solve medical problems, in future they could be applied to military purposes. Computer systems attached to brain tissue could enable a paralysed patient to control a robotic arm or leg. The same technology could be used to direct a bionic pilot or soldier. Brain devices designed to treat the conditions of Alzheimer's disease could be implanted in soldiers to erase memories or create new ones. "It's not a question of if non-state actors will use some form of neuroscientific techniques or technologies, but when, and which ones they'll use," reckons James Giordano, a neuroethicist at Georgetown University Medical Center, "**The brain is the next battlespace.**"⁵¹

The availability and, at times, the unregulated nature of many of these innovations have a further important implication. Current trends suggest a rapid and massive democratization of the capacity to inflict damage on a very large scale, something previously limited to governments and very sophisticated organizations. From 3D-printed weapons to genetic engineering in home laboratories, destructive tools across a range of emerging technologies are becoming more readily available. And with the fusion of technologies, a key theme of this book, unpredictable dynamics inherently surface, challenging existing legal and ethical frameworks.

Towards a more secure world

In the face of these challenges, how do we persuade people to take the security threats from emerging technologies seriously? Even more importantly, can we engender cooperation between the public and private sectors on the global scale to mitigate these threats?

Over the second half of the last century, the fear of nuclear warfare gradually gave way to the relative stability of mutually assured destruction

Shift 17: The Sharing Economy

The tipping point: Globally more trips/journeys via car sharing than in private cars

By 2025: 67% of respondents expected this tipping point to have occurred

The common understanding of this phenomenon is the usually technology-enabled ability for entities (individuals or organizations) to share the use of a physical good/asset, or share/provide a service, at a level that was not nearly as efficient or perhaps even possible before. This sharing of goods or services is commonly possible through online marketplaces, mobile apps/location services or other technology-enabled platforms. These have reduced the transaction costs and friction in the system to a point where it is an economic gain for all involved, divided in much finer increments.

Well-known examples of the sharing economy exist in the transportation sector. Zipcar provides one method for people to share use of a vehicle for shorter periods of time and more reasonably than traditional rental car companies. RelayRides provides a platform to locate and borrow someone's personal vehicle for a period of time. Uber and Lyft provide much more efficient "taxi-like" services from individuals, but aggregated through a service, enabled by location services and accessed through mobile apps. In addition, they are available at a moment's notice.

The sharing economy has any number of ingredients, characteristics or descriptors: technology enabled, preference for access over ownership, peer to peer, sharing of personal assets (versus corporate assets), ease of access, increased social interaction, collaborative consumption and openly shared user feedback (resulting in increased trust). Not all are present in every "sharing economy" transaction.

Positive impacts

- Increased access to tools and other useful physical resources
- Better environmental outcomes (less production and fewer assets required)
- More personal services available
- Increased ability to live off cash flow (with less need for savings to be able to afford use of assets)
- Better asset utilization
- Less opportunity for long-term abuse of trust because of direct and public feedback loops
- Creation of secondary economies (Uber drivers delivering goods or food)

Negative impacts

- Less resilience after a job loss (because of less savings)
- More contract / task-based labour (versus typically more stable long-term employment)
- Decreased ability to measure this potentially grey economy
- More opportunity for short-term abuse of trust
- Less investment capital available in the system

Unknown, or cuts both ways

- Changed property and asset ownership
- More subscription models
- Less savings
- Lack of clarity on what "wealth" and "well off" mean