

The Fourth Industrial Revolution and the Government of the Future: Taking Stock of the Big Picture

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During the 2016 World Economic Forum in Davos, Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, observed:

Previous industrial revolutions liberated humankind from animal power, made mass production possible and brought digital capabilities to billions of people. This fourth industrial revolution is, however, fundamentally different. It is characterized by a range of new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human (Schwab 2016).

The fourth industrial revolution is upon us via the imminent rise of artificial intelligence, the robotization of economies and everyday life, the use of 3D printing, the dominance of big data and of the web of things, as well as resulting from major breakthroughs in the field of biogenetics. These developments hold great promise to make life better for everyone and to generate new wealth. However, they also bring along major concerns about transformations in human activity. This research note focuses on government in light of this dawning industrial revolution.

Given that this industrial revolution would generate profound political, economic and social changes, and that many of these are imminent: how are governments to prepare, manage, and respond to the developments associated with the fourth industrial revolution? Additionally, what will the government of the future look like, how will it fulfill its core functions – broadly defined as, to act for the public good – and, what will be its role in forging pathways into the next era? In regards to the public sector, what sort of impact will these developments have upon the way it is organized and how it functions? What will all of these changes mean for government, governance and the concept of democracy? This research note provides a preliminary assessment of some of the major issues for governments to consider as they approach this next paradigm shift. The proposed analysis does not pretend to be exhaustive; rather, this research note focuses on some of the existing or looming core challenges facing government. This research note asserts that governments have a responsibility to structure the discourse and development surrounding the fourth industrial revolution, while acknowledging that the notion of governance itself is also going to be subject to transformation. Politicians and the public service need to begin serious deliberations about the future role of government. This research note does not attempt to predict the government of the future, nor is it a full-fledged exercise in foresight. Instead, this analysis is concerned with three core areas that should dominate government thinking at this early stage. The first consideration relates to the fourth industrial revolution's impact on the

economy, especially on changes in the labour force. The second consideration refers to the organization of the public service since changes in the economy will not bypass governments' own labour force. The third major consideration are the ethics of these developments. We use the homecare policy field to exemplify an instance where the merits to both sides of the human-robot debate are relatively easy to accept, and where ethical issues already have to be considered. We suggest throughout that governments need to act proactively to structure and guide transformations relating to the fourth industrial revolution so that developments take place in a manner reflecting and respecting the dignity of citizens. If governments are too passive, the fourth industrial revolution may end up benefiting the few to the detriment of the majority.

Of primary concern to governments is how to react to robot and artificial intelligence replacing people across spheres of human activity. With machines that can process and communicate large amounts of data in less time than it takes to blink, the role of humans might be reduced significantly; these robots and machines imbued with artificial intelligence are, even, likely to raise questions about our own humanness. In order to deal with such issues, governments are likely to need overarching values and norms that go beyond currently existing ethical codes of behaviours and that can be used as reference for future decisions to minimize overt political or economic biases. From this standpoint, governments may want to consider the elaboration of a new code specifically geared to addressing robot and artificial intelligence-human interaction for policymaking purposes. The details of such a code are beyond the scope of this research note, but the issue is worth considering when addressing ways by which governments can be ready at the onset of the fourth industrial revolution. The development of this code will be difficult, especially considering the fact that we lack knowledge of the full extent of what to expect from the fourth industrial revolution. The benefits, however, are that it can constructively guide change in a manner that promotes the best interests of citizens, without undermining future possible creative endeavors.

This research note will remain general in its scope, and largely focus on the experience of developed countries; it is the result of a literature review that includes the academic literature, 'grey' literature, and the popular press.

A Few Words on the Fourth Industrial Revolution

This section seeks to provide a succinct overview of the fourth industrial revolution, and considers existing and possible upcoming impacts. Governments may find it useful to make use of foresight to help identify some of the major trends associated with this shift, and identify the opportunities and challenges ahead.

The seeds of the fourth industrial revolution have already been sowed. They are seen by major transformations across spheres of human activities; scientific breakthroughs and discoveries in the fields of artificial intelligence, robotics, 3D printing, big data, the web of things, and biogenetics. These developments bring science fiction to life. To depict these advancements, previously figments of imagination, examples such as the use of artificial intelligence for e-commerce, come to mind. Additionally, self-driving cars have gone beyond the prototype phase, much of farm work has been robotized, and big data is dominating many fields (e.g. healthcare). The arrival of 4K technology is the first step towards the creation of virtual reality; biogenetics still holds great potential for the treatment of major diseases. The developments implied by this fourth industrial revolution are already showing various effects on our lives and they are likely to occur at a much faster pace going forward.

How different is this industrial revolution from the previous three? Could it not be argued that industrialization and the growth of cities represented as big a change as what we now face? There was tremendous economic displacement associated with industrialization, yet it generated countless new economic opportunities. For observers of the fourth industrial revolution, there is, in fact, something fundamentally different this time around. The development of artificial intelligence and of robotics could render humans obsolete in the long-run (Kaplan 2015). The foreseeable future is likely to be more chaotic, but 'Machine intelligence is already having a major effect on the value of work – and for major segments of the population, human value is now being set by the cost of equivalent machine intelligence (Davidow 2014). Colvin (2015) in *Humans are Underrated* goes against the grain to suggest that the people who will succeed in the new economy will be those with a high capacity for empathy, and that robots will have a hard time replacing human to human interaction. Whatever the case may be, the fourth industrial revolution will likely raise questions about the very nature of our humanness and purpose for our existence.

The fourth industrial revolution provides opportunities and threats to our way of life. The benefits are potentially numerous, and in many cases unknown since they will be the result of forthcoming advances in science and technology. However, the changes implied will not necessarily be linear in that they are just extensions or improvements upon whatever currently exists. Furthermore, the pace of change is even harder to predict, short of the assumption that it would be at an ever-increasing rate as artificial intelligence takes up a greater role in enabling and enhancing change. There is also the possibility, not explored in this research note, that the new technologies are going to be used, abused, and adapted by political fanatics, terrorists, or criminal organizations. Additionally, the possibility also exists that government itself will use these new technologies towards impinging on the natural right of citizens. There are foresight scholars for whom the future is undoubtedly gloomy, and do not hesitate to talk of the 'mega-crisis' (Halal and Marien 2011). Even computer scientists like Jerry Kaplan (2015) who are optimistic about human progress admit that the transition is likely to be tumultuous. Though the scope and pace of change are debatable, there is little doubt that governments are soon going to have to grapple with some very serious challenges.

Governments should start to think about the impacts of the fourth industrial revolution sooner rather than later. They should work to identify the major trends that are likely to affect political, economic, and social developments in the years ahead. Foresight is the traditional instrument used to refer to possible futures. The objective of foresight is not to predict the future; rather, it is to use social science methods to identify alternative futures, and enact change to move towards a desirable image of the future. Governments already use foresight, but practices vary from country to country (Roberge 2013). There are arrays of political factors that impede the use of foresight, and make it difficult for governments to seriously debate and discuss futures. Additionally, foresight itself has limitations that impede its usefulness; the overwhelming and largely unfathomable nature of these potential and highly varied changes makes the use of foresight difficult, yet necessary to ascertain possible comprehensive changes.

As this new era begins, governments need not plan for a dramatic new future. Rather, they need to ask the 'big questions' to begin and structure the debate now, so that as issues arise they have a clear understanding of how society expects them to respond. The quintessential examples are those from the sharing economy like Uber or Airbnb, and the threat they pose upon the taxi and hotel industries by being able to avoid a lot of red tape imposed upon these sectors by government. Despite their respective launches years ago, many governments are still struggling to find appropriate responses to

these new business models. As further developments of the kind occur, governments need to be better prepared to have rapid responses that reflect society's preferences, while accounting for the costs and possible drawbacks of the restructuring. Taking years to deliberate upon and to respond to emerging situations becomes less and less viable as these rapid developments increase in pace and number. These earlier examples, though extremely noisy, are of a fairly modest scale if some of the boldest predictions related to the fourth industrial revolution are to come to fruition. Governments tend to be myopic when looking to the future, in part, because many do not possess the requisite policy capacity, or the imagination for this kind of deep policy work. Part of the solution may be for governments to look back through history and identify the decision-making patterns that propelled policy in a manner suitable for society, government legitimacy, and development through prior industrial revolutions. Through analysis of patterns, criteria can be identified and extrapolated for the future. Those criteria could be used as axioms for the decisions faced by governments when conducting futures exercises. Identifying these founding axioms may be the key to guiding policy creation, and responding to impending changes likely to disturb existing sectors of the economy, or moral norms of society. As with many stories of development and progression, governments may well have to analyse and understand their historical role in order to gain clarity about the present or even begin to consider the future and how best to perform the policy work relating to the emergence of unfathomable technologies that can eventually replace people and call our humanness into question.

The fourth industrial revolution holds potential for significant transformational change across sectors of society. Governments cannot let the conversation unfold in a forum where those at the fringes have no voice. For that reason, governments have a crucial role to play in structuring the debate and in ensuring that all segments of society are represented fairly, especially since changes are likely to profoundly affect the way all citizens live. Governments should be at the frontier, not to simply respond to developments post-hoc. They should be defining the boundaries, setting limits so the private sector does not set the tone via technological innovations that are to leave public authorities in a bind. Private sector actors need to be involved in forthcoming debates, but public values have to be at the forefront of considerations. Through foresight, and other tools as necessary, governments have to identify trends in order to determine where and how they ought to intervene to manage upcoming developments.

Below, we analyse three areas identified as requiring rapid governmental attention.

Government Challenges: The Economy and the Labour Force

The fourth industrial revolution is to bring about significant economic transformations, potential changes in the workforce and in labour practices, for which governments will need to account. These circumstances will give rise to both opportunities for generating new wealth, and risks related to rising inequality, due to the use of artificial intelligence and the robotization of labour on a scale unseen in history. Governments need to give serious thoughts to what a robotized economy is to resemble.

With rapid developments in technology, it is clear that there will be significant impacts on the economy, on the labour force, and on the ways people work within various sectors of activities. The concept of the demographic time bomb, which has now been debated for years, suggests that as the population ages, there is not going to be enough workers to sustain high economic growth. Countries may even experience labour shortages. Chan (2016), in an article for *The Telegraph*, relays traditional concerns about the ageing demographics of developed countries. She concludes her article by stating:

'Demographic decline in advanced economies is one of the biggest challenges facing the world this century, and solutions will take at least a generation. But without change, countries may find themselves sleepwalking into a new reality of permanently lower growth and higher debt.' (Chan 2016). Due to increased productivity, the fourth industrial revolution likely turns this problem on its head – there may well be more workers than available and necessary work for humans to perform; there will be serious fiscal pressures on governments, likely more challenging than that which are expected as part of the demographic time bomb argument. We come back to the issue of public finance below. Technological breakthroughs in the fields of artificial intelligence and robotics will potentially lead to firms requiring less human labour. The result of this economic transformation will mean higher levels of unemployment and a larger pool of unused or under-used labour. As a simple example, widespread 3D printing is like to dramatically restructure manufacturing. Thus, the fourth industrial revolution could represent major economic upheavals, with many social consequences unseen by society in decades, if ever. Such consideration warrants further attention, public debate, and possibly eventual action by government.

At its 2016 meeting, the World Economic Forum estimated that five million jobs across 15 major economies would be lost before 2020 because of the fourth industrial revolution (WEF 2016). The fear that robots will replace people is real, and may happen across spheres of economic activities. This research note makes no attempt to determine which professions will thrive, which will diminish, or which will completely disappear as we move forward. However, there is agreement amongst the literature that both blue and white collar jobs will be threatened by the employment of robots. In the not-too-distant future, robots will be able to do many jobs as effectively as humans, however at much lower costs. Richard and Daniel Susskind (2015) provide an extreme view on the future of the professions in which they argue that robots will soon be able to do much of what professionals do today. When it comes to the practice of law, medicine or even teaching, they argue that robots will play an ever-increasing role in the delivery of services to clients.

How will governments manage a robotized economy, and respond to the social upheaval likely to take place during this period? If taken to the extreme, how will the economy grow if robots do all the work and the vast majority of the workforce is unemployed? There is one area that draws attention, even among the most ardent of futurists: governments will need to be a lot more attentive to the distribution of wealth, and income distribution (Ford 2015). Until a new equilibrium of some kind is found, governments will need to mitigate the economic upheaval. There are many policy options for consideration, from more traditional means of government redistribution, ex. a guaranteed minimum income, to more market oriented solutions.

What if, when each citizen turns 18, the government bought him or her a diversified portfolio of equity? Of course, some people would want to sell it immediately, cash out, and party, but this could be prevented with some fairly light paternalism, like temporary 'lock-up' provisions. This portfolio of capital ownership would act as an insurance policy for each human worker; if technological improvements reduced the value of that person's labor, he or she would reap compensating benefits through increased dividends and capital gains (Smith 2013).

Other related issues to consider would include education and post-secondary education, labour market training, etc. Again, the argument in this research note is that governments need to steer this transition

and that they cannot passively let events unfold without giving serious thoughts to the changes already underway. In the situation of the labour market, an ethical code, as mentioned in the introduction, might help identify the rights of people to gainful existence or employment, such that policies could be implemented to ensure that these natural rights are upheld.

Governments need to manage the transformation to the economy, and create a sound foundation to ensure that society profits from these improvements, instead of facing peril due to development. Grobart in Bloomberg Business argues, 'The ratio of jobs created to jobs eliminated by robots and where all the newfound wealth ultimately winds up are entirely dependent on how workers, businesses, and policymakers prepare for this new era' (2012). Governments must ensure that the policy response is thoughtful and not simply reactive.

Government Challenges: The Public Service

The fourth industrial revolution reveals questions about governmental organization, and how the public service could deliver programs and services to citizens. Although, there are opportunities for greater government effectiveness and increased efficiency in service delivery, these circumstances will put tremendous pressure on public authorities to change the way government operates. Governments may also face tremendous fiscal pressure if confronted with ever-increasing inequalities. Furthermore, governments' role in society and in the economy will once more be scrutinized.

The effect of the fourth industrial revolution on the public sector may well be paradoxical. There is a narrative that sees governments being able to take full advantage of the opportunities provided by the fourth industrial revolution. Governments' capacity for policy work and evidence-based policy to address economic and social problems could increase, as a result of the creation of a new wealth of knowledge. Due to management reforms from the 1980s onward, there has been much concern about the policy capacity of governments. The fourth industrial revolution could turn this around, making a vast amount of knowledge available for evidence-based decision-making. Governments will also, as per current trends, be able to use new and evolving online technologies to better serve citizens directly. Governments could deliver services effectively and at a reasonable cost as a result of advances in robotics; robotics coupled with the web of things could, for instance, enhance healthcare and home care service delivery (as is discussed below). Front-line and service delivery jobs could easily be done by robots, and citizens could easily be accommodated via the web. At the municipal level, to highlight a simple example, robots could, in the not-so-distant future, do much of the maintenance work for parks and recreation. The fourth industrial revolution could lead to a more effective, and a leaner and cheaper, government. Governments may be able to, as the oft-stated maxim suggests, provide more and better services for less. The fourth industrial revolution could, thus, lead to improved policymaking and policy, increased effectiveness and efficiency and better programs and services for citizens.

There are, however, many risks that lurk and that challenge this optimistic scenario. The fourth industrial revolution could put governments and public services under strain. Government services will be ever-more needed, especially to address rising wealth inequalities. The welfare state will be under heavy pressure due to existing trends such as population ageing, and new possible realities such as high unemployment and increased welfare needs. Governments will still be relied upon to deliver key services such as healthcare, education and welfare. The demand for government services will be high, but public authorities may not have the financial capacity to deliver the goods due to slow growth.

Muller (2006) long ago noted that the state has never been as contested as it is today, yet citizens' expectations continue to grow. The fourth industrial revolution may further exacerbate this tension. Governments could, therefore, face major policy and service delivery challenges without having the means to meet the demand of citizens. Furthermore, as part of the fourth industrial revolution, public administration may be one of the few repositories of good solid full-time employment. Governments' possible embrace of robotization under pressure from the public to deliver more for less could erode its workforce and decrease the number of available 'good jobs'.

What are the likely impacts of the fourth industrial revolution on our institutions, and democratic practices? The answer to such a question is beyond the scope of this article. The question, however, is important and warrants considerations. The fourth industrial revolution, if not managed, has the potential to generate serious political, economic and social upheavals. Governments could be faced with non-options, as private sector actors come to structure, without sufficient public debate or restraint, what is possible via technological innovations. Due to institutional sclerosis and path-dependency, governments may have problems adapting, especially if the pace of change is extremely rapid. How will the government, in this context, defend the public interest, promote and preserve the public good?

Government Challenges: Ethics of the 4th Industrial Revolution

The fourth industrial revolution shall give rise to a number of policy-related ethical questions, and government will have to participate in resolving these dilemmas. Many policy fields could be referenced to highlight arising ethical issues. For the purpose of this research note, homecare service delivery is used as an example due to the incidence of ageing demographics in developed nations. Though variations exist across countries, the use of robotics in homecare service delivery has already begun, especially in Asia (Kolling et. al. 2013). This policy field is particularly relevant because it refers to the direct interaction between humans and robots, and the consequences of living side by side. The evolution of homecare service delivery already raises important ethical questions. Potential transformations are sketched below, noting possible advantages and ethical concerns.

The fourth industrial revolution creates multiple opportunities to improve healthcare as a whole, and more specifically, homecare service delivery. Advances in robotics and the advent of the 'smart home' provide opportunities for people to stay in their home longer, and still obtain the care they need. There are multiple advantages both in terms of the delivery of services, and for the individual's quality of life. From a health standpoint, healthcare practitioners will be able to, without having to meet in person, closely monitor and track the health of their patients. The development of 'smart home' technologies also offers the possibility to provide efficient and quick emergency services. The use of robots as nurses or companions – although it raises ethical issues, discussed in the next paragraph – could allow substantive cost savings from replacing human labour. Robots may also provide emotional support, especially to single and lonely individuals; the trend in favour of pet robots is underway across various age groups. The fourth industrial revolution and the expected developments in healthcare and homecare service delivery could also permit providers to better serve distant regions and rural areas, including remote communities. The extent to which governments will be able to facilitate this transition in order to improve homecare service delivery remains to be seen. Governments have the opportunity, in this field like in many others, to use new technologies in such a way as to be able to provide more and better services at a lower cost.

Beyond practical considerations, there are important and difficult to resolve ethical issues that need to be considered. The literature in this field, most importantly, has focused on the relation between robots and humans. Kernaghan (2014) raises a number of ethical considerations that range from the invasion of privacy as a result of the 'smart home' to the risk of attachment to a machine for frail and elderly individuals. About care for the elderly and the use of robots, Sparrow and Sparrow argue, 'What most of us want out of life is to be loved and cared for, and to have friends and companions, not merely to believe that we are loved and cared for, and to believe that we have friends and companions, when in fact these beliefs are false (2006: 18). The development of artificial intelligence shows great promise for homecare, but it also raises concerns. Melson et. al. state:

For as robots of today (and the future) become increasingly social – autonomous (insofar as they initiate action), adaptive (act in response to their physical and social environment), personified (convey an animal or human persona), and embodied (the computation is embedded in the artifacts rather than just in desktop computers or peripherals) – it seems likely that children and adults will not only interact with them 'as if' they were social others, but begin to feel about them and treat them as having life, mental states, sociality, and moral worth. (2009: 563).

The argument is not that governments need to solve these debates per se. Government agencies and frontline workers, however, already must consider these types of issues. As such, governments need to take the time now to think concretely about how the technology is to be used, how to make sure citizens benefit from it, and how to minimize risks while accounting for moral and ethical matters. Doing so is important to avoid some future disputes over the imposition of technology upon society.

While government has always faced concerns of ethics, this time the concerns strike at the very nature of humanness and a possible resolution might be for government to entrench the right of humanity to the unmitigated individualism that separates us from machines via a new code that would address more directly, among other topics, human-robot interaction. There are substantive ethical issues across policy fields and governments are going to need to be particularly attentive in areas where the most vulnerable, such as the elderly, are going to need protection.

Conclusion

This research note has been interested in the impact of, and government's role in relation to, the fourth industrial revolution. Though the scope and the speed of change associated with the fourth industrial revolution are debatable, governments will have to play a greater role to make sure society benefits from the emerging transformation. They will also need to make sure that the risks associated with these changes are minimized. The argument in this research note is that governments need to use foresight to prepare, plan, and think about the changes that are forthcoming – so that they are not caught off guard by the breadth and depth of the fourth industrial revolution. The fourth industrial revolution raises multiple policy questions, most notably in areas relating to the economy, economic development and the labour force. Government can help shape the fourth industrial revolution, but they will also be affected by it. Governments' ability to deliver services effectively and efficiently will be affected, and citizens' expectations of public services will also change. Governments will equally need to lead, or at a minimum participate in, the conversation on many important ethical issues brought forth by the emergence of the fourth industrial revolution. The observations throughout this research note suggest

that there are very good reasons for governments to be pro-active to help structure and manage the requisite public debates on the fourth industrial revolution and its many effects. One of the actions suggested in this research note is for government to proactively have the necessary discussion about the changing purpose of human existence given that robots will fulfill their roles in greater quantity. Of this discussion, one of the best results might well be an ethical code for how government will foster humanity and preserve humanness in light of these advancements.

The analysis offered in this research note is preliminary. The fourth industrial revolution raises many other issues left unaddressed in this research note. There is, as such, ample room for further research. There are many broad questions such as the relationship between the fourth industrial revolution and state institutions and democratic practices that should be fully analyzed. The relationship between the state and other actors in society, private sector actors and the third sector, are also likely to be affected by the fourth industrial revolution. There are also issues that are more closely connected to specific policy fields, and areas of intervention. For instance, the fourth industrial revolution is likely to revolutionize the military, transportation systems, courts and the law, etc. Governments need to exercise leadership to make sure that the interests of citizens are central to the changes in these fields. This research note has intentionally focused on the developed world, but consideration should be given to how the fourth industrial revolution is to play out in emerging and developing countries. The fourth industrial revolution could benefit developing countries via technology transfers, but it could also exacerbate many of the political, economic and social tensions that these countries face.

The fourth industrial revolution is in its early stages. Its development will not be linear, nor will it be predictable. As mentioned earlier, the fourth industrial revolution may bring about currently unimaginable changes. It could also be disrupted by wars, conflict, terrorism, and/or organized crime. Governments, thus, need to exercise foresight and good judgment in thinking about the fourth industrial revolution. We suspect that the countries to fare well in this new age are those that will have taken the time to analyze the potential and the risks associated with the fourth industrial revolution. It is our contention that governments can and need to assist in structuring and managing these transformations as they unfold. They must do so with a view to protect and enhance the public good.

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