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People and Machines

Competitors or Collaborators in the Emerging World of Work?



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Imran Arshad
[Policy Horizons Canada]

The replacement of people with machines is an age-old discussion focusing on both positive and negative aspects of automation. On one hand, advanced technology helps firms become more productive, profitable and efficient, and benefits society as a whole as it frees people from routine tasks so they can focus on more enjoyable and creative activities. On the other hand, human displacement by machines may result in limited job prospects and mass unemployment.

Keeping Pace in the Intelligence Race

A recent [McKinsey paper](#) highlights three waves of technological change that have transformed the nature of work in the contemporary era. The first was the use of automation for routine *production* work. The second involved the automation and/or outsourcing of information processing and routine *transaction* work (i.e., tasks that could be standardized and scripted such as the ATM displacing the Bank Teller, service calls fielded in Mumbai instead of Mississauga, etc.). The paper argues that we are currently in the midst of the third wave of

change, where automation may impact the *interaction* jobs of the knowledge economy – those that require “deep knowledge, independent judgment, and experience”.

While technological advancement has long been a factor in the displacement and creation of jobs, the major shift today is the accelerating pace of technological change. Generally speaking, there is a belief that as technology advances, the computational capacity of computers doubles every 18 months (also known as [Moore’s Law](#)). This exponential growth in computing capacity accompanied by decreasing costs has a tremendous impact on the development of [artificial intelligence](#). Some prominent thinkers, including Google’s [Larry Page](#) and [Ray Kurzweil](#), one of the world’s leading inventors, believe that computers will exceed the full range of human intelligence in the next 15-20 years. Advancements in the field of [artificial neural networks](#), which are built on the model of the human brain, may result in further developments of artificial intelligence, especially as scientists are better able to understand how human brains work.

Automating the Routine and Creating Space for the Unseen

If computer technology continues to progress at the pace we have seen in the recent past, it is likely that machine technology, enabled by artificial intelligence, may be advanced enough to take over some tasks associated with high-skilled interaction professionals – such as doctors, lawyers, engineers, managers and salespeople. As [Acemoglu and Autor](#) suggest, the distribution of tasks allows for some routine tasks (e.g., research, analysis, diagnostics) to be separated from high-skilled jobs and either automated or assigned to middle-skilled specialists (who may reside offshore). Impacts of automation on low-skilled jobs are fairly evident (e.g., use of robotics in manufacturing), but artificial intelligence has the capacity to displace some middle-skilled professions as well. For example, [Microsoft's virtual assistant](#) is able to process information and make sophisticated decisions and judgments on a client's preferences, mood and physical appearance. Imagine the job impacts of using this technology in professional, [medical](#) and [legal](#) fields, to name a few.

Although automation may lead to job losses in certain areas, new opportunities may arise through enhanced economic growth and innovation. In some cases, entirely new jobs may be created, such as programming, operator, support, sales and service jobs (e.g., [IT cloud services jobs](#)). In other cases, smart algorithms may be used to quickly search, evaluate and summarize information, augmenting the work traditionally done by people. If machines free us from doing the more mundane tasks, people may be able to develop latent capacities and take on more creative and sophisticated jobs.

The key is to figure out what will be the balance in terms of job creation and displacement as a result of technology. In his book, [The Lights in the Tunnel](#), [Martin Ford](#) argues that the new job types created by technology are a relatively small proportion of employment compared to traditional jobs and tend not to last as long. He describes some of the characteristics and job types that may be easily displaced by automation, as well as those that may be relatively safe.



Routine, technically oriented jobs that require fairly limited human interaction are likely to be easily displaced by automation. They include jobs that can be broken into specific tasks and that operate in standardized environments such as routine jobs in retail stores, factories, offices and warehouses (e.g., stocking shelves, unloading trucks, etc.) and ones that facilitate self-service (e.g., fully automated supermarkets such as Germany's [Future Store](#)). Other examples may include what today are considered medium- to high-skilled tasks such as case research for lawyers, analysis and evaluation of visual images for diagnosis, and



interface jobs that require collecting, copying, collating and communicating information (e.g., mortgage agents, loans officers, accountants), which may be handled through simple or complex algorithms.

Jobs that require a combination of skills and manual dexterity may be relatively safe from automation in the next 10-15 years. Examples include jobs that require complex visual recognition and adaptation tasks such as housekeepers, chefs, mechanics, plumbers and waiters. Other jobs in which people may have a comparative advantage include those that require human interaction, empathy and compassion (e.g., health care, community development work). These jobs require a level of personalized service that many clients may still prefer.



Living Off the “Right-side” of the Brain

While there is speculation on the varying levels of impact that automation will have on jobs, the overall balance between job creation, retention and elimination remains unclear. Nevertheless, it is important to think of the changing world of work, the skills required to succeed in this future world, and whether we are educating our future work force accordingly.

Past trends indicate that high-skilled workers – those that have strong communication, intellectual and problem-solving skills – have experienced low unemployment and increasing wages. The opposite seems to be true for some low-skilled jobs that have been displaced to outsourcing and automation. The Institute for the Future recently released a report, [Future Work Skills 2020](#), which explores some of the skills that will be required for the workforce of the future. Daniel Pink has also done some work on identifying the “[right-brained](#)” skills that will serve us in good stead as we move forward in the changing world of work. Some of the skills that may be much more difficult for machines to replicate include:

Critical thinking – Artificial intelligence may be able to create sophisticated algorithms, but these algorithms do not possess the human intelligence that help us make sense of our lives. While some speculate artificial intelligence will surpass human intelligence in the next 15-20 years, how can we be so sure when we have such a limited understanding of how the brain works?

Social intelligence – As we move towards more collaborative ways of working, emotions, empathy and “play” will be some of the key “right-brained” tools needed to effectively come up with innovative solutions to complex problems. While advances in the development of emotional and social robots will continue, the realm of “feelings” is much harder to automate given the limited understanding of how they develop and evolve.

Adaptive thinking – The ability to immediately respond to unexpected situations is a skill required in both highly-skilled jobs (e.g., professional and management-related work) as



well as low-skilled occupations (e.g., personal care and food services). Humans are likely to have a comparative advantage in these skills within the next 10-15 years.

Creativity and design – The art of shaping imaginative ideas into reality is a process that is difficult to codify. The practice of this skill is buried in the complexity of the human brain and will be hard for any machine to emulate in the near future.

Cross-cultural competency – In increasingly diverse and/or unfamiliar contexts, especially given the rise of a more global and networked world (both physical and virtual), this skill will be key in navigating relationships and collaborative endeavours.

In addition to these high-level thinking and social capabilities, some practical skills that will also be critical in terms of working with advancing technology include:

New media and data literacy skills to aid in better communication of novel and compelling ideas, concepts and stories through visual, auditory and sensory means;

Filtering abilities to manage information overload and focus, yet still take in and process a vast range of information; and

Virtual skills that enable workers to harness collaborative technologies in order to share ideas and work via online interactions and across geographical distances.

Other important future skills that may be enhanced by emerging technologies include:

Foresight and systems thinking capabilities that help people understand the critical elements included in a particular system, explore options, challenges and opportunities, and develop strategies to better prepare for the future; and

Interdisciplinary skills that provide people with the ability to see the linkages between and communicate in the language of a range of disciplines in order to help address multifaceted and complex problems.



What does all this mean for policy?

It is evident that technology will have a disruptive impact on the jobs and skills of the future. The key for Canada is to find ways to navigate the challenges and take advantage of opportunities. Some potential policy questions that arise include:

1. How can automation be used to improve the efficiency and effectiveness of human capital, while creating new job opportunities for those at both the high- and low-skill levels?
2. If automation results in substantial unemployment, what will be the impacts on the economy? How will Canada fare in the global competition for talent, as automation



displaces large labour pools in emerging economies? How will governments address issues such as income inequality, dwindling consumption, and redistribution of wealth?

3. How can Canada help develop a culture of life-long learning that meets the needs of the labour market while helping its citizens develop the skills necessary to adapt to rapidly changing circumstances? What impacts will skills shortages have on competitiveness, innovation and income inequality if not adequately addressed?
4. What type of social policy framework will be required to support Canadian participation in a world where collaborative technologies foster non-traditional work arrangements (e.g., [increased contract and freelance work](#) vs. traditional employer-employee relationships)?

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