SKILLSNEXT

Thinking Twice About Technology and the Future of Work

JANUARY 2020

Jim Stanford

PUBLIC POLICY FORUM

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Future Skills Centre

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ABOUT THE PROJECT

Canadians' needs for skills training are changing rapidly. Through Skills Next, the Public Policy Forum and the Diversity Institute—in its role as a research lead for the Future Skills Centre—are publishing a series of reports that explore a number of the most important issues currently impacting the skills ecosystem in Canada. Each report focuses on one issue, reviews the existing state of knowledge on this topic, and identifies areas in need of additional research. This strong foundation is intended to help support further research and strengthen policymaking. A diverse set of authors who are engaged in the skills ecosystem through various roles, including through research, activism, and policymaking, have been carefully selected to provide a broad range of perspectives while also foregrounding the Canadian context. Their varied backgrounds, experiences, and expertise have shaped their individual perspectives, their analyses of the current skills ecosystem, and the reports they have authored.

Skills Next includes reports focused on:

- **Global comparison of trends to understand the future of skills**
- **Knowns and unknowns about skills in labour market information**
- **Rethinking the relationship between technology and the future of work**
- **Defining digital skills and the pathways to acquiring them**
- **Barriers to employment for immigrants and racialized people in Canada**
- **Barriers to employment for persons with disabilities**
- **The return on investment of industry leadership in skills and training**
- **Approaches to improving the transitions of university graduates from education to the workforce**

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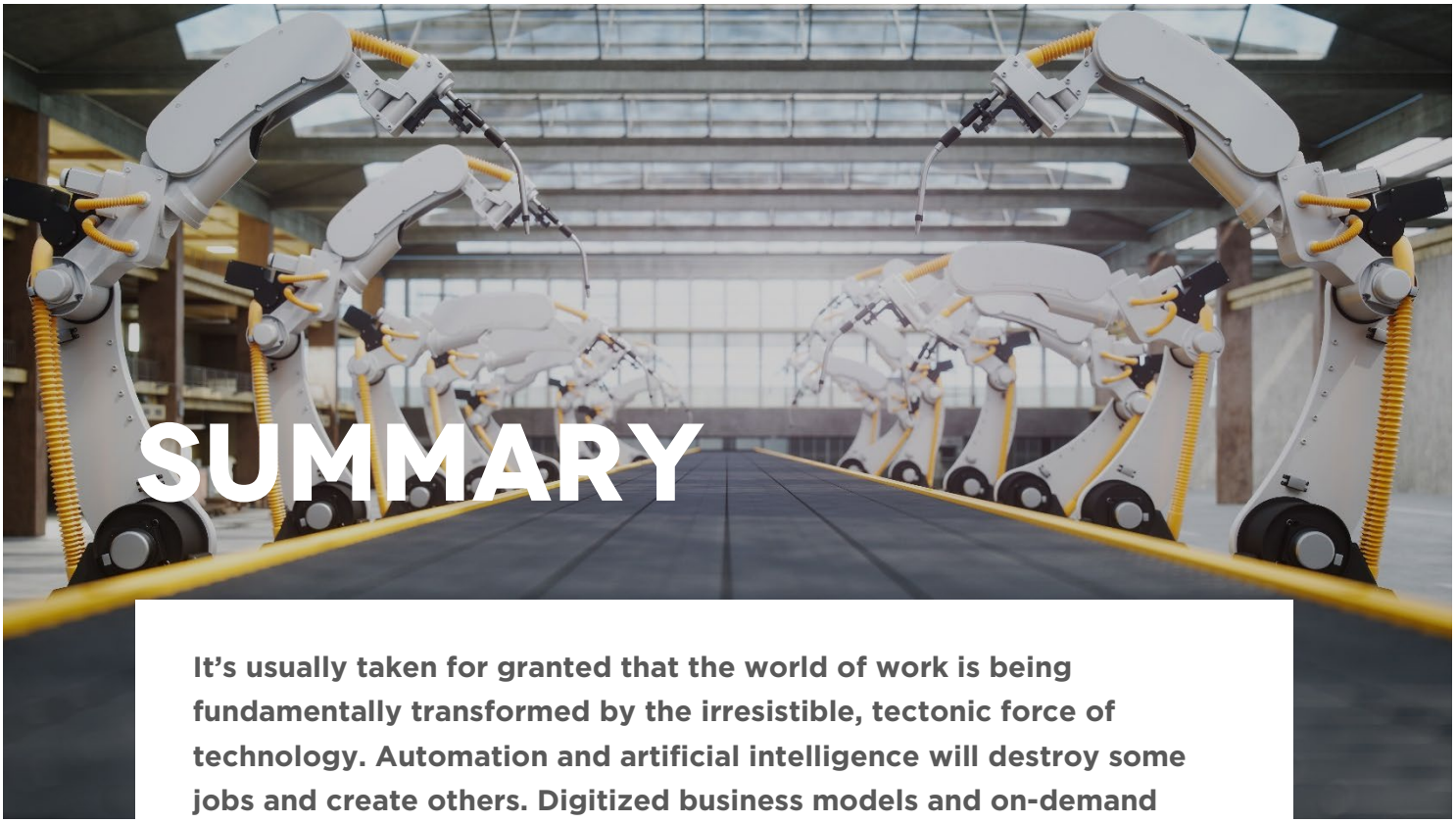

SUMMARY

It's usually taken for granted that the world of work is being fundamentally transformed by the irresistible, tectonic force of technology. Automation and artificial intelligence will destroy some jobs and create others. Digitized business models and on-demand platforms will convert jobs into gigs. Huge gains in productivity could usher in abundant leisure time—or create a world of digital sweatshops.

Some observers are optimistic about the economic and social benefits of these changes. Others fear a more frightening, polarized world in which the benefits of new technology are captured by a small elite, while the rest of society suffers mass unemployment and pervasive precarity. But either way, it is assumed that the driver of change is technology itself. And as the Luddites learned two centuries ago, you can't stop technology.

This report examines the assumptions underlying these popular narratives about technology and the future of work. It adopts a longer historical perspective on the relationship between technology and work. Are these pressures and disruptions in labour markets truly unprecedented, or have we in fact seen them before? Measured in aggregate economic terms, has technological change really even sped up? Above all, is it technology driving these changes—or is there a degree of human agency and choice that is often overlooked, in both utopian and dystopian visions of the high-tech future?

The report concludes it is counterproductive for labour market stakeholders—workers, employers and policymakers—to accept that these epochal changes are technologically determined and hence inevitable. Technology itself is neither exogenous nor neutral: the trajectories of innovation always reflect the priorities and interests of those who pay for it to happen. And there is even more choice and agency at work in how and where technology is applied, and how its costs and benefits are shared. Assuming

that technology drives the whole process of change, and is beyond our control, can promote passivity and complacency on the part of stakeholders and policymakers. Change is then left to occur in an unplanned, fragmented and chaotic way; opportunities for effective preparation and coordination are forsaken; and prospects for achieving a more inclusive and participatory high-tech future are squandered.

To challenge this often fatalistic approach, this paper argues that many popular assumptions about the future of work are unfounded. Specifically:

- **Technology is not replacing work and, in fact, cannot replace work in a general sense.**
- **The "gig economy" is not a new, technologically generated development, but rather a relabelling of long-standing precarious employment relationships.**
- **Technology is being used to change power balances within workplaces as much as to change the nature of production itself.**
- **New technologies are being rolled out in the real-world economy more slowly than is often assumed.**
- **Additional education and skills training, while desirable, will not on their own ensure efficient adjustment to change.**

Ultimately, workers face more urgent problems than being made redundant by future technology. They already face pervasive precarity, stagnant and increasingly unequal incomes, and lack avenues to exert a collective voice in their work lives. These challenges, which cannot be fixed by market forces, demand quick and powerful responses from policymakers and other labour market stakeholders. By building more representative and participatory structures and processes to address these existing challenges, we will also enhance the capacity of the labour market to manage technological change more successfully and fairly.

The paper ends by considering the concrete steps required to achieve a future of work in which conscious and collective decisions shape the forces of technology, productivity and creativity to create better jobs and build better lives.

Is there a degree of human agency and choice that is often overlooked, in both utopian and dystopian visions of the high-tech future?

INTRODUCTION: THINKING TWICE ABOUT TECHNOLOGY AND JOBS

In recent years, new and emerging technologies, such as artificial intelligence (AI), automation and self-driving cars, have sparked widespread concern that technology will rapidly transform and even eliminate many jobs, perhaps causing mass unemployment.[1, 2, 3] The advent of new digital business models and the changing nature of employment relationships have also raised concerns over whether short-term "gigs" will come to replace traditional jobs.[4, 5] A common response to these anticipated changes is to advocate more investment in skills and training to smooth labour market transitions. This focus on skills is reinforced by employer complaints about a supposed shortage of skilled workers, sparking calls from business for government programs to develop more job-ready graduates or liberalize access to international migrant workers.[6, 7]

But a more careful review of economic and empirical evidence suggests that these twin assumptions—that technology is driving change, and that gaining more skills is the best way to manage this change—do not tell the whole story. Assuming that work is being fundamentally transformed or even made redundant by technology misunderstands how production actually occurs.[8] Assuming that both technological change, and the disruptions it causes, are somehow "new" disregards the history of labour, technology and employment relationships. And assuming that the crucial policy challenge is simply to facilitate adaptation to new technology misdiagnoses the broader challenges facing workers, their families and communities.

Technology is not an exogenous, irresistible force; nor is it the fundamental cause of the big ongoing changes in the world of work. Counter to widespread narratives, this paper argues that:

- **Technology is not replacing work, and indeed cannot replace work in a general sense.** It can, however, change the *quality* of work, for better or worse.

[1] Dunlop, T. (2016). Why the future is workless. Sydney, New South Wales: University of New South Wales Press.

[2] Arntz, M., Gregory, T. and Zierahn, U. (2016.) The risk of automation for jobs in OECD countries: A comparative analysis. OECD Social, Employment and Migration Working Papers, No. 189. OECD Publishing.

[3] Frey, C. B. and Osborne, M. A. (2013). The future of employment: How susceptible are jobs to computerisation?, Oxford Martin School.

[4] Manyika J. et al. (2016). Independent work: Chhoice, necessity, and the gig economy. McKinsey Global Institute.

[5] Slee, T. (2016). What's yours is mine: Against the sharing economy. OR Books.

[6] Kelly, D. (2016). Immigrants are the solution to Canada's labour shortage. Huffington Post. I

[7] Snyder, J. (2019). Amid worker shortage, business groups call on Ottawa to expand jobs programs in pre-election budget. National Post.

[8] Ticoll, D. (2019). Robots will replace us! it's not that simple – or that scary. Brave New Work Blog. Public Policy Forum. From Ticoll, D. (2019). Toward a systems framework for technology and the future of work. LMI Insights, 12. Labour Market Information Council.

- **The "gig economy" is not a new, technologically generated development, but a relabelling of long-standing precarious employment relationships.**[9] The resurgence of precarious work in recent years reflects a shift in the balance of economic and political power in the labour market, which has provided more opportunities for employers to reduce labour costs and shift risk to workers.
- **Technology has changed power balances in workplaces much more than it has changed the nature of production.** In other words, technology has done more to shift employment relationships in favour of those who pay for it, than to fundamentally transform production and productivity.
- **New technologies are being rolled out more slowly in practice than predicted.** Canadian businesses are not actually investing enough in capital and new technology to spark dramatic changes in employment.
- **Skills and training alone will not ensure an efficient and inclusive Canadian labour market.** Canadian workers are already better educated than workers in most other countries, and more Canadian workers are overqualified for their jobs than are underqualified.[10]

This report takes a critical look at the common narratives currently driving the discussion about technology and work. By taking a more historical and structural analysis of how technology does and does not affect work, and reemphasizing the role of conscious choice and policy in shaping work, we can imagine more effective and pragmatic policy measures to ensure that the high-tech future of work is fair, inclusive and productive.

[9] For a comparison of new and old "gig" jobs and the employment arrangements structuring them, see: Piovesan, C. (2019). Old gigs, new gigs: Are courts and legislators reinterpreting an age-old debate for the new world of work? Brave New Work Key Issues Series. Public Policy Forum.

[10] See, for instance, Braham, E., Tobin, S. (2019). Solving the skills puzzle: The missing piece is good information. Skills Next. Public Policy Forum, Diversity Institute at Ryerson University, Future Skills Centre.

Whenever large numbers of unemployed or underemployed workers are available, firms can find surprisingly marginal and unproductive (yet profitable) ways to employ them. This explains the continued expansion of jobs in menial service industries—like preparing and delivering fast food, handing out flyers, soliciting donations on street corners, walking dogs or performing manicures—despite the potential of automation to lift productivity and the quality of jobs.

WORK IS NOT DISAPPEARING

Productive human labour, in all its forms, is the only force capable of adding value to the resources and raw materials harvested from nature, transforming them into the myriad useful goods and services that are essential to modern life. Robots and other forms of automation cannot replace human labour, in any general sense. Rather, they supplement human labour by making it more productive and efficient. But technology does not fall from the sky like the killer robots in the *Terminator* movies. Machines and computers and robots must be conceived, engineered, tested, manufactured, installed, operated, maintained and repaired. That all takes work—and lots of it.

Work and employment cannot disappear *en masse* because of automation. Fundamentally, there are simply too many important things that humans need to continue to do for the foreseeable future—and many of these things require more work, not less. This imperative is much broader than just producing more "stuff" (like big-screen TVs, monster suburban homes and sport utility vehicles). It revolves more centrally around the production of services, especially human and caring services (like early child education, elder care and disability services). Our collective need for those services is growing as society advances and ages; and, in general, it's better for those services to be provided by human beings, rather than machines. Furthermore, protecting the environment requires more work, too: allocating labour to priorities like building sustainable energy systems, energy conservation and public transit.

Many economists have noted that new technology usually creates new work, even as it changes or eliminates some jobs.[11] For example, the work associated with developing, manufacturing, operating and maintaining technology will offset at least some of the jobs displaced by application of that technology.[12] So, too, will new jobs in the industries and services created by new technology, such as developing apps for smartphones, producing content for streaming services or performing new medical procedures enabled by new tools.[13]

There are other less benign reasons why work cannot disappear in any general sense. A hyper-flexible, competitive labour market creates and recreates large numbers of low-productivity, low-quality jobs.[14] Whenever large numbers of unemployed or underemployed workers are available, firms can find surprisingly marginal and unproductive (yet profitable) ways to employ them.[15] This explains the continued expansion of jobs in menial service industries—like preparing and delivering fast food, handing out flyers, soliciting donations on street corners, walking dogs or performing manicures—despite the potential of automation to lift productivity and the quality of jobs.

[11] Berriman, R. and Hawksworth, J. (2017). Will robots steal our jobs? The potential impact of automation on the UK and other major economies. UK Economic Outlook. PricewaterhouseCoopers.

[12] Of course, there is no guarantee that jobs created by new technology will offset the jobs destroyed by it. And even if technology produces more jobs in the long run, an entire generation could be impacted by short-term disruptive changes to the economy and job market. See Krugman, P. (2013). Sympathy for the luddites. The New York Times.

[13] Bakhshi, H. et al. (2017). The future of skills: Employment in 2030. NESTA.

[14] Organisation for Economic Co-operation and Development (OECD). (2019). low productivity jobs continue to drive employment growth. Statistics and Data Directorate.

[15] Porter, E. (2019). Tech is splitting the U.S. work force in two. The New York Times.

THE GIG ECONOMY: NEW OR OLD?

The rise of digital platforms and gig employment models has been interpreted as another sign that technology is irrevocably changing work. But gig employment models are not new; in fact, the core employment practices used by modern digital platforms are hundreds of years old.[16, 17, 18] While new technologies have certainly enabled the rapid expansion of on-demand employment practices, it is misleading to assume these changes were "caused" by technology.[19] Other preconditions essential to the spread of gig work include an abundant supply of underemployed workers willing to work irregular hours for uncertain pay, and the willingness of regulators to ignore the effective abrogation of many traditional labour laws and norms.[20]

Work conducted through digital platforms is characterized by the following core features:

- **On-demand employment:** workers are hired only when there is immediate demand for their output;
- **Piece-work compensation**: workers are paid for each unit of output, not for their time;
- **Worker-provided capital equipment**: workers provide the tools, equipment and often the place of work (like a vehicle); and
- **Intermediation**: some intermediary facilitates the transaction between the worker and the end user of their services (a consumer or another business) and then skims off some of the resulting economic surplus (or "cream").

Each of these features has a long history in employment practices that is as old as capitalism itself. Their precursors were 18th-century agricultural gang-masters; women who performed small-scale, home-based manufacturing under the "putting out system" of the 19th century; and modern day-labourers in many industries, like miners, dockworkers and drivers, who still toil in precarious on-demand positions.

Precarious work isn't new. And precarious work extends far beyond digitally mediated gigs.[21] Indeed, when we consider all the forms of precarious work, including part-time jobs, temporary work and

[16] Quinlan, M. (2012). The 'pre-invention' of precarious employment: The changing world of work in context**.** The Economic and Labour Relations Review 23(4), 3-24.

[17] Stanford, J. (2017). The resurgence of gig work: Historical and theoretical perspectives. The Economic and Labour Relations Review 28(3), 382-401.

[18] Valenduc, G. and Vendramin, P. (2016). Work in the digital economy: Sorting the old from the new. European Trade Union Institute Working Paper, Working Paper No. 2016.03.

[19] Mazzucato, M. (2011). The entrepreneurial state: debunking public vs. private sector myths. London, UK: Anthem Press.

[20] Stanford, J. (2017). The resurgence of gig work: Historical and theoretical perspectives. The Economic and Labour Relations Review 28(3), 382-401.

[21] Lewchuk, W. et al. (2015). The precarity penalty: The impact of employment precarity on individuals, households and communities—and what to do about it. Poverty and Employment Precarity in Southern Ontario (PEPSO).

marginal self-employment, around half of all workers now experience at least one dimension of precarity in their work.[22]

Employers have always tried to shift the risks and costs associated with work, including the cost of capital equipment and the risks associated with fluctuations in demand, to those who are performing the labour. And workers with few options have long accepted jobs with unappealing features, such as uncertain schedules, low wages and lack of fringe benefits (like pensions or sick pay). This acceptance does not reflect the genuine "choice" of those workers (some disdain for a regular salary, paid holidays and a pension). Rather, it reflects a lack of access to more secure and better-paying jobs. It is no coincidence that most modern "gig" workers are young people and racialized and immigrant workers, who have fewer opportunities for traditional employment.[23]

The resurgence in employment precarity can thus be seen as a return to what have been, historically, rather "normal" conditions of work in capitalism. What we now call the "standard employment relationship" (full-time permanent jobs with normal entitlements) only became widespread in the 20th century. Mass production technologies required a more regular and disciplined workforce than could be arranged through earlier gig-type employment practices. But other non-technological factors were also important in the ascendance of the standard employment relationship (or SER).[24] These included macroeconomic conditions (very low unemployment provided the incentive to "lock in" stable workforces); more ambitious and interventionist labour regulators (who forced employers to pay minimum wages, pensions and paid holidays); and workers' high expectations and stronger bargaining power (thanks to strong unions and strong labour standards). For a while, the SER underpinned important improvements in job quality and compensation, and widespread (though never fully inclusive or universal) prosperity.[25]

The more recent erosion of that stable, regulated vision of work, and the resurgence of contingent work practices, reflect a similar convergence of economic, political and social forces. Restrictive macroeconomic policies now maintain a "healthy" cushion of unemployment[26] that helps to discipline workers and their wage demands, instilling in them a fear that they could be easily replaced should they be seen as too demanding. Simultaneously, unemployment and other forms of underutilization (like underemployment) provide a pool of underused workers eager to accept gig jobs, despite their

[22] Carney, T. and Stanford, J. (2018). The dimensions of insecure work. Centre for Future Work.

[23] Block, S. and Hennessy, T. (2017). "Sharing economy" or on-demand service economy?: A survey of workers and consumers in the greater toronto area. Canadian Centre for Policy Alternatives.

[24] Stanford, J. (2017). The resurgence of gig work: Historical and theoretical perspectives. The Economic and Labour Relations Review 28(3), 382-401.

[25] Kalleberg, A. (2009). Precarious work, insecure workers: Employment relations in transition. American Sociological Review, 74(1), 1–22.

[26] Euphemistically termed the "natural" or non-accelerating inflation rate of unemployment.

drawbacks.[27, 28] The widespread acceptance of precarity as a fact of economic life, and an illegitimate infatuation with gig practices as somehow "new" and "innovative," have slowed the hand of policymakers in regulating gig employment practices and preventing exploitation (including safety risks, racial profiling and other negative side-effects).[29] Meanwhile, workers have fewer supports and less power to resist exploitation, given the erosion of collective bargaining and widespread resignation that insecurity is normal and inevitable.

Digital platforms' exploitive employment practices do not reflect the inevitable onward march of technology. Rather, they reflect deliberate choices, made in an economic and regulatory context that also reflects deliberate choices. Jurisdictions around the world are now moving to close legal loopholes through which platform businesses and gig employers have tried to evade normal employment responsibilities.[30] This trend, driven by growing awareness of the abuses of gig practices, and advocacy on behalf of those working in the industry, will likely continue.

[27] Pollin, R. (1999). Class conflict and the "natural rate of unemployment". Challenge 42(6), 103-111.

[28] Standing, G. (2011). The precariat: The new dangerous class. Bloomsbury.

[29] Alwani, K. and Urban, M. C. (2019). The digital age: Exploring the role of standards for data governance, artificial intelligence and emerging platforms. CSA Group.

[30] Piovesan, C. (2019). Old gigs, new gigs: Are courts and legislators reinterpreting an age-old debate for the new world of work? Brave New Work Key Issues Series. Public Policy Forum.

TECHNOLOGY, RELATIONSHIPS AND POWER

The types of technologies that are developed and their implementation will always reflect the priorities and biases of whoever is paying to develop and use them.[31] It is important to consider the non-neutral ways technology is conceived, developed and applied. In many cases, technology is all about relationships—and has surprisingly little impact on the actual process of work and production.

This is certainly true of the technology underlying most digital platform businesses. Consider ride-hailing. Digital apps have changed the way these rides are booked, but rather trivially; instead of phoning, a passenger can now book their car online. That change in practice is hardly revolutionary or "disruptive." Moreover, it is fully compatible with traditional business models and forms of employment in the taxi industry (indeed, most traditional taxi companies have also implemented digital booking systems). Digital booking does not require or presuppose far-reaching changes in how work is organized and compensated. Yet employers have seized the opportunity to use this technology to restructure work practices, reduce labour costs and shift risk to the drivers.[32]

The key innovation of Uber and its competitors was not to change how passengers are driven from Point A to Point B. Rather, it was to fundamentally change employment relationships, so that drivers are classified as independent contractors rather than employees. This allows these businesses to shed risks and costs associated with down time, equipment, accidents and insurance, and more. It sidesteps regulations that once aimed to establish minimum standards for compensation and incomes in the taxi industry, ranging from collective bargaining to limits on numbers of allowed drivers. With a digital app, the platform company controls transactions and captures a large share of revenue from what is intrinsically a small-scale, decentralized and rather mundane activity.

Reclassifying workers as contractors also allows the employer to avoid the normal obligations of employment, such as minimum wages, workers' compensation premiums, paid holidays and sick time. The common claim that allowing drivers to close their app and stop working somehow negates employers' normal labour obligations is morally and legally unconvincing, as a growing number of legal precedents around the world is confirming.[33]

[31] Kirkpatrick, G. (2008). Technology and social power. Basingstoke, England: Palgrave.

[32] Stanford, J. (2018). Subsidising billionaires: Simulating the net incomes of UberX drivers in Australia. Canberra: Centre for Future Work at the Australia Institute, 32.

[33] Piovesan, C. (2019). Old gigs, new gigs: Are courts and legislators reinterpreting an age-old debate for the new world of work? Brave New Work Key Issues Series. Public Policy Forum.

There are many other examples of how new technology is changing employment relationships, without significantly altering production. For instance, digital technology has made workplace surveillance cheap and hence omnipresent, used for monitoring, evaluating and disciplining workers.[34] Digital technologies can even be used to hire and fire workers—like ride-hail drivers deprived of their livelihoods when their web-based customer ratings fall too low for their employer's liking.

These "innovations" in digital surveillance and performance management have negative consequences beyond infringing workers' privacy and dignity. When it is so inexpensive for employers to motivate their workers with an ubiquitous digital "stick," there is less need for them to use a "carrot"—that is, less pressure to offer attractive salaries, promotions and job security to motivate performance and retention. The growing role of digital surveillance and discipline in employer human resource strategies is one cause of the worrisome wage stagnation in many industrial countries over the past decade.[35, 36]

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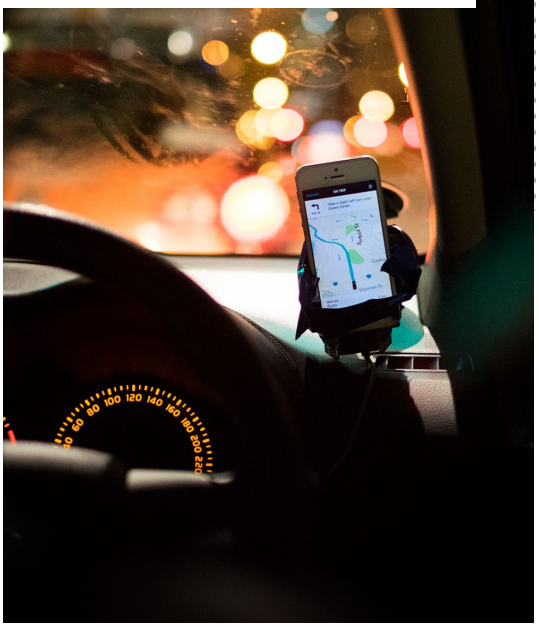


[34] Henderson, T., Swann, T. and Stanford, J. (2018). Under the employer's eye: Electronic monitoring & surveillance in australian workplaces. Centre for Future Work. Australia Institute.

[35] No Author. (2018). "Nefarious" technological surveillance suppressing wages: Expert. Workplace Express.

[36] Ow, P. (2019). 62 problems and challenges faced by employees at work. Allmoneymakingideas.com.

TECHNOLOGY IN ACTION: FAST OR SLOW?

New devices and robots can perform incredible feats in controlled and laboratory settings. But their impact on real-world work and productivity is not accelerating as expected. In fact, it seems to be slowing.[37, 38] In practice, many real-world hurdles and prerequisites must be overcome before some of these innovations can be adopted in widespread day-to-day use.[39, 40] Automation, artificial intelligence, and other innovations can't be used in practice without major capital investments by firms; enhancements in infrastructure; meeting safety, privacy and insurance requirements; new training and qualifications for workers; and social acceptance.

Take the case of self-driving vehicles. While autonomous vehicle technology has advanced rapidly, the barriers to its use in real-world applications are still so daunting that this shift will almost certainly take place slowly and over multiple decades.[41] For now, driving (whether trucks, buses, taxis or even bicycles) remains one of the fastest-growing occupations.[42] To be sure, the elimination of monotonous, low-paying, often dangerous driving jobs could be a positive development, so long as displaced workers could be assigned to less dangerous and better paying work. But in practice, this occupation is going to stay with us for a long time to come.

[37] Baker, D. (2015). The job-killing-robot myth. Los Angeles Times.

[38] Manokha, I. (2019). New means of workplace surveillance: From the gaze of the supervisor to the digitization of employees. Monthly Review.

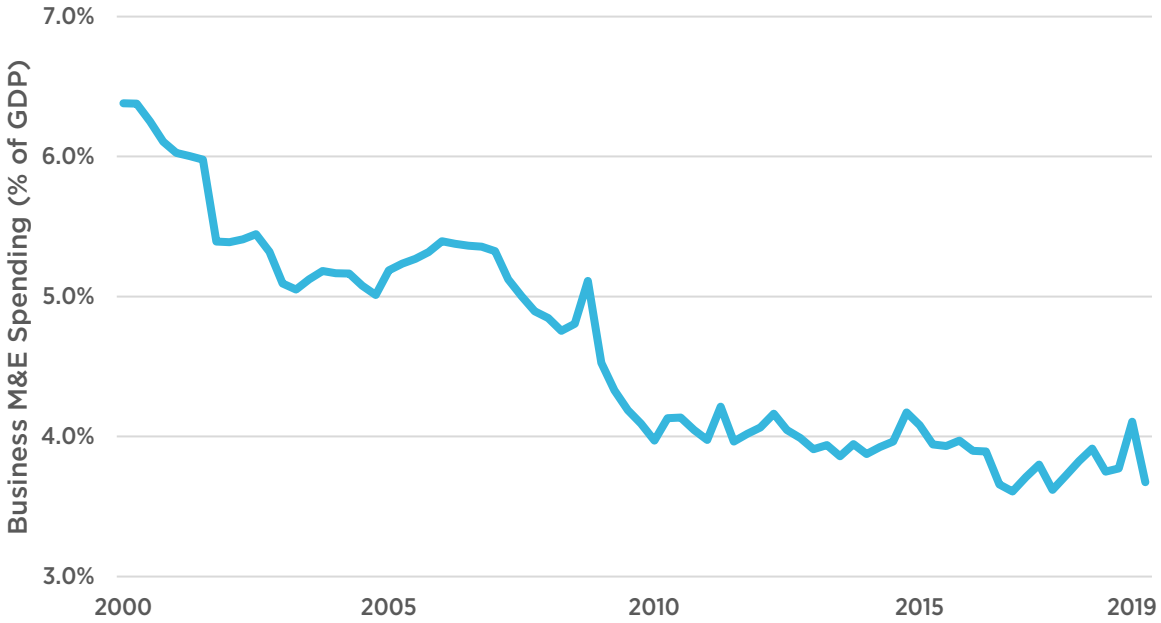
[39] Holley, P. (2018). Tesla misses model 3 production goal — again. The Washington Post.

[40] Premack, R. (2019). America's 1.8 million truck drivers don't need to worry about autonomous tech threatening their jobs anytime soon, experts say. Business Insider US.

[41] Stanford, J. and Grudnoff, M. (2018). The future of transportation work: Technology, work organization, and the quality of jobs. Centre for Future Work, 43-47.

[42] Ibid.

Figure 1
Business Investment in Machinery and Equipment, Canada, 2000-2019



Source: Author's calculations from Statistics Canada Table 36-10-0104-01.

In recent years, business investment has been very weak in Canada and many other industrial economies.[43] And Canadian businesses have lagged behind others in technology adoption.[44] Businesses are investing too little—not too much—in robots, automation and other forms of capital equipment and technology. As illustrated in Figure 1, private capital spending has declined by more than one-third as a share of GDP since 2000. The continued expansion of low-productivity, menial jobs is one consequence of this chronically weak investment performance.[45]

This explains a perverse finding: the aggregate capital-intensity of production in Canada's economy is actually *falling*. After depreciation, net capital assets have been growing more slowly than employment. In other words, the typical Canadian worker uses less capital equipment in their work today, not more.

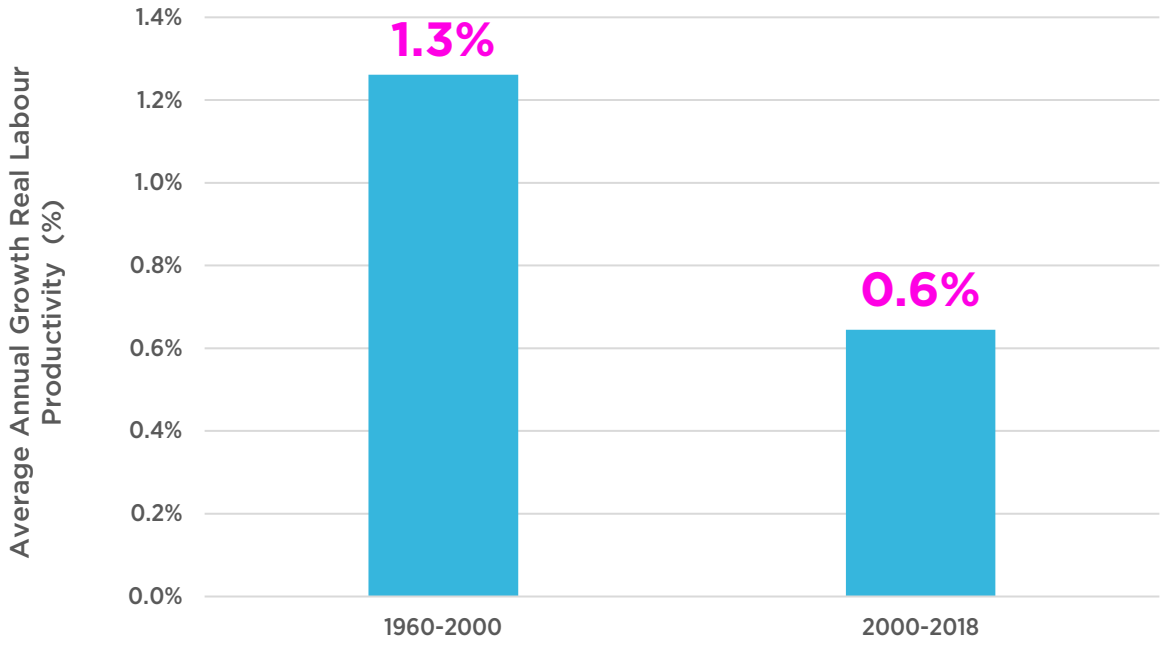
[43] Stanford, J. (2019). Chapter 1: The great stagnation and the failure of business investment. In Dieter P. et al. (Eds.)., Austerity: 12 myths exposed. Social Europe, 1-9.

[44] Lamb, C., Munro, D. and Vu, V. (2018). Better, faster, stronger: Maximizing the benefits of automation for ontario's firms and people. Brookfield Institute for Innovation + Entrepreneurship.

[45] Organisation for Economic Co-operation and Development. (2019). Low productivity jobs continue to drive employment growth. Statistics and Data Directorate.

Instead of pumping after-tax profits into new capital and technology, businesses are instead emphasizing dividend payouts, share buybacks and generous executive compensation.[46, 47]

Figure 2
Labour Productivity Growth, Canada, 1960-2018



Source: Author's calculations from OECD Economic Outlook database.

Because of the chronic weakness in business capital spending and innovation, economy-wide productivity growth is slowing down, not speeding up. This is the most compelling indicator that the use of labour-saving technology is not actually accelerating. As illustrated in Figure 2, labour productivity has grown by less than 1% a year since the turn of the century. That's unspectacular by both historical and international standards, and is less than half the pace of the period from 1960 through 2000.

In the expansionary postwar decades of the 1950s, 1960s and 1970s, unemployment was low, real wages grew rapidly and social programs expanded. Technological change and productivity growth went hand-in-hand with rising living standards, near-full employment and growing social security.[48, 49] Today,

[46] Zochodne, G. (2019). 'The American disease': Canadian companies pouring cash into stock buybacks as backlash grows abroad. Financial Post.

[47] Macdonald, D. (2019). Mint condition: CEO pay in Canada. Canadian Centre for Policy Alternatives.

[48] Usalcas, J. and Kinack, M. (2017). History of the Canadian Labour Force Survey, 1945 to 2016. Statistics Canada. Government of Canada.

[49] Statistics Canada. (2001). Productivity growth in Canada. Government of Canada. C

however, society is more unequal and competitive.[50] This has reinforced the uncertainty and precarity experienced by many Canadians, which in turn fosters fear and resistance to new technology.[51] It is the change in the social and economic context of work, not technology itself, that best explains the insecurity and inequality so visible in Canada's labour market.

SKILLS IN CONTEXT

Many analysts concede that technologically driven employment disruptions in particular industries and occupations will occur. But many are confident that the normal equilibrating tendencies of the labour market (helped along, when needed, by countercyclical monetary and fiscal policy) should ensure that enough new work is created to absorb any significant displacement of labour. In this view, smoothing the necessary and inevitable transitions, rather than resisting them, is the best focus for policy. And in this regard, the call for more and better education and skills always takes top billing. This focus on skills is reinforced by complaints from employers that they face an ongoing shortage of skilled workers. They want government to fix that problem by delivering a bigger supply of job-ready graduates and relaxing restrictions on recruiting foreign migrant labour.[52, 53]

The conviction that economic growth is held back by widespread skilled labour shortages needs to be re-examined. Canadian workers are better educated than any generation before them and better educated than workers in most other countries. Indeed, the Organisation for Economic Co-operation and Development (OECD) reports that 57% of Canadian workers aged 25-64 have tertiary education, the highest proportion of any OECD country.[54] Education enrolment and attainment is even higher among young workers—the very ones now being told they must resign themselves to a never-ending series of gig jobs, rather than a traditional career.

Investments in education do not, in and of themselves, create jobs in which newly skilled or reskilled workers can use those skills. And unfortunately, many Canadians hold jobs that do not remotely use the skills and capacities they have already acquired.[55] Recent research shows that in conditions of chronically weak labour demand, employers can demand greater educational requirements from job applicants

[50] Weil, D. (2017). The fissured workplace: why work became so bad for so many and what can be done to improve it. Harvard University Press.

[51] Loewen, P. and Allen Stevens, B. (2019). Automation, AI and anxiety: Policy preferred, populism possible. Public Policy Forum.

[52] Kelly, D. (2016). Immigrants are the solution to Canada's labour shortage. Huffington Post.

[53] Snyder, J. 2019. Amid worker shortage, business groups call on ottawa to expand jobs programs in pre-election budget. National Post.

[54] Organisation for Economic Co-operation and Development. (2015). Education Policy Outlook Canada. OECD Publishing.

[55] Braham, E., Tobin, S. (2019). Solving the skills puzzle: The missing piece is good information. Skills Next. Public Policy Forum, Diversity Institute at Ryerson University, Future Skills Centre.

precisely because they can be more discerning in who they hire.[56] This sparks an unproductive process of credential inflation, whereby employers' expectations increase with the number of applications they receive for each opening.

This is not to discount the value of investments in all of levels of public education: from early childhood education,[57] to vocational training, to lifelong learning opportunities for employed workers[58]. And there are ways that school-to-work transitions and the usefulness of education for employment could be improved. As demonstrated in Germany and other European countries, high-quality vocational education linked to opportunities in regulated trades, and strict qualification and certification requirements, enhances confidence in acquired skills and boosts earnings potential.[59]

Despite these benefits, however, skills and training are not a magic bullet for ensuring an efficient and inclusive labour market and smooth adaptation to technological change. They must be accompanied by determined, active measures to expand the availability of decent work, creating more jobs for those skilled workers. This fact is borne out by the widespread underutilization of skills already possessed by Canadian workers. Just as much attention and emphasis must be placed on creating high-quality jobs for future well-educated workers to occupy, so that the individual and social investments made in further training and education are validated and rewarded.

[56] Modestino, A. S., Shoag, D. and Balance, J. (2015). Upskilling: Do employers demand greater skill when skilled workers are plentiful? Working Paper #14-17, Federal Reserve Bank of Boston.

[57] Fortin, P., Godbout, L. and St.-Cerny, S. (2012). The impact of Quebec's Universal Low Fee Childcare Program on female labour force participation, domestic income, and government budgets. University of Sherbrooke Working Paper 2012/02.

[58] Blanden, J. et al. (2010). Measuring the returns to lifelong learning. Centre for the Economics of Education. London School of Economics. CEE Discussion Papers.

[59] Hoffman, N. and Schwartz, R. (2015). Gold standard: The Swiss vocational education and training system. International Comparative Study of Vocational Education Systems. Center on Education and the Economy.

CONCLUSION: CHOOSING A GREAT FUTURE FOR WORK

Canadian workers face many challenges, including pervasive precarity, stagnant and increasingly unequal incomes, and limited avenues to exert a collective voice in their work lives. The challenges and uncertainties arising from technological change, including automation and the rise of on-demand platforms, only make these already difficult problems seem all the more daunting.

Yet technology will not independently determine the future of work. Rather, conscious and collective policy decisions will determine whether this future is amazing, or grim. Used well, technology could allow people to work less, eliminate tedious or dangerous work, and balance production with environmental sustainability. So there are reasons to remain fundamentally optimistic about the prospects for building a much better world of work in the future. Technology will not independently or inexorably determine the direction of change, in either dystopian or utopian ways.

Rather, it is the conscious and collective decisions we make as a society that will determine whether the future of work is promising or frightening. Realizing a more hopeful future requires a more thoughtful, collective and democratic approach to technological change and labour market policy. It requires having the capacity to negotiate competing priorities, and using policy to realize technology's positive potential, while minimizing its downsides and blocking its abuses.

To achieve this, we need more thoughtful, inclusive strategies for managing technological change and achieving a great future for work and workers. To achieve that goal, the following priorities need to be given greater emphasis in both research and policy development:

How can employers make stronger commitments to redeployment and upgrading of workers affected by technology (thus facilitating internal mobility)?	What commitments are needed by government to income protections, genuine training and adjustment assistance for workers (to facilitate external mobility)?	What limits should be placed on the abuse of digital technology in workplace surveillance, performance monitoring and staff discipline?
How can workers in digital and on-demand businesses be provided with the same basic rights and protections as other workers (including minimum wages, paid time off, pensions and workers' compensation)?	How can vocational training programs be better planned, funded and delivered? How can these programs be linked more effectively to pathways into recognized, regulated trades and careers?	What does a commitment to genuine full employment in macroeconomic policy look like in today's economy, and how can such a policy be implemented?
What investments in public human and caring services are needed—to both create high-value jobs and support the ongoing individual and community capacity-building that will be critical to well-functioning future labour markets?	What other social policies, such as housing, health care, childcare, income support and job transition supports would help protect and increase opportunities for workers?	How can we ensure more equitable opportunities for historically disadvantaged groups (like young workers, women, racialized workers, workers with disabilities and others) who are typically "last hired, first fired" in a competitive, underutilized labour market?

The potential of technology can be channelled and managed in ways that lift the quality of work, and the quality of life, rather than intensifying and degrading it. Achieving this vision will require a conscious redistribution of power: reclaiming unilateral authority from the private interests that currently make

most of the decisions, and sharing it with workers, communities, educational institutions and all of society.

Changes to the world of work are not technologically determined. Rather, the impact of technology in the workplace is shaped by priorities and practices determined by actual human beings—most often those who have paid for its development and implementation. The social and economic context for the relationship between technology and work directly impacts whether work is decent, and who can participate in the labour market.

To ensure that the future of work is inclusive, balanced and efficient, governments and regulators must make proactive choices about how work is directed, organized, compensated and valued, rather than leaving it to the "market." We need more inclusive processes to balance competing interests, respect ideas and preferences from across the full range of stakeholders (not just employers and investors), and build an awesome future for work: one where the forces of technology, creativity and productivity can create better jobs and build better lives.

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