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POLICY BRIEF

Key points

- Expanding the digital revolution into production promises far-reaching welfare and productivity gains.
- Robotization in developed countries erodes developing countries' traditional labour-cost advantages, while robotization in the latter reduces the potential of manufacturing to absorb surplus rural labour, the basis on which industrialization strategies have traditionally relied.
- Effective innovation policies and stepped-up capital investment can help capture benefits from digitization and tax reform may replace lost fiscal revenue from a robotized workforce.
- Enhanced social protection for freed labour, and innovation that complements the digital revolution, can help ensure inclusiveness.



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HARNESSING EMERGING TECHNOLOGICAL BREAKTHROUGHS FOR THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Leveraging innovation is central for achieving the Sustainable Development Goals agreed by the international community in September 2015 as part of the 2030 Agenda for Sustainable Development. The expansion of the digital revolution into production processes, exemplified by what some have come to call the fourth industrial revolution, promises far-reaching development benefits, but also poses new challenges to inclusiveness. Achieving the Goals will require realizing the potential of these new innovations not only for transforming economies, tackling vulnerability and building resilience (Goal 9), but also for attaining economic growth and decent work (Goal 8) and reducing inequality (Goal 10). To harness these benefits, a strengthened and revitalized global partnership (Goal 17) will be crucial, supported by policies that address a host of emerging issues, from translating innovation into investment to safeguarding universal benefits from productivity growth.

The contribution of innovation to development is greatest when innovation-based investment raises productivity growth and allows workers operating new machinery and software to demand higher wages, with resulting higher aggregate spending further boosting investment and the prosperity of society as a whole.¹ Relative to the productivity gains and economic transformation engendered by the steam engine and electricity, the digital age has yet to deliver.² Part of this underperformance may be due to mismeasurement, as the many products the digital economy provides for free are not captured in productivity statistics. Another possibility is that many of the benefits have yet to be seen.

Reaping the full benefits of the digital revolution is becoming increasingly likely given the move to an era of big data and what is called the

Internet of Things. What is often termed the fourth industrial revolution is set to address the slowdown in productivity growth that has afflicted the world economy over the past few years.³ If such innovations permit the digital age to have an impact on the order of the earlier industrial revolutions, the digital economy will, sooner or later, provide universal benefits and contribute to the 2030 Agenda for Sustainable Development.

The fourth industrial revolution fundamentally shifts established modes of production. It mainly concerns the increased use of robots powered through Internet links between computers and massive data storage and computing resources. A distinctive feature of robots is that they free workers not only from routine but also from predictable activities. In addition, the artificial intelligence of robots

1 For a more complete account of key trends related to science, technology and innovation likely to be relevant under the 2030 Agenda for Sustainable Development, see United Nations Economic and Social Council, 2015, Strategic foresight for the post-2015 development agenda, E/CN.16/2015/3, 23 February.

2 See, for example, M Ford, 2015, *Rise of the Robots: Technology and the Threat of a Jobless Future* (London, Basic Books), and World Intellectual Property Organization, 2015, *World Intellectual Property Report: Breakthrough Innovation and Economic Growth* (Geneva).

3 See, for example, World Economic Forum, 2015, The fourth industrial revolution: what it means, how to respond, available at <https://agenda.weforum.org/2015/12/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/> (accessed 12 January 2016).

implies that, contrary to earlier industrial revolutions, the new machinery and equipment does not make workers operating it more valuable. Modes of production also change as digitized knowledge in data and applications, once generated, may be reproduced endlessly at almost no extra cost. The increased use of robots, therefore, provides enormous efficiency gains in production and services provision. From an optimistic point of view, such gains may be further enhanced as freed workers may perform additional or more interesting work or engage in personal development and cultural activities that eventually benefits the well-being of societies.

However, the overall effect of the use of robots may be less positive and result in a vicious circle of job displacement, widening lack of equality and welfare reduction. One reason for this is that potential benefits accrue in a stratified way, as the labour market effects of using robots differ across skill categories. Using robots tends to generate employment for a few high-skilled workers that create artificial intelligence or monitor automated activities, but tends to reduce employment in routine and predictable activities that span not only low-skilled categories but also, increasingly, medium skill-level categories. According to a widely cited estimate, almost half of all jobs in the United States of America may be open to automation within the next two decades.⁴

The inclusiveness of potential benefits from robotization may be further reduced, as the increased use of robots in developed countries implies an erosion of the traditional labour-cost advantages of developing countries. The resulting shortening of global value chains and accelerated relocation of production back to developed countries could deprive developing countries from current employment and income opportunities.

Developing countries may contain these adverse effects by accelerating the use of robots themselves. Yet doing so may merely substitute the erosion of their labour-cost advantages by adding domestic pressure to the stratification of their labour markets, similar to situations observed in developed countries. Importantly, doing so could limit the

potential of manufacturing sectors to absorb large numbers of rural workers, which is the basis on which industrialization strategies have traditionally relied.

Taken together, the welfare and productivity gains from the fourth industrial revolution may be profound, and may offer even more opportunities that have not yet been recognized. However, there are new and serious concerns to be considered that may have a detrimental impact, particularly on the vision of sustainable development embodied in the 2030 Agenda for Sustainable Development. These concerns may be grouped under three headings and are detailed in the following sections.

Replacing lost fiscal revenue

If the widely anticipated large-scale replacement of jobs by robots comes to pass, it may cause substantial losses to Government fiscal revenue, as a significant part of tax receipts comes from income taxes and payroll-based insurance levies. Such losses could lead Governments to struggle to find the resources necessary to fund social protection at a time when more people may be requiring such schemes.

Eliminating tax avoidance and tapping new sources, for example in the form of financial transactions and carbon emissions taxes, may address part of the challenge of substituting lost fiscal revenue. Another method may be to restructure income tax systems to make them more progressive or introduce new higher tax brackets for very high incomes, to mirror developments in income distribution. Concerns that such measures could create adverse incentives and further increase the already disproportionate tax burden for the labour force may be addressed by taxing the use of technology and robots. Yet this may actually hamper the diffusion of innovation and the associated welfare and productivity benefits. A further possibility may be to tax property, such as by placing levies on land and real estate. Doing so may fully replace lost fiscal revenue and at the same time address equality concerns while maintaining incentives to invest in innovation and technology diffusion.

4 CB Frey and M Osborne, 2013, The future of employment: How susceptible are jobs to computerization?, Oxford Martin School Working Paper, available at <http://www.futuretech.ox.ac.uk/future-employment-how-susceptible-are-jobs-computerisation-oms-working-paper-dr-carl-benedikt-frey-m> (accessed 12 January 2016). For a different view, see DH Autor, 2015, Why are there still so many jobs? The history and future of workplace automation, *Journal of Economic Perspectives*, 29(3): 3–30.

Capturing potential benefits

To capture the benefits from technological progress more generally, innovation must diffuse widely throughout the economy. This requires moving promising technology from the laboratory to operational machines and incorporating such machines into production processes. Success in the first of these steps depends on close collaboration between Governments, science and technology centres and the business community.

The Internet itself and many related innovations resulted from close collaboration between an entrepreneurial State and science and technology clusters, supported by industrial policy that facilitated the commercial use of the resulting innovations through corporate investment.⁵ For a better link between innovation and industrial policies, developing countries need to enhance policy coherence, reduce competition between ministries and other agencies, enhance capacity in policy evaluation and monitoring and improve coordination between policymaking and private sector engagement.⁶

With regard to the second step, capital investment is required to incorporate new machinery, equipment and software into production processes and translate innovation into productivity growth, quality improvements and new forms of economic output. Some observers have suggested that the recent decline in productivity growth observed across developed countries reflects a slowdown in innovation.⁷

However, the decline in corporate fixed investment, which may be observed in most developed countries from even before the financial crisis, may be more important.⁸ Ageing societies and offshoring may have caused some of the slowdown in corporate investment in developed countries. Yet innovation and the ensuing decline in the prices of machinery and equipment have clearly also played a role, as has deficient aggregate demand stemming

from an increased lack of equality in income and wealth.

A range of policies are available to return to rising corporate investment and accelerate the diffusion of innovation in developed countries. One is expansionary fiscal policy, especially through boosting public investment in infrastructure that is complementary to corporate investment. Another is changes in corporate taxation, including higher tax rates on retained earnings, combined with the full deductibility of investment and dividend payments, which may encourage both investment and the distribution of profits. Yet for a sustained increase in aggregate demand, an increase in the wage share is likely to be indispensable. Policies regarding minimum wage and income that reverse the trend towards a widening gap between productivity and wage growth may help achieve this.

Ensuring inclusiveness

Enhanced technology transfer continues to be the basis for economic and social upgrading in many countries behind the technological frontier. In addition, boosting corporate investment to accelerate the dispersal of innovation throughout the economy and tackling the rising lack of equality in income and wealth are crucial not only to reap the full benefits of the fourth industrial revolution but also to enhance their inclusiveness under the 2030 Agenda for Sustainable Development. To protect workers made redundant by the greater use of robots, further distributional policies are needed. One possibility is a basic income guarantee or similar ways of providing social protection floors. Such measures may be financed by the tax reforms already referred to. They may be further complemented by more decisive action to strengthen workers' rights and provide extended social protection.⁹

A more direct way to promote inclusiveness may be by pursuing innovation that is complementary to the digital revolution. Targeting the eradication of poverty in developing countries, pro-poor

5 M Mazzucato, 2013, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (London, Anthem Press).

6 UNCTAD, 2015, *Technology and Innovation Report 2015: Fostering Innovation Policies for Industrial Development*, (New York and Geneva, Sales no. E.15.II.D.3, United Nations publication).

7 RJ Gordon, 2015, Secular stagnation: A supply-side view, *American Economic Review*, 105(5): 54–59.

8 JW Gruber and SB Kamin, 2015, The corporate saving glut in the aftermath of the global financial crisis, International Finance Discussion Paper no. 1150, Board of Governors of the Federal Reserve System, available at <http://www.federalreserve.gov/econresdata/ifdp/2015/files/ifdp1150.pdf> (accessed 12 January 2016).

9 For further discussion of such complementary measures, see United Nations Development Programme, 2015, *Human Development Report 2015: Work for Human Development* (New York, Sales no. E.15.III.B.1, United Nations publication).

inclusive innovation, for example, aims at developing new goods and services for those at the bottom of the income pyramid and otherwise excluded people. This may be achieved by nurturing an innovation-friendly environment in sectors (such as health, education and small-scale agriculture) that matter most to these target groups and by promoting innovation undertaken by these groups themselves, as they know their own preferences best.

Enhancing domestic innovation through a combination of innovation and industrial policies is also crucial for some large developing countries, where consumer demand from the domestic middle class has been expanding rapidly. Such innovation would allow for the production of goods and services that match the incomes and preferences of these consumers and that may often not be provided by developed country producers whose cost structures are determined by the income and preference structures of their home markets. The enhanced production of such goods in developing countries would also create the income that their consumers require to purchase these goods, in order that boosting domestic consumer demand would not lead to surges in household debt.

Addressing climate change through innovation in developing countries could further reduce potential adverse effects from the growing use of robots in developed countries. This may require considering climate change as an opportunity for technological catch-up as much as a challenge for economic development. The recent adoption of the Paris Agreement under the United Nations Framework Convention on Climate Change provides a framework of new targets and transparency measures, as well as financial support for poor countries, which will guide policies in this area over the next few years.

To conclude, only a comprehensive approach may harness the evolving global innovation and technology landscape and deliver the policy response required to achieve prosperity for all while preserving the planet. Effective global partnerships among all countries, sufficient financing for development and close cooperation between Governments and the private sector will be indispensable. UNCTAD will continue to use its integrated mandate – which links technology, investment and trade to inclusive development – to help make this happen.

Contact

Policy Brief Ref.: 2016/45
Office of the Secretary-General
sgo@unctad.org
Tel. 41 22 917 5806
Press Office
Tel. 41 22 917 5828
unctadpress@unctad.org
unctad.org

