

Technology, Productivity and The Fourth Industrial Revolution

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Technology is a Key Driver for Productivity

Long lasting and permanent increases in productivity and potential output can only be achieved through technology. Gains from productivity can only increase over a short period of time by reallocating resources or increasing the use of inputs. That does not mean, however, that true productivity improvements are actually achieved. Consider the daily operations on a farm. If a farmer reaps crops by hand, he might pick 30 pounds of fruit per hour. He can increase the quantity of fruits he picks by working longer hours, but the rate at which he picks, his rate of productivity, is still the same. However, if the farmer uses an automated harvesting robot, which is a highly intelligent machine designed to assist labour, he may be able to reap 120 pounds per hour. In this scenario, technology would have improved the quantity of fruit the farmer can harvest without requiring him to work harder or longer. This demonstrates how productivity improvements are attained using technology.

A recent study, *Global Productivity: Trends, Drivers, and Policies*, highlighted how important technology is as a driver of productivity across the globe. The study found that technological productivity drivers such as innovation, education, and investment in physical capital accounted for 65% to 75% of productivity improvements between 1980 and 2018 (Dieppe, 2020). Technology works alongside and through the aforementioned drivers to stimulate the rate at which output can be produced.

The adoption of technology facilitates economic complexity, and thus the production of more diverse and higher value outputs. Economic complexity measures the knowledge in a society based on the products made within that particular country (Harvard University Growth Lab, 2021). The production of higher value-added products generates higher incomes and a higher standard of living. It can also reduce the cost of information and promote market access, thereby increasing efficiency and increasing the quantity and quality of production in the region (Dutz, Almeida, & Packard, 2018).

Technology and Productivity in Jamaica and the Caribbean

While technological adoption in Jamaica lags behind developed economies, the application of technology in Jamaica has facilitated productivity improvements by enhancing the way firms do business. One such way has been the emergence of financial technologies (fintech) which have provided consumers with easier access to the services offered by financial institutions. They can easily send and receive money between accounts, and make payments. In addition, such a system enables financial workers to be more productive. Technology provides an effective medium for financial product marketing to potentially reach a wider range of consumers and increase brand awareness. In fact, data from the Jamaica Productivity Centre reveals that the Finance and Insurance Services industry has the second highest labour productivity rate in Jamaica from 2008 to 2018.

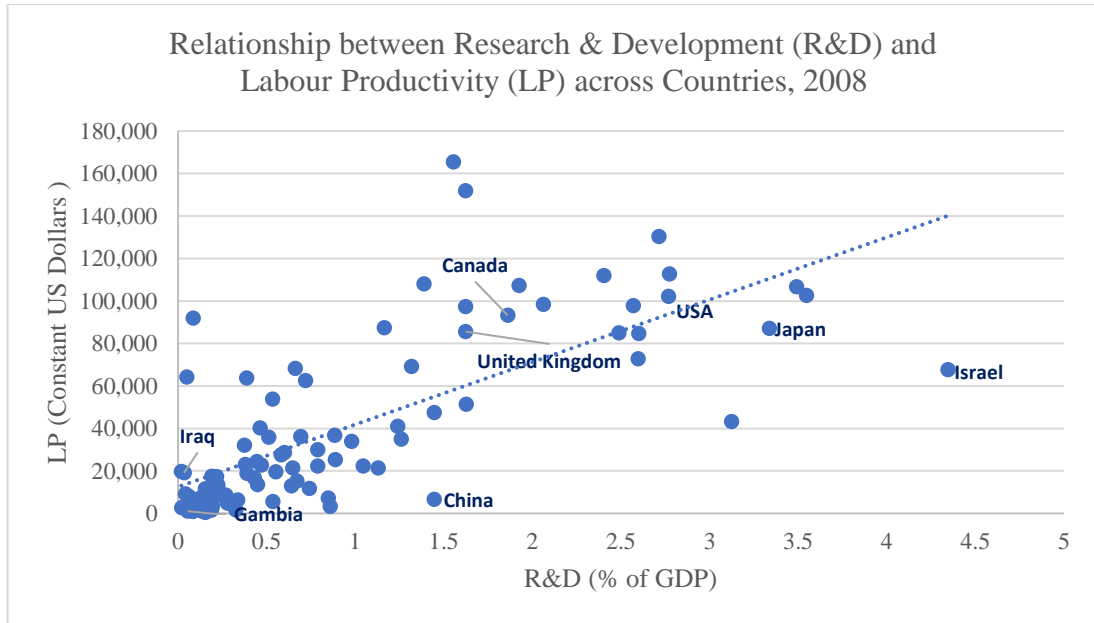
Technology has also given rise to e-commerce in Jamaica. With the increasing establishment of small online based businesses providing consumer goods and services, suppliers can easily connect with local and international markets. This has increased customer access and enabled brand awareness, as well as, lowered business overhead costs. Local musicians are also able to utilize technology to sell their music globally to maintain their income streams during the pandemic.

Technology is also useful for the provision of public services. As a country, we can develop and improve efficiency through technology that facilitates new business models, transforms the sustainability of our healthcare systems and complements the provision of geriatric and child care. There is local evidence of the avenues that have been created for public institutions to assist businesses to improve productivity and competitiveness. For instance, the Jamaica Trade Information Portal (JTIP) which is regulated by the Ministry of Industry, Commerce, Agriculture, and Fisheries (MICAF) provides information about importing to and exporting from Jamaica. This has reduced time and costs for firms and individuals who wish to transport goods across our borders. Essentially, it ensures transparency of Jamaica's trade procedures while reducing traders' costs and enabling them to efficiently do businesses across the country's borders.

In comparison to more advanced economies, technological progression is slowly adopted in the Caribbean region and as a result we tend to lag behind. Thus, increasing the rate of technological adoption will enhance productivity. The Economic Complexity Index can be used as a signal of technological deepening in Jamaica. According to the Harvard University Growth Lab, Jamaica has a lower level of complexity than is expected due to its level of income. In terms of Gross Domestic Product (GDP) per capita, Jamaica is ranked 76th out of 133 countries but ranked 92nd in the Economic Complexity Index—a rank of countries based on the diversity of their export basket. Over 90% of Jamaica's exports in 2018 were classified as having low economic complexity. Greater use of technology by producers of goods and services can assist in diversifying outputs and increasing the complexity of exports.

Facilitating Technological Advancement through Research & Development (R&D)

The use of R&D as a key factor for economic growth and productivity enhancement is not new. Productivity gains from technology are amplified when there is R&D. The World Bank estimated that R&D amounted to 0.6% of Jamaica's GDP in 2002. Whereas, the world average was just over 2.0%. Following this, it was noted in 2017 that R&D in the Latin America and the Caribbean accounted for 0.7% of GDP compared with 2.1% for the world. Furthermore, recent data indicated that R&D in Jamaica accounted for 0.1% of GDP (Schwab, 2019). As the evidence suggests, Jamaica has lagged behind in terms of R&D enhancements likewise technological adoption. As a result, Jamaica needs more R&D supported facilities and resources.



Source of data: The World Bank Open Data

The diagram above displays the relationship between R&D as a share of gross domestic product and the growth in labour productivity across countries. Note that, data for both variables were obtained from the World Bank Open Data for the year ended 2008 for 91 countries. The graph shows that a higher share of R&D is associated with rising labour productivity, a relationship that has held true over time. Emphasizing that there is a positive relationship between productivity and R&D as a share of output. It is important to realize that R&D carried by the business sector stimulates new products and services, better output efficiency and new manufacturing processes (Amani & Fox, 2015). In addition, research conducted in Iran indicated that R&D expenditures in medium-tech and high-tech industries have the most positive and important effects on productivity growth (Soltanisehat, Alizadeh & Mehregan, 2019).

Economic growth is driven by innovation, which is fueled by R&D and technological advancements. Nonetheless, technological development can be supported by targeted R&D programmes and strategic public procurement. Evidence from the Global Competitiveness Report 2019 suggested that public and private investment in R&D, technological diffusion aimed at job creation and the development of new firms are necessary for economic transformation and recovery (Schwab & Zahidi, 2020).

COVID-19 influencing the pace of the Fourth Industrial Revolution (4IR)

The Fourth Industrial Revolution refers to a new era of emerging technologies blurring the lines between the physical and digitized world in unanticipated ways (Philbeck, & Davis, 2018). As a result, our way of life will be affected by technological advancements and how economies use advances such as blockchains, artificial intelligence (AI) and automations to improve efficiency. Despite the adverse economic effects, the COVID-19 pandemic has accelerated the pace of the 4IR across the globe. Information and communications technology (ICT) have facilitated work-from-home and the manufacturing sector has been transitioning with advanced technologies such as internet of things (IoT), AIs, 3D-printing and robotics,

eroding traditional practices (United Nations Industrial Development Organization (UNIDO), 2020).

Moreover, the pandemic has also created a “new normal” whereby, interviews, business meetings and other collaborations that were usually conducted face-to-face are now being conducted using virtual platforms. Furthermore, with measures implemented to stop the spread of the disease, there is less office space used in some organizations and, by extension, firm’s variable costs are lower and there are potential gains from increased staff productivity due to reduced travelling time.

As denoted by UNIDO (2020), although the pandemic has hindered some business trends, other business trends have accelerated, such as the digitization of manufacturing processes, the creation of more efficient global value chains and the improvement of trade in regional spaces. More efforts should therefore be made to develop quality infrastructure to increase competitiveness, as well as technological upskilling and learning. In addition, focused efforts are needed to attract foreign direct investment (FDI) to enhance knowledge and technology transfer.

Moving Forward

With the continued preparation for the 4IR, Jamaica needs more educated and competent graduates in the field of Science, Technology, Engineering and Mathematics (STEM). They are not only necessary for the operation and functioning of advanced computer software and technology, but also for equipping Jamaicans to be technologically advanced innovators and developers.

It is important to note that the adoption of AI has real implications for the global services sector and R&D in all industries. Additionally, AIs have changed the way services such as travel and, vacations are marketed to tourists. In the Services Sector, AIs and the wider use of technology tend to be more complementary to labour than in the goods sector. Since, Jamaica is well known for tourism, going forward, AIs can aid in advanced data collection that humans find difficult. AIs can quickly make predictions that allow us to assess the needs and desires of tourists and clients such as pricing strategies and favourite destination packages.

Nonetheless, Jamaica is also a labour driven economy, although the adoption of certain technologies can complement labour it may also displace it, particularly in areas that are easily automated. Effective policies must therefore focus primarily on preparing the labour force for change due to technology shifts. This includes training to complement the labour force with the use of new technologies and interventions that will reduce the negative impacts that workers face as they move forward. Lastly, it is also important to bring forth infrastructures and, institutions that will encourage innovators, as well as increase investments in R&D that supports innovation.

References

- Amani, E., & Fox, K. J. (2015). R&D, innovation and productivity: The role of public support. *KDI Journal of Economic Policy*, 37(1), 73-96.
- Dieppe, A. (2020). *Global Productivity: Trends, Drivers, and Policies (Advance Edition)*. The World Bank Group.
- Dutz, M. A., Almeida, R. K., & Packard, T. G. (2018). *The Jobs of Tomorrow: Technology, Productivity, and Prosperity in Latin America and the Caribbean*. The World Bank.
- Harvard Growth Lab. (2021). *The Atlas of Economic Complexity. Atlas-International-Frontend*. <https://atlas.cid.harvard.edu/rankings>
- Philbeck, T., & Davis, N. (2018). The Fourth Industrial Revolution. *Journal of International Affairs*, 72(1), 17-22.
- Schwab, K. (2018). *The Global Competitiveness Report 2018*. In *World Economic Forum* (Vol. 671)
- Schwab, K. (2019). *The Global Competitiveness Report 2019*. In *World Economic Forum*.
- Schwab, K., & Zahidi, S. (2020). *The Global Competitiveness Report Special Edition 2020*. In *World Economic Forum*.
- Soltanisehat, L., Alizadeh, R., & Mehregan, N. (2019). Research and development investment and productivity growth in firms with different levels of technology. *Iranian Economic Review*, 23(4), 795-818.
- United Nations Industrial Development Organization. (2020). *UNIDO's Response to COVID-19 and the Fourth Industrial Revolution*. Retrieved January 27, 2021, from <https://www.unido.org/stories/unidos-response-covid-19-and-fourth-industrial-revolution>
- United Nations Industrial Development Organization. (2020). *Industrializing in the Digital Age*. Retrieved January 27, 2021, from <https://www.unido.org/resources-publications-flagship-publications-industrial-development-report-series/idr2020>