

The spatial and socioeconomic implications of technology-driven transitions in the context of the Global South

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The relationship between technology and inequality is multifaceted. Significant technological advances are being made across a range of fields, including information communications technology (ICT); artificial intelligence (AI), particularly in terms of machine learning and robotics; nanotechnology; space technology; biotechnology; and quantum computing to just name a few.² These breakthroughs are expected to be highly disruptive and bring about major transformative shifts in how societies function. Technology has enhanced productivity, accelerated economic growth, enabled knowledge and information sharing and increased access to basic services. However, it has also been the cause of inequalities. There are mounting concerns that technology-driven transformation poses some challenges to the development of the South. Rapid technological developments have economic, social, and spatial implications for developing countries, at the very least. For this reason, it is particularly important to enhance connectivity between South-South countries to address global challenges.

1. Adverse economic implications of technology-driven transitions in Global South

Science and technology are primary productive forces. It is undeniable that the development of science and technology will stimulate the development of human economy and society, and technology-driven transition has unlimited potential in the future. However, it is worth noting that technology-driven transitions may also bring crises and challenges, and may have an adverse effect on the economies of developing countries. It mainly includes the digital divide, and the widening gap between the rich and the poor caused by inequality in employment and unbalanced enterprise development.

1) Digital divide

An important content of the technology-driven transition is the development of the digital economy, which will bring about a digital divide between North and South countries. Digital connectivity remains at the heart of a country's economic and social progress through connecting people, government, and business altogether in real time to achieve sustainable development in diverse sectors.³ Yet, not all and sundry in the society has access to information and communication technology (ICT) to do so, which

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² Camino Kavanagh. (2019). New Tech, New Threats, and New Governance Challenges: An Opportunity to Craft Smarter Responses? <https://carnegieendowment.org/2019/08/28/new-tech-new-threats-and-new-governance-challenges-opportunity-to-craft-smarter-responses-pub-79736>

³ Jamil, S. (2021). From digital divide to digital inclusion: Challenges for wide-ranging digitalization in Pakistan. *Telecommunications Policy*, 45(8), 102206. <https://doi.org/10.1016/j.telpol.2021.102206>

results in the problem of digital divide.⁴ This difference in the level of digital technology application between countries is a manifestation of the North-South problem in the digital economy era. According to International Telecommunication Union data, in 2017, the Internet penetration rate in developed countries reached 81%, while that in developing countries was only 41%. And there are still 31 developing countries with an Internet penetration rate of less than 20%. Besides, as for the ICT Development Index (IDI), gap between the highest and lowest performing countries in the Index rose to 8.02 points (out of 10.0), with least developed countries (LDCs) filling 37 of the 44 places in the lowest (least connected) quartile of the distribution.⁵

The process of digital technology dissemination is also the process of global wealth accumulation. For example, the rapid growth of Internet giants such as Microsoft and Google have become an important source of economic growth in developed countries such as the United States. However, developing countries are limited by their own level of economic development and digital technology. For one thing, it is difficult to become a digital consumer country and cannot enjoy the convenience of production and life brought by digital technology; for another thing, even if they become a digital consumer country, it is difficult to realize the transition from a digital consumer country to a digital producer country.⁶ This puts developing countries in a very passive position in the distribution of dividends in the global digital economy.

2) Widening gap between the rich and the poor

There is a huge gap between the rich and the poor in the current society. Recent reports warn of the rise of global wealth inequality—as the richest 1 percent of the world's population owns 88 % world's wealth⁷. However, the technology-driven transitions will further increase the gap between the rich and the poor, and its influence mechanism includes both labor and enterprises.

From labors perspective, technological transformation will decrease employment opportunities. Land, labor, capital, and technology are all important production factors, while with the development of economy and the advancement of science and technology, technology has become more and more important factor, and it may also replace labor. For example, the increasing use of ICT in the workplace means that the labor market requires new skills and digital capabilities, whether in the production of goods and services, or in the need for workers with complementary skills⁸. The development of artificial intelligence technology has also deprived jobs. For young people, they may be excluded from the labor market and lack educational opportunities

⁴ Ibid.

⁵ International Telecommunication Union. (2017). Measuring the Information Society Report 2017. https://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-ICTOI-2017-SUM-PDF-E.pdf.

⁶ Shuzhong Ma. (2020, August 4). Bridging the digital divide and promoting the development of the digital economy. *Guangming Daily*. <https://baijiahao.baidu.com/s?id=1674058536328130341&wfr=spider&for=pc>

⁷ Credit Suisse (2017). *Global wealth databook*. https://www.credit-suisse.com/news/doc/credit_suisse_global_wealth_databook.pdf.

⁸ OECD. (2016). New Skills for the Digital Economy, OECD Digital Economy Papers, no. 258. OECD Publishing, Paris. <http://dx.doi.org/10.1787/5jlwnkm2fc9x-en>.

to enter the increasingly technologically advanced business world.⁹ For ordinary workers, they are laid off and unemployed because they have no skills, becoming victims of technology substitution. The quality of the labor force in developing countries is far lower than that in developed countries, so the unemployment rate in developing countries is even more serious, which will inevitably widen the gap between the North and South countries.

For enterprises, the existing giants become stronger due to technological development, and the creators of large technologies (and companies) will become wealthier due to technological transformation.¹⁰ Internet giants that already have the advantage of scale, hold valuable data resources (such as consumption data controlled by Amazon, social data controlled by Facebook, search data controlled by Google, etc.), and then invest heavily in machine learning to obtain more profits. However, for small companies, they do not have data and technology, which are the foundation of artificial intelligence deep learning. Even if start-up companies have good ideas, most of them cannot escape the fate of being acquired by large companies or plagiarized by large companies. Therefore, shareholders, executives, and very high-level technical personnel accounted for most of the wealth of the technology industry.

2. Social implications of technology-driven transitions in Global South

“Technology driven” in business means the emphasis on technical ability of one company as the motive of innovating new products and services rather than emphasizing the demand of the market.¹¹ For a country, technology driven transitions can bring positive influence and motivate the society to move forward but it also leads to many negative implications, especially from the social perspective.

1) Jeopardizing Mental Health

In the past few decades, enormous advances in technology including automation, digitization, artificial intelligence have been seen in the workplace.¹² Yet, in the process of shifting traditional work form to new “boundaryless” career, technology advances also changed the way people work and brought disruptive influence to workers, undermining workers’ mental health.¹³ Technology in workplaces usually focuses more on the increase of efficiency, outcome and productivity, rendering less attention to the impact on employees.¹⁴ Technology can invent a ‘norm of

⁹ Technological progress has widened the gap between the rich and the poor? (2019, April 14). *Wall Street Journal*. <https://baijiahao.baidu.com/s?id=1630782574830840795&wfr=spider&for=pc>

¹⁰ Ibid.

¹¹ Rosenzweig, E. (2015). *Successful user experience: Strategies and roadmaps*. Morgan Kaufmann. <https://doi.org/10.1016/B978-0-12-800985-7.00004-1>.

¹² Makridakis S (2017) The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. *Futures* 90: 46–60. <https://doi.org/10.1016/j.futures.2017.03.006>.

¹³ Johnson, A., Dey, S., Nguyen, H., (2020). A review and agenda for examining how technology-driven changes at work will impact workplace mental health and employee well-being. *Australian Journal of Management*, 45(3), 402-424. <https://doi.org/10.1177/0312896220922292>.

¹⁴ Ibid.

responsiveness' which usually is linked to concepts like perceived demands, unrealistic performance and productivity expectations, which, to a large extent could provoke workers' feelings of increased mental exhaustion.¹⁵ The frequent use of technology in the workplace also increases workers' time spent in front of the screen and leads to a sedentary work model.¹⁶ It is proven that this workforce behavior is closely linked to poor mental physical health outcomes and could even increase likelihood of physical health problems like diabetes, heart and cardiovascular disease and so forth. Technology also undermines the quality of interpersonal relationships among workers in the workplace by isolating individuals and widening social distance.¹⁷

Overall, technology, by increasing demands, reducing resources and changing how employees work could bring negative implication to employees' mental health.

2) Leading to Resources Depletion and Poverty

Inequality is often seen increasing with overuse of resources. Although access to natural resources offers a larger common pool of social resources, might mitigating poverty, the wealth's exclusive access to technology may lead to excessive resource extraction and depletion of the society's resource as a whole and widen the wealth gap, worsening poverty.¹⁸ In interactions between the social and ecological components based on a model through resource extraction and access to technology, availability to technology rise to local thresholds. However, technology-driven increases resource extraction as a whole in the same time of motivating wealth growth. The negative impacts on the growth of available resources for the whole society will in turn limit the amount of resource for exploitation in the future.¹⁹ Also, although access to technology seems improve wealth, it pushes inequality up, nudging the society to move along a "capital intensive pathways to wealth generation", creating poverty traps and causing inequality rise.²⁰

All in all, the positive relationship between wealth and technology in fact would lead to quite a high level of inequality especially in developing society focus. With a "heavy-tailed distribution of technology", inequality grow fast.²¹ A small group of wealthy upper-class people further accumulate wealth because of access to better technology and accordingly resource. The fast rise in inequality will incur overuse of resources,

¹⁵ Perlow L (2012) *Sleeping with Your Smartphone: How to Break the 24/7 Habit and Change the Way You Work*. Boston, MA: Harvard Business Review Press.

¹⁶ Yang Y, Shin JC, Li D, et al. (2017) Sedentary behavior and sleep problems: A systematic review and meta-analysis. *International Journal of Behavioral Medicine* 24: 481–492. <https://doi.org/10.1007/s12529-016-9609-0>.

¹⁷ Johnson, A., Dey, S., Nguyen, H., (2020). A review and agenda for examining how technology-driven changes at work will impact workplace mental health and employee well-being. *Australian Journal of Management*, 45(3), 402-424. <https://doi.org/10.1177/0312896220922292>.

¹⁸ Mirza, M. U., Richter, A., van Nes, E. H., & Scheffer, M. (2019). Technology driven inequality leads to poverty and resource depletion. *Ecological Economics*, 160, 215-226. <https://doi.org/10.1016/j.ecolecon.2019.02.015>.

¹⁹ Ibid.

²⁰ Gabaix, X., Lasry, J.-M., Lions, P.-L., Moll, B., (2016). The Dynamics of Inequality. *Econometrica* 84, 2071–2111. <https://doi.org/10.3982/ECTA13569>.

²¹ Mirza, M. U., Richter, A., van Nes, E. H., & Scheffer, M. (2019). Technology driven inequality leads to poverty and resource depletion. *Ecological Economics*, 160, 215-226. <https://doi.org/10.1016/j.ecolecon.2019.02.015>.

rendering people who dependent on the resource into poverty.²²

3) Causing Negative influence on education

Technology is radically changing the way we accept education, bringing convenience and mitigating the distance barrier for education. However, it also brings negative impacts to the quality of education. According to Khadija Alhumaid's study, technology has an adverse implication on the quality of education from four perspectives.²³ Overuse of technology undermines students' basic reading, writing, and arithmetic abilities, which are inevitable for student's long-term development. Excessive dependence on technology entails disruption of relationship between teachers and students and among students themselves, eroding the social networking vibe involved in teaching. More importantly, technology driven transits in education area, deepens social inequalities between the haves and the have-nots. Between developed and developing countries, there is a huge gap in technology access in education. It is hard for students in underdeveloped and developing countries to get access to those technology infrastructure and devices that are used by students in developed countries, thus widening the gap on education level between the northern and southern world and thus the labor quality level and development level.

4) Incurring the digital gender divide

"Digital gender divide" refers to the "discrepancy between women's and men's access to IT technology".²⁴ Especially in developing countries, women, have significantly lower technology participation rates than men.²⁵ According to a 2018 OECD report, there are many root causes as to why there is gender-based digital exclusion.²⁶ "Restricted access to digital tools due to affordability, lack of education and technological literacy, gender biases and socio-cultural norms" all contribute to the presence of digital gender divide.²⁷ Social care and health care policies also influence women in a STEM career. Instead of working in the STEM career, it is shown by related survey that women with a STEM degree are more likely to work in education and healthcare.²⁸ The highly automated manufacturing would further weaken women's already poor occupancy at the employment market. In the future, automation is expected to spread to sectors like retail trade, food and beverage services, hurting

²² Ibid.

²³ Alhumaid, K. (2019). Four ways technology has negatively changed education. *Journal of Educational and Social Research*, 9(4), 10-10. <https://doi.org/10.2478/jesr-2019-0049>.

²⁴ Larsson, A., & Viitaoja, Y. (2019). Identifying the digital gender divide: How digitalization may affect the future working conditions for women. In *The Digital Transformation of Labor* (pp. 235-253). Routledge.

²⁵ Marzano, G., & Lubkina, V. (2019, May). The Digital Gender Divide: An Overview. In *SOCIETY. INTEGRATION. EDUCATION. Proceedings of the International Scientific Conference* (Vol. 5, pp. 413-421). <http://dx.doi.org/10.17770/sie2019vol5.3849>.

²⁶ Borgonovi, F., Centurelli, R., Demis, H., Grundke, R., Horvát, P., Jamet, S., Keese, M., Liebender, A.S., Marcolin, L., Rosenfeld, D. and Squicciarini, M., 2018. Bridging the Digital Gender Divide: Include, Upskill, Innovate. [online] OECD. www.oecd.org/newsroom/more-needs-to-be-done-to-bridge-the-digital-gender-divide.htm.

²⁷ Larsson, A., & Viitaoja, Y. (2019). Identifying the digital gender divide: How digitalization may affect the future working conditions for women. In *The Digital Transformation of Labor* (pp. 235-253). Routledge.

²⁸ Marzano, G., & Lubkina, V. (2019, May). The Digital Gender Divide: An Overview. In *SOCIETY. INTEGRATION. EDUCATION. Proceedings of the International Scientific Conference* (Vol. 5, pp. 413-421). <http://dx.doi.org/10.17770/sie2019vol5.3849>.

women's employment situation.

5) Other Social Cons

Technology driven development form and the accordingly born new form of production in both manufacturing and agriculture can bring environmental benefits but, in the same time negative social implication. For example, in South Africa, Biotechnology cotton makes poor individual farmers more vulnerable and widens socio-economic inequality.²⁹ In fact, conversion to plantations for biofuels production also often drive local smallholders away, who may then end up as low-paid seasonal workers. Renewable energy industry, at the social level, indeed, compromises public health. The noise caused by constructing new energy infrastructure is harmful for people's health and daily life. These problems are more obvious in the developing countries due to their relatively weaker social safety net to protect the disadvantaged people. In one word, technology driven transitions and the accordingly coming various innovations might have negative social impacts to the society like unemployment, harmful impacts on public health, gender inequality, increased vulnerability of the poorest, and so on and so forth.

3. Spatial implications of technology-driven transitions in Global South

International experience has shown that economic activities concentrate in a relatively small number of places – it is estimated that only 1.5% of the world's land is home to about half of global production. Such economic concentration is a built-in feature of human settlement development and a key driver of growth. However, while some countries have succeeded in spreading economic benefits to most of their citizens, many other countries have not. Especially outside the economic centers that concentrate production, there are “lagging areas” with persistent disparities in living standards and a lack of access to basic services and economic opportunities. Today, over two billion people live in such lagging areas. Over one billion people live in underserved slums with many disparities from the rest of the city in terms of access to infrastructure and services, tenure security, and vulnerability to disaster risk. A further one billion people live in underdeveloped areas with few job opportunities and public services.³⁰

At the same time, rapidly evolving technologies are to some extent increasing the imbalance of development between countries, and even within a country. Technology is a key driver of aggregate economic growth, through productivity improvements, but its contribution to economic growth varies greatly across countries because different countries have different capacities to acquire, absorb, disseminate and apply modern technologies. Therefore, advanced technologies are not necessarily suitable for all

²⁹ Massa, I. (2015). Technological change in developing countries: Trade-offs between economic, social, and environmental sustainability. *United Nations University-Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT)*.

³⁰ Sameh Wahba, Judy Zheng Jia. (2018). Spatially awwhere: Bridging the gap between leading and lagging regions. <https://blogs.worldbank.org/sustainablecities/spatially-awwhere-bridging-gap-between-leading-and-lagging-regions>

countries and regions

Take automation technology as an example, automation and robotic technologies tend to favor non-routine cognitive tasks while they are reducing demand for manual work. Robotics and AI tend to augment the tasks of high skilled professionals such as engineering, customer problem solving, management, medical diagnosis, software development, etc. New technologies also have the capability to take over routine tasks, for example manufacturing assembly and back-office work, which fall under the middle-skilled category. As a result, automation can create employment polarization by “hollowing out” jobs in the middle of the employment distribution. Evidence is extensively documented in developed countries, such as the United States and the European countries. In the future, as labor costs in developing economies increase, tasks that can be automated will return to developed countries. This trend could reduce the opportunity not only to create more jobs but also for industrialization and technological upgrading strategy based on labor-intensive manufacturing. About half of all the activities people are paid to do globally, amounting to 1.2 billion workers, could potentially be automated by adapting currently demonstrated technologies. The World Bank estimates that up to two-thirds of all jobs are susceptible to automation in the developing world. In the Asia-Pacific region the risk of jobs being automated is also high: 785 million workers or 51.5 per cent of total employment in the region.³¹ It is clear that the development of automation technology will escalate unemployment in the South for a period of time, to the detriment of the economic progress of developing countries, which will further widen the development gap between the countries of the South and the North on a global scale.

Reasons why less developed regions are unable to adopt more advanced technologies include the low absorptive capacity of firms, weaknesses in knowledge generation (basic research capacity) and diffusion (limited vocational and STEM education and weak linkages between academia and industry). Weak framework conditions (where governance and market weaknesses inhibit FDI and curtail business activities), along with poor infrastructure (energy, transport and telecommunications) also constrain the development of technological capabilities. To this end, we propose the following recommendations to strengthen South-South cooperation to address the challenges posed by technological advances

4. How should Southern countries cooperate to reduce inequality brought by technology-driven transition?

Technology-driven transition has imposed various negative impacts on countries, making it more difficult for them to achieve sustainable development. The COVID-19 pandemic has underlined the disparity between developed and developing countries. While battling with the pandemic, those without the Internet access have been unable

³¹ UNESCAP. (2018). Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development. <https://www.unescap.org/publications/inequality-asia-and-pacific-era-2030-agenda-sustainable-development#>

to benefit from remote education, remote work, or remote health services. The situation of digital divide, especially in the countries of global South, have come under close scrutiny during the COVID-19 pandemic. Millions of students and people, particularly in Africa, Latin and South America, and South Asia, are not just able to continue their education and respective jobs by virtue of poor ICT infrastructure and a lack of accessibility to the Internet and ICT devices.³²

The United Nations Agenda for Sustainable Development in 2030 points out that eliminating poverty, including digital poverty, is the primary task of sustainable development. The developed world has realized the issue and made efforts to reduce inequality. The “EU 2020” released in 2010 formulated the European Digital Agenda, emphasizing the improvement of digital literacy and skills of European citizens, especially the digital poor groups. For the Global South, the issue is more serious and it is crucial that southern countries work closer together to narrow the digital gap and catch up with the technology development, and help their people live a better life.

To address uncertainties and inequalities, narrow the digital divide, increase the access of the poor to new technologies, address the impact on vulnerable groups, and minimize inequalities and uncertainties, it is important to narrow the digital gap for southern countries. One main approach is to move from digital divide to digital inclusion through cooperation.

For the cooperation mode, in the past, south-south cooperation was mainly based on bilateral cooperation mode.³³ Nowadays, emerging economies, especially China, have begun to participate in tripartite cooperation as an important aid provider, and the specific forms of tripartite cooperation have been expanded. Tripartite cooperation with the participation of new economies represented by China has become an innovation of south-south cooperation model.³⁴

Some suggestions are listed below:

First, developing countries should share development experience through tripartite cooperation. Knowledge, experience sharing and technology transfer under the framework of south-south cooperation have long been regarded as an important economic resource by developing countries. In this regard, the United Nations regards promoting the sharing of experience, knowledge and technology among countries in the South as one of the important measures to help south-south cooperation.

Second, south-south aid through tripartite cooperation is important. On the one hand, south-south aid pays more attention to the development stage and its own characteristics of recipient countries and is more targeted. On the other hand, traditional north-south aid often comes with strings attached, which means that if the countries of the South want to receive aid, they will pay political and economic costs, which will undermine

³² Macau, W., (2021) The Impact of COVID-19 on the Growing North-South Divide, <https://www.e-ir.info/2021/03/15/the-impact-of-covid-19-on-the-growing-north-south-divide/>

³³ Xu, J., Liang, X., Innovation of United Nations south-south Cooperation: Structure, Concept and Model, *Area Studies and Global Development*. (04): 23-43.

³⁴ Ibid.

national sovereignty.³⁵ China can bring aid to recipient countries, while the United Nations can provide professional guidance to recipient countries with its rich experience, such as the use and distribution of disaster relief materials, measures to prevent secondary disasters and opinions on post-disaster reconstruction.

Third, tripartite cooperation should be adopted to obtain financing for southern countries. Lack of funds will seriously affect the implementation of projects, resulting in missed development opportunities for individuals, communities and even the whole country. In order to promote the development of the countries of the South, the United Nations actively helps the countries of the South to raise funds through tripartite cooperation.

Fourth, it is crucial for developing countries to cultivate their own talents in technology. Although those countries have long had talent exchange and training programs, the advantages of human resources cooperation have not been fully utilized. The United Nations attaches great importance to the talent training of south-south cooperation in developing countries, hoping to help the Southern countries fundamentally improve their own development capabilities. The United Nations encourages China to actively assist other Southern countries in training talents, so as to enhance the development capacity of recipient countries.

³⁵ Ibid.