Digital transformation of global value chains and sustainable post-pandemic recovery

Xiaolan Fu*

This perspective paper examines the impact of the COVID-19 pandemic on global production and trade from the perspective of global value chains. Particular attention is paid to the transmission mechanisms and the role of digital technology in sustainable post-pandemic economic recovery. It argues that emerging technologies will be a driver of the global economic recovery, while the challenge to sustainable and inclusive global development will be significant, especially with regard to inequality and job creation. Also discussed are policy implications, to ensure this recovery is inclusive and sustainable, not leaving any country or people behind.

Keywords: automation, COVID-19, digital transformation, global value chains, post-pandemic recovery

1. Introduction

The segmentation and globalization of production systems into fragments of tasks have transformed how countries trade with the rest of the world (Gereffi, 1999; Grossman and Rossi-Hansberg, 2008; Zhu and Fu, 2013). Participation and upgrading in global value chains (GVCs) enable developing countries to gradually develop technological capabilities for "faster" industrial upgrading (Baldwin, 2012; Gereffi, 1999), and to expand exports (Criscuolo and Timmis, 2017; Collier and Venables, 2007). GVCs can also be a tool for industrialized countries to re-invigorate slow growth in the absence of major innovations (Kummritz, 2017).

The COVID-19 pandemic and the resultant global lockdown have caused enormous disruptions and permanent change to global production networks. Together with the trend that had developed before the pandemic, especially driven by the Fourth Industrial Revolution and trade protection, the pandemic is set to reinforce the regionalization, localization and diversification trends of GVCs (Rodrik, 2020; Fu,

* Xiaolan Fu (xiaolan.fu@qeh.ox.ac.uk) is at the Technology and Management for Development Centre, Department of International Development, University of Oxford, Oxford.

2020), and business leaders are now thinking about changing the way business is organized (UNCTAD, 2020b). It is estimated that the cost of world trade could increase by as much as one-third and that of global foreign direct investment (FDI) by 30 per cent to 40 per cent, according to (WTO, 2020) and UNCTAD (2020a). In early March, when the pandemic had not yet expanded globally, UNCTAD (2020b) reported that the coronavirus had already cost GVCs $50 billion. Such a deep drop in global trade and FDI has far-reaching implications for economies and societies. We will see a subsequent fall in incomes and job opportunities, and price fluctuations. As the shock varies across industries and countries, inequalities within and between countries and even poverty in some countries will inevitably rise.

Although there is a wealth of literature on GVCs concerning their governance and organization, the gains from GVC participation and factors influencing a country's degree of participation (Timmer, 2013; Johnson and Noguera, 2012; Koopman et al., 2014; Antràs, 2015, 2019), our understanding of the impact of a pandemic on GVC organization and participation is scant, with only a few exceptions. Studies have found that the 2014 Ebola pandemic in some countries in West Africa resulted in a drop in trade (e.g. Kostova et al., 2019). Using a disaster impact model and simulation method, Guan et al. (2020) built a global supply-chain network on the basis of the Global Trade Analysis Project database for 2014 and assessed the global supply-chain effect of COVID-19. They found that supply-chain losses related to the initial lockdowns were largely dependent on the number of countries imposing restrictions and that losses were more sensitive to the duration of a lockdown than to its strictness. While this research provides valuable and timely assessment of the global supply-chain effects of COVID-19 control measures in terms of duration and strictness, the impact of these control measures are assumed to be homogeneous across industries and countries. In fact, the impact of a pandemic varies significantly across industries according to differences in contact intensity, degree of GVC fragmentation, and digitizability of the sector and to the degree of digitization in different sectors and different countries.

This paper analyses the varying impact of the pandemic on global production and trade through a detailed analysis of the transmission mechanisms from the GVC perspective. Particular attention is paid to the role of digital technology in changing the contact intensity of an industry, enhancing the resilience of value chains, and offering solutions to the challenge of social distancing and fostering new drivers of growth for post-pandemic economic recovery. It argues that such emerging technologies will be a driver of that recovery, while inequality and employment is expected to reach a record high. International technological, financial and policy cooperation and coordination need to come into force now if we are serious about the aim to achieve the 2030 Sustainable Development Goals (SDGs) to which the global society has committed.

2. How does the pandemic hit GVCs?

2.1 Mechanisms

The pandemic hits GVCs by way of three channels. First, it hugely disrupts transportation systems and almost cuts off access to the logistics of supply chains in some cases. In the past several decades, multinational enterprises (MNEs) have sliced their production processes into fine segments and relocated these small parts of the process to different locations around the world in order to maximize their profits. Intra-industry trade of spare parts and components within GVCs accounts for more than 60 per cent of global trade. In such a production and trade model, stable and on-time logistics is very important to the supply chain. When any part of the chain is blocked, all the subsequent production activity is affected. For example, in Japan car manufacturing was affected because some outsourced spare parts could not be delivered on time and no stock had been maintained due to the lean production system. As countries have adopted various social distancing and border control measures, transportation of goods has been significantly reduced. In the first half of 2020, 1,675 sailings have been cancelled, representing 13 to 17 per cent of the proforma sailings for the major shipping alliances (The Maritime Executive, 2020). As a result, supply chains have been seriously disrupted.

The second channel by which the pandemic affects GVCs is through its disruption of the supply side of production. In addition to the disruption to the supply chain, other measures that have been introduced, such as the closure of workplaces and public transportation, put significant constraints on labour inputs into production.

The third channel through which the pandemic affects GVCs is through the sharp fall in demand. It was not significant in January and February, when China was the epicentre. However, from March 2020, as the virus spread globally, it led to a sharp fall in demand. Cancellations of orders were widely reported; for example, cancellation of orders for garment factories in Sri Lanka and Bangladesh, and for electronics factories in South-East Asia. Through this channel, the shock of the pandemic has been transmitted to regions such as Africa, where the pandemic had not yet broken out. Orders from the global north were cancelled, commodity prices fell by 20 per cent and the total amount of trade is predicted to fall by 50 per cent (UNCTAD, 2020c).

2.2 Sectoral and national variations

However, the pandemic has had different impacts on different sectors and in different countries. In general, four factors affect the degree of the pandemic shock in different sectors and countries. These are the contact intensity of the industry, degree of fragmentation of the GVC, the degree of digitization of the company and country, and quarantine measures adopted by a country.

First, if a sector is more contact-intensive, it will be hit more heavily than others. For example, hair salons, beauty shops, hotels and tourism are heavily affected because of the necessity of contact between customer and service provider. However, for the financial services sector, business consulting and some parts of the retail industry, which can move their business activities online, the impact is lower. During the pandemic, new demands also fostered the growth of some sectors, such as e-health, e-learning and online entertainment.

Second, the degree of fragmentation of the value chain is important. If a value chain is less fragmented, it will be less affected; in GVCs that are highly fragmented such as those of the electronics and automobile industries, the impact will be significant.

Third, the degree of digitization of a company and of a country matters, too. Here there are two factors at play. One factor is the "digitizability" of the production and services. Some business activities are more digitizable and some are less or even not digitizable. For example, business services are more digitizable, whereas beauty services are not; on average, manufacturing is more digitizable than provision of services. The other factor is the capability of a country or a company to digitize its business activities. Companies that are more digitized and automatized have fewer workers and use more automated machines or artificial intelligence. They can accomplish more production activities online through online activities or by remote control of production in the factories. These companies, whether in manufacturing or services, are less likely to be affected. For example, in the City of London, many of the business services and financial companies continue to operate online during the pandemic and quarantine. Of course, the level of digitization and the digital infrastructure of a country significantly affect the degree to which companies can reach the market by means of digitization. Firms in developing countries, which have weaker digital infrastructure, are less able to move their business activities online and hence will be hit harder than their peers in rich countries.

Finally, policy measures, especially the quarantine measures adopted by governments, will also determine the degree of the shocks felt by the economy in different countries. Quarantine measures range from very strict, such as the ones adopted in China, to much more flexible, such as the ones adopted in the United States and the United Kingdom. As a result, the impact on the services and the manufacturing sectors is different in different countries.

Because different countries have different industrial structures, the overall impact of COVID-19 will differ, for the reasons discussed earlier. Most of the countries in the global north are basically service economies. In the United States and the United Kingdom, 70-80 per cent of gross domestic product (GDP) and employment come from the services sector, mostly knowledge-intensive services. In comparison with countries whose economies are mainly based on manufacturing, their economies will be less affected should the contagion ratio of the pandemic be the same in

all countries. Low-income countries are dominated by the informal sector and contact-intensive service sectors such as small retailers, restaurants and family-run microbusinesses, as well as by agriculture and resource extraction, for which global demand and commodity prices will drop considerably. Moreover, the level of digitization is also low in these countries. They do not have the digital infrastructure and digital competencies to enable a rapid transition to online business. As a result, these low-income countries will be heavily affected.

In addition to these factors, the pandemic will deepen the earlier trend. Three macroeconomic factors will interact, reinforce and form an aggregate shock to the developing countries. First, the Fourth Industrial Revolution and technical progress in automation and digitization have made economically viable the reshoring of some manufacturing activities in industrialized countries. Second, rising economic nationalism and the wave of deglobalization have spurred this reshoring tendency with political support. As a result, MNEs are considering the regionalization or localization of value chains as well as the diversification of GVCs. Third, in the last two years, this tendency has been further reinforced by the trade war. The pandemic has deepened instead of reversed these trends. Economic self-sufficiency and even state economies are being discussed in the policy and academic arena, despite the fact that they are not economically efficient. Business leaders are now thinking about changing the way business is organized. Regionalization and diversification of GVCs through digitization are popular choices.

3. Automation and digitization to be the stars in post-COVID economic recovery

Looking forward to the post-COVID economic recovery, then, automation and digitization are likely to be the star features, for three reasons. First, digital technology and automation have played an important role in the global community's fight against COVID-19. Several novel services have proliferated during the pandemic. These include remote tracking and detection (including of infections), robotic cleaning in hospitals, and the delivery of medicine, live materials and notices by drones. Tele-health, e-business, online education, online entertainment, and online conference and office systems have also grown rapidly and are contributing to the global response to COVID-19 and thus to society and the economy.

Second, some sectors – and even some "new" sectors such as the online provision of various services – have already grown rapidly during the pandemic owing to increasing demand. It will not be surprising to see new star industries in the

reshuffle and relocation of GVCs. Some countries will fill the gap of relocated GVCs by investing heavily in star future sectors in the digital economy, innovation in digital applications in traditional industries and the development of digital infrastructure. These sectors will be new engines of economic growth.

Third, lessons from the pandemic and the trade war will push business to build more resilient production systems and supply chains.[1] Digital transformation of industries and production systems will be a popular choice for companies in both the manufacturing and services industries. Digitization often means greater capital and technology intensity and less use of labour. Engineers can even manage the production process by remote control. This makes the production process less contact-intensive and hence less affected by social distancing and restrictions on human mobility. Therefore, digital transformation – including smart manufacturing, smart services, e-government and digitized green transformation supported by 5G, Big Data, cloud technology, the Internet of Things and blockchain technology – will transform or even revolutionize manufacturing and the provision of private and public services.

4. Increasing inequality to become a challenge

Because of differences between countries in digital skills, capabilities and infrastructure, as well as in the ability to invest in new technology and digital infrastructure, we are bound to see increasing inequalities within and between countries. The opportunity window for low-income countries to catch up will narrow. This will be exacerbated by increasing protectionism in the world economy. Although the relocation and regionalization of GVCs may benefit a few countries, most of the developing countries – especially in Africa and in South Asia – will not be better off because they are not geographically close to the rich markets. Neither are their current industrial capabilities and infrastructure conditions close to the level that would enable them to fill the gap left by China in a short time. On the contrary, they may be affected by uncertainties and volatilities in the market due to trade tensions.

In sum, emerging technologies – especially automation and digitization – will be an effective driver of the post-pandemic global economic recovery. At the same time, the mission to reduce inequality and promote decent jobs for all will be more challenging. International technological and financial cooperation, and policy coordination are urgently needed to prepare developing countries, not only to

[1] See also Gölgeci, I., H. Emre Yildiz and U. Andersson, 'The rising tensions between efficiency and resilience in global value chains in the post-COVID-19 world', in this issue (Editor).

combat the shock of the pandemic, but also to develop their digital competencies and infrastructure so that they will not fall behind again in the post-pandemic economic recovery. If we fail to do this, we will not achieve the SDGs by 2030.

5. Conclusions and policy implications

Looking forward to the economic recovery, digital technologies and digital transformation of GVCs will play important roles in offering solutions to the challenge of the great lockdown, enhancing the resilience of the global production system and supply chains, and fostering new drivers of economic growth.

First, innovative technologies have played an important role in the fight against COVID-19. Not only robot cleaners in hospitals, drone delivery of medicine and food, and contact tracking, but also tele-health, e-business, online education, online entertainment and online office systems have all grown rapidly. Second, some sectors such as various e-businesses have already expanded owing to increasing demand. New industries will emerge in the reshuffle and relocation of GVCs, not only in the digital economy but also in the provision of public health. They will be new engines of economic growth. Third, the digital transformation of industries will shield the production process from restrictions on human mobility. Therefore, digital transformation – including smart manufacturing, smart services and digitized green transformation supported by 5G, Big Data, and cloud and blockchain technology – will support the way to a sustainable recovery.

The discussion in this paper has some significant policy implications. First, this digital transformation requires essential digital competencies. They include digital skills, digital infrastructure and a business environment favourable to them. Given the significant gap in digital competencies between developing and developed countries, and the lack of capital in developing countries, especially the low-income ones, to invest in these critical infrastructure and skills, developing countries will be left behind again if they have to build up all these on their own. Therefore, international technological, financial and policy cooperation and coordination need to come into force now to help developing countries to build up the necessary digital infrastructure – including broadband connectivity, mobile phone and 4G/5G infrastructure, and data collection, storage and processing facilities – and gradually develop their capacity in high-speed Big Data transmission capacity. International cooperation is also needed in building training capacity and enhancing the digital skills of the workforce, especially among the youth and women.

Second, given the challenge of the pandemic to human mobility, traditional knowledge diffusion channels – interpersonal meetings, conferences, visits and training – have been significantly and brutally cut off. Policies should give urgent

priority to encourage and assist the use of online digital platforms for international and intranational knowledge transfer and diffusion. This will enable the global community to keep knowledge flow smooth at a time when human mobility is restricted. Policy actions should emphasize (i) the provision of online platforms, (ii) the enhancement and active use of online platforms by governments to disseminate information and knowledge to fight the pandemic, provide job information and disseminate knowledge to assist economic recovery, especially for the poor and for small and medium enterprises; and (iii) the provision of technical assistance and training for people on how to use these platforms. Conditional cash transfers for access to online information should be introduced, in addition to various cash subsidies for citizens and households.

In sum, digital technologies will be an important driver of post-pandemic economic recovery. To ensure this recovery is sustainable and inclusive, international cooperation in a wide range of aspects is crucial to enable developing countries, the least developed in particular, to have the necessary financial and technological resources, skills and infrastructural competencies to harness the benefits of digital technologies. Digital technologies should also be harnessed to facilitate global knowledge flow, especially when human mobility is hindered by pandemic-related measures.

References

Abadie, A., Diamond, A., and Hainmueller, J. (2015). Comparative politics and the synthetic control method. *American Journal of Political Science*, 59(2), 495–510. doi:10.1111/ajps.12116.

Antràs, P. (2015). *Global Production: Firms, Contracts, and Trade Structure*. Princeton, N.J.: Princeton University Press.

Antràs, P. (2019). Conceptual aspects of global value chains, NBER Working Paper No. 26539. Cambridge, MA: National Bureau of Economic Research.

Baldwin, R. (2012). Global supply chains: Why they emerged, why they matter, and where they are going. CEPR Discussion Paper #9103. London: Centre for Economic Policy Research.

Collier, P., and Venables, A. (2007). Rethinking trade preferences: How Africa can diversify its exports. *World Economy*, 30(8), 1326–45.

Criscuolo, C., and Timmis, J. (2017). The relationship between global value chains and productivity. *International Productivity Monitor*, Centre for the Study of Living Standards (32), 61–83. Available at https://pdfs.semanticscholar.org/0826/e979d199f0c10b73019f2f10704b70cb1108.pdf

Eaton, J., and Kortum, S. (2002). Technology, geography, and trade. *Econometrica*, 70(5), 1741–79. doi:10.1111/1468-0262.00352.

Fu, X. (2020). The impact of Covie-19 on global value chains and the role of innovative technologies in post-coronavirus recovery. International Science Council, 2 June.

Gereffi, G. (1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics*, 48(1), 37–70.

Grossman, G., and Rossi-Hansberg, E. (2008). Trading tasks: A simple theory of offshoring. *American Economic Review*, 98(5), 1978–97.

Guan, D., et al. (2020). Global supply-chain effects of COVID-19 control measures. *Nature Human Behaviour*, 4, 577–587. https://doi.org/10.1038/s41562-020-0896-8.

Johnson, R., and Noguera, G. (2012). Accounting for intermediates: production sharing and trade in value-added. *Journal of International Economics*, 86, 224–36.

Koopman, R., Wang, Z., and Wei, S.J. (2014). Tracing value-added and double counting in gross exports. *American Economic Review*, 104(2), 1–37.

Kostova, D., et al. (2019). Long-distance effects of epidemics: Assessing the link between the 2014 West Africa Ebola outbreak and U.S. exports and employment. *Health Economics*, 28, 1248–61. doi.org/10.1002/hec.3938.

Kummritz, V., Taglioni, D., and Winkler, D. (2017). Economic upgrading through global value chain participation – Which policies increase the value added gains? Policy Research Working Paper No. 8007. Washington, DC: World Bank.

Los, B., Timmer, M.P., and de Vries, G.J. (2015). How global are global value chains? A new approach to measure international fragmentation. *Journal of Regional Science*, 55, 66–92. doi:10.1111/jors.12121.

Rodrik, D. (2020). Will COVID-19 remake the world? *Project Syndicate*, April 6, https://www.project-syndicate.org/commentary/will-covid19-remake-the-world-by-dani-rodrik-2020-04.

The Maritime Executive (2020) Global Container Ship Trade Suffers Capacity Drop. The Maritime Executive web site. Avaiable at https://www.maritime-executive.com/article/global-container-ship-trade-suffers-capacity-drop.

Timmer, M. P., Los, B., Stehrer, R., and de Vries, G. (2013). Fragmentation, incomes, and jobs: An analysis of European competitiveness. *Economic Policy*, 11(4), 613–61.

UNCTAD (2020a). Impact of the COVID-19 pandemic on global FDI and GVCs. *Investment Trends Monitor* No. 35 (Special Issue March 2020). Geneva: UNCTAD. https://unctad.org/en/PublicationsLibrary/diaeiainf2020d3_en.pdf.

UNCTAD (2020b). Coronavirus outbreak has cost global value chains $50 billion in exports. News release, 4 March. https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2297.

UNCTAD (2020c). COVID-19 triggers marked decline in global trade, new data shows. UNCTAD Newsdetails. Available at https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2369.

World Bank (2015). The economic impact of Ebola on Sub-Saharan Africa: Updated estimates for 2015. https://pdfs.semanticscholar.org/c55d/c87da29494cb2308f3f0f33aaabdd0a82148.pdf?_ga=2.165709310.1981046710.1586962685-634618428.1584467589.

WTO (World Trade Organization) (2020). Trade set to plunge as COVID-19 pandemic upends global economy. Press release, 8 April. https://www.wto.org/english/news_e/pres20_e/pr855_e.htm.

Zhu, S., and Fu, X. (2013). Drivers of export upgrading. *World Development*, 51, 221–33.