

The Disruption of Personal Protection Equipment Supply Chain:

What Can We Learn from Global Value Chain in the Time of Covid-19

Outbreak?

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The Covid-19 pandemic has disrupted many aspects of life and has prompted multifaceted crises on a global scale. With the continued health crisis caused by this communicable disease, personal protection equipment (PPE) becomes an essential commodity for the general public and healthcare professionals. Therefore, there is a growing demand for Personal Protection Equipment especially face masks and N95 respirators on a global scale. Unfortunately, the decade of expansive trade had been distorted by the Covid-19 pandemic that made medical supplies incapable of meeting the global demand. Prior to the outbreak of covid-19, there was an interdependency of PPE and medical supplies through the Global Value Chain (GVC). GVC has made the production of PPE supplies to be effectively fragmented and globally integrated. This article tries to examine the architecture of Personal Protection Equipment through the lens of Global Value Chain (GVC) before and after the pandemic. Using a qualitative methodology, this article tries to provide analytical descriptive on global medical device fragmentation. The authors utilize the full UN Comtrade data from 1990 to 2018, Foreign Direct Investment Data from OECD, and mass media news to track the shifting of medical device production during the Covid-19 pandemic. The main results indicate that the aggravating situation of the Covid-19 pandemic has brought state actors and non-state actors to create a new pattern in GVC, which caters to PPE demands globally. Finally, this article aims to cast a light on the importance of global cooperation and trade interdependency during a crisis.

Keywords: *Global Value Chain, Covid-19, personal protection equipment. ppe*

Introduction

The Covid-19 virus has been affecting 215 countries globally with new cases reported daily. Until October 2020, there are 36 million confirmed positive cases and 1.49 million confirmed deaths globally (WHO Report, 2020). It is not only the global health sector that had been abruptly affected by this communicable disease. The impact of the Covid-19 virus on global production has been equally draconian.

Thousands of manufacturers have shut down due to the isolation imperative given by governments. Since the production activities are highly integrated through the global supply chain, activity in the downstream can be very influential to the midstream and upstream activities in other countries (P. Torsekar, 2018). This disruption in the global value chain can be very daunting when it comes to the supply of life-saving commodities such as personal

protection equipment (PPE).

The need for personal protection equipment has dramatically soared along with the increased number of positive covid-19. Without personal protection equipment, health workers are prone to be infected by this disease. Health workers need personal protection equipment products including face masks, face shields, goggles, and protection gowns. At the same time, common people also need to protect themselves from contracting these diseases by using medical face masks and face shields. Whereas, the stocks of medical devices around the world also very crucial to make the world recover sooner. Medical devices such as ventilators have been tremendously important in a life-threatening conditions. In the most severe cases of covid-19, patients cannot breathe without a ventilator because their lungs are full of fluid that they no longer deliver oxygen (BBC, 2020). Meanwhile, surgical masks and N95 respirators are very important since they effectively prevent the droplets from entering the nose and mouth. Therefore, the existence of medical devices and personal protection equipment has been vital to global health recovery.

Corona Virus has distorted thousands of production chain activities including in the medical devices sector. Disposable face masks and breathing devices are likely to experience a considerable rising in demand during the pandemic period. Medical devices that are mostly used to tackle this coronavirus are predicted to rise at a CAGR of 11.0% during the forecast period (OECD, 2020). However, the supply of PPE cannot meet the global demand due to factories closure worldwide and

China's total isolation. Almost all machinery compartments needed by medical devices are produced in China (Penny Bamber, 2013). As a consequence of that, there is a bottleneck in the GVC of Personal Protection Equipment. The bottleneck in the personal protection equipment during COVID-19 can be seen at various stages of production as well as in the political context. This article tries to answer how state and non-state actors around the world respond to medical device shortages brought by the COVID-19 pandemic. Specifically what global value chain tells us how to expand the availability of essential breathing appliances and personal protective equipment during the public health emergency? Do the global actors tend to work together in building the resilient GVC in PPE or the interdependency on global trade architecture is no longer desirable? This article elaborates the shifting of GVC in PPE from three phases: before the pandemic, at the early outbreak of the pandemic, and at the peak of the critical phase. The writers argue that the trade interdependency is less desirable in the early outbreak of a pandemic, where global leaders tend to use an individualistic approach to secure their interests. Nevertheless, the worsening situation of Pandemic Covid-19 has brought state actors and non-state actors to create a new pattern in GVC to provide medical devices worldwide. This article also shows that the disruption of the PPE supply chain affects the low and middle-income countries and how the outbreak of covid-19 has encouraged the participation of new players in the PPE Value Chain. Previous studies on medical devices GVC mainly focused on technical context without intentionally analyzing its political

context (Gereffi, 2020). This research tries to fill the gap from the previous research by analyzing the political context which also influences the GVC architecture. This research also tries to fill the gap by contrasting the GVC of Personal Protection Equipment on three different time frames. Therefore, this research can show the dynamic of cross-border production sharing in the PPE sector and the dynamic of countries' cooperation on that trade activity. The research finding shows that interdependency is likely more desirable when a health crisis exacerbates. The novelty and significance of this research lie in the notion of a new pattern in GVC during a health crisis. This new pattern in production sharing can be a lesson learned showing that developing countries can also participate in the making of resilient PPE Global Value Chain and political context play a significant role in determining the PPE supply chain.

Methodology

In elaborating this article, the writers use qualitative methodology to generate in-depth analysis and provide thick descriptions related to the distribution of medical devices through the lens of the Global Value Chain. The data gathered through secondary resources ranging from article journals, official reports, and electronic media. We adopt the decomposition framework that was developed by Garry Gereffi and use the data from UN Comtrade Database. Global Value Chain will be used as an analytical tool as well as a conceptual framework in this article.

The concept of the Global Value Chain will be used to explain the disruption of the PPE value chain at the time of the Covid-19

outbreak. The concept of global value chain was introduced in the 1990s. The idea of the emergence of the GVC originated from the development of the global economy after the Second World War when modernization theory and dependency theory emerged as a perspective to see the economic gap problem for developing countries which at that time was called The Third World Countries. Later on, the scholars who studied dependency theory saw a new potential issue and started converging their focus to industrial dependency rather than country dependency due to the growth of MNCs (Gereffi, 2018). The approach tries to analyze the interplay between the state, MNCs, and national business elites in shaping the local outcomes in manufacturing industries. The industrial sectors included in the studies were pharmaceuticals, automobiles, computers, and the electrical, tractor, tire, and food processing industries (Gereffi, 2018). This study then became the predecessor of the Global Commodity Chain studies which emerged in the mid-1990s. The Global Value Chain is often associated with the Global Supply chain. People often question the difference between Global Commodity Chain, Global Supply Chain, and Global Value Chain. The difference between Global Commodity Chain and Global Value Chain lays in the perspective of the framework. The global commodity chain focused its attention on the producers such as the firms and corporations. To put it simply, the global commodity chain is producer-driven. While the global value chain tries to see the matters from two perspectives: buyer-driven and producer-driven. Producer-driven chains have more linkages between affiliates of multinational

firms, while buyer-driven chains have more linkages between legally independent firms. The distinction also lies in the fact that buyer-driven chains are more common in relatively simple products, such as apparel, home goods, and toys. In these industries, innovation is highly demanded and usually lies more in product design and marketing. The difference between Global Supply Chain and Global Value Chain lays in the added value on the supply chain. While the supply chain emphasizes the manufacturing and distribution-related steps, the value chain includes the importance of other activities such as design and branding that add value to a product, but do not necessarily reflect a physical transformation. (Global Value Chains, 2016).

Global value chain studies were originated in sociology, yet the term “value chain” was conceived in business management studies. A value chain is a basic framework for developing a corporate strategy to promote firm competitiveness by directing attention to the entire system of activities involved in producing and consuming a product. To analyze the corporate competitive advantage, a value chain is decomposed into a set of business activities with individual functions which constitute analytical units (Inomata, 2017). Meanwhile, the global value chain considers the generation and transfer of value within the system as a consequence of firm efforts to optimize production networks and the mechanism of how the value distribution structure affects the firm’s choice of the organizational form of international production networks (Inomata, 2017).

There are five types of governance in the global value chain: market, modular value

chains, relational value chains, captive value chain, and hierarchy (Gereffi, 2005). The market is the simplest form of governance in the global value chain. It involves corporates and individuals who sell products and buyers who buy the product. The central government of the market is price. Modular value chains make products or services based on market specifications. The linkages are based on codified knowledge which provides many of the benefits of arms-length market linkages such as speed, flexibility, and access to low-cost inputs. A relational value chain can be considered when product specifications cannot be codified, transactions are complex, and supplier capabilities are high. The mutual dependence that then arises may be regulated through reputation, social and spatial proximity, family and ethnic ties. It can also be handled through mechanisms that impose costs on the party that breaks a contract (Gereffi, 2005). Captive value chains happen when the ability to codify detailed instructions and the complexity of product specifications are both high but supplier capabilities are low thus it creates an asymmetric power relationship. Small suppliers tend to be dependent on larger, dominant buyers. Depending on a dominant lead firm raises switching costs for suppliers, which are “captive.” Such networks are frequently characterized by a high degree of monitoring and control by the lead firm. Hierarchy governance happens when product specification cannot be codified, products are complex, and highly competent suppliers cannot be found then causes the lead firm to develop and manufacture products in-house. This governance is usually motivated by the

need to exchange tacit knowledge between value chain activities and to manage complex webs of inputs and outputs effectively and control resources, especially intellectual property (Gereffi, 2005).

Academics and practitioners often use the global value chain research approach to conduct detailed research on the structure and dynamics of global industries. They use this approach to understand where, how, and by whom economic, social, and environmental value is created and distributed. On the practical level, research questions center on development and competitiveness issues, and analysis seeks to identify potential leverage points and bottlenecks in the chain. Economic developers often use the results of a value chain analysis to devise industrial policies and strategic plans for firms or countries (Global Value Chain 2016). The research that uses the GVC framework typically involves two main steps: value chain mapping and value chain analysis. Value chain mapping sees the process of identifying the geography and activities of stakeholders involved from taking a good or service from raw material to production and then to the consumer. While value chain analysis seeks to determine the role dynamic factors such as governance, institutions; and inter-firm relationships interplay in influencing the location, development, and competitiveness of a product or service (Global Value Chain, 2016).

The topics which are commonly discussed in Global Value Chain studies revolves around the governance of industry, who is the major driven in that certain industry, and also about the regional development

through the linking knots of global industry. GVC sees the trickle-down effect through domestic production linkages, innovation, and technological spillover. This article will use the global value chain to identify the value chain mapping of the PPE supply chain and to scrutinize the PPE supply chain in three phases: before the pandemic, at the early outbreak of a pandemic, and in the peak of the critical phase. Furthermore, the global value chain will be used to determine the role of government, institutions, and firms in the production and distribution of Personal Protective Equipment.

Global Value Chain of PPE before the Pandemic

The Covid-19 virus has spread across the world at an alarming rate, infecting millions and causing economic disruption on an unprecedented scale (Susan Olivia, 2020). There has been tremendous change in the architecture of the global supply chain since various regions worldwide have imposed a lockdown to restrain the spread of the Covid-19 pandemic. China had made its first isolation measure in early December 2019 as there are more positive cases confirmed in China mainland especially in Wuhan. As a consequence, the global supply chain has been distorted since China is a major contracting party for numerous global companies. Almost all machinery compartments needed by medical devices are produced in China (Penny Bamber, 2013). China also the greatest exporter of personal protective equipment such as gloves and face masks based on textile materials. Face masks (HS 630790) are highly monopolized by China's mainland. Plastic apparels and

plastic accessories for Healthcare Personnel also rely on China's production. Therefore, the closure of China's manufacturers leads to a PPE shortage. However, after China recovered, the other problem arose where China faced bad framing of Chinese-made products and export-import restraint (OECD, 2020).

The production of high technology medical devices such as ventilators (HS 901920) is largely led by Singapore and the US. Meanwhile, testing kit appliances (HS 901390) exporters are dominated by the US and EU.

The top global companies which produce medical devices are Medtronic, Johnson and Johnson, and Abbott. Those global companies produce Medical devices ranging from low-tech medical equipment to highly sophisticated medical devices such as diagnostic equipment.

1. Low-tech medical goods involve personal protection equipment (PPE) such as disposable masks, surgical gloves, plastic syringe, face shield, and hair cover.
2. Medium-tech medical goods such as hearing aid, ventilators, and infusion pump
3. High-tech medical goods such as diagnostic equipment computed tomography scanners and magnetic resonance imaging devices (P.Torsekar, 2018).

However, this article only focusing on medical devices that are commonly used during pandemic Covid-19 such as Ventilator and Personal Protection Equipment. To determine the shifting players on PPE before and after the pandemic, the authors utilize data from UN Comtrade, OECD, and WTO. Ventilators and gas masks are grouped into breathing appliances in the harmonized system (HS 9080). Before the Covid-19 pandemic, the US,

Germany, and UK are the three top exporters of breathing apparatuses, which accounted for more than half percent of global value shared.

Medium to high technology medical devices such as ventilators and MRI mostly made in lead firms' countries; the US, UK, and Germany. However, some compartments needed in producing those medical devices are supplied by China and Latin America with specific standardization from lead firms. The governance can be used to illuminate how power operates in global value chains merits elaboration (Gary Gereffi, 2005). In this global value chain context, power is exercised directly by lead firms on medical part suppliers through specific standardization. The suppliers of lead firms can sometimes be Original Equipment Manufacturers (OEM) that has supplied supporting parts for ventilator outside the United States.



Picture 3.3. Country shares in global exports by goods (OECD, 2020).

Meanwhile, low-technology medical devices such as surgical masks, plastic gloves, gowns, and N95 respirators are mostly produced in China. This can be seen in the type of Foreign Direct Investment that China attracted and exported. FDI's that are directed into China's medical device sector during 2013-2017 were concentrated in two

provinces; Guangdong and Jiangsu as well as two municipalities (Beijing and Shanghai) in eastern China (P. Torsekar, 2018). Collectively these destinations accounted for three-quarters of all sector's FDI projects in the country (P. Torsekar, 2018).

Albeit, personal protection equipment such as surgical masks is considered as a low-technology medical device, their production involves several types of inputs and the assembly of different parts in a relatively sophisticated process (OECD, 2020). The GVC for medical devices can be roughly broken down into 6 distinct stages that represent the value-added processes in each stage.

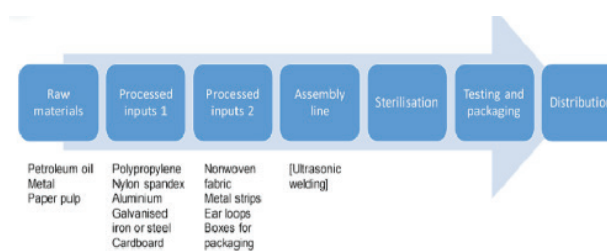


Figure 1.1. The figure above shows the GVC of the face mask that represents the value-added processes in each stage (OECD, 2020).

Early Outbreak of Pandemic: Supply Chain Disruption to PPE Politicization

During the period of Covid-19, the sourcing of Personal Protection Equipment overseas has become increasingly challenging. There is a range of direct and indirect impacts, which affect PPE GVCs to differing degrees. First, there is a supply chain impact, when production in one location requires inputs from another and this other location is directly impacted (OECD, 2020). For example, US-made ventilators couldn't operate as usual due to Chinese-made component shortages.

The closures of China factories that produce ventilators components certainly disrupt the production of ventilators in lead firm countries. Another direct impact is distribution failure caused by the lockdown measure and travel banning. Major ports worldwide are congested with reefer containers that cannot be shipped due to trade restrictions. Therefore, the shipments are being diverted to minor ports resulting in substantial revenue losses for the logistics providers (Hey, 2020). Besides the direct impacts, there have been indirect impacts that also impede the medical devices GVC such as tariff barriers, trade war, and politicization of PPE supply chain. This part will be focusing on the politicization of PPE supply which delaying much-needed delivery equipment for Health Care Worker.

Several countries have put in place export restrictions or equivalent measures to stop exported goods. The trade war initiated by President Trump against China in early 2018 imposed an additional cost due to the tariffs continue to affect the medical devices from China (Brown, 2020). The more serious and widespread problem of export controls emerged in the cascade of nearly 80 countries that introduced export prohibitions or temporary restrictions for COVID-19 products by the end of April 2020 (WTO, 2020). This kind of foreign policy can harm international trade as well exacerbating the global health crisis. Many countries that actually can produce the Personal Protection themselves still face shortages as the demand is doubled while the production capacity is decreased due to limitation labor and factories closure over coronavirus. As a consequence of this restriction policy, many

countries failed to provide adequate surgical masks, textile-based masks, face shields, ventilators, and N95 respirators.

Some countries rejected Chinese-made equipment due to several allegations; such as low-quality of fabric and poor product standardization. Thousands of testing kits and medical masks are below standard or defective, according to authorities in Spain, Turkey, and the Netherland. In March, the Dutch health ministry announced it had recalled 600,000 face masks (BBC News, 2020). Dutch officials confirmed that the masks did not fit, the filters did not work as intended and the Chinese-made certificate cannot be authorized by the EU (BBC News, 2020). Several objections are causing Chinese-made PPE couldn't be well distributed. China has been accused of selling substandard PPE for the sake of furthering its influence worldwide. The condition of Chinese workers that produce medical equipment had been alleged as the main reason why the Chinese-made equipment was rejected by many countries. The world had been questioning the safety of Chinese-made personal equipment; disposable face masks were pointed out as the used or second-hand masks (CNN Indonesia, 2020). Not only European governments imposed an export banning on Chinese-made personal protection but also the US, and Turkey followed the same path (BBCNews, 2020). Meanwhile, several South East Asian Countries insisted on using PPE donations from China. China has so far donated Bangladesh 45,500 COVID-19 testing kits, 400,000 masks, 15,000 personal protective equipment (PPE) (Vietname Times, 2020). On the other hand, Myanmar and Nepal received 12 tons of medical supplies

from China.

Dr. Seemi Jamali from the head of Jinnah Post Graduate Medical Center Karachi said that he believed in Chinese-Made PPE due to it being clinically tested and the fact that Asian countries don't have a much better option (Vietname Times, 2020). Anadolu Agency in Bangladesh also claimed that Chinese-Made PPE was validated by WHO and checked thoroughly by their team of experts (Vietnam Times, 2020). The Indonesian government also received a bulk of medical gowns and N95 respirators from China regardless of the growing number of bad narratives among Indonesian citizens related to Chinese-made products. Indonesia's social media at the early outbreak of the pandemic were full of negativity related to Chinese-made PPE. Even though the Indonesian Government was convinced of the safety of Chinese-Made Equipment, but still people doubted it and questioning China's intention in giving a donation or selling PPEs' at a low cost.

At the early outbreak of a pandemic, the world becomes suspicious since states are peeping at one and another in a distrustful manner. China as the epicenter of the initial pandemic had been accused of intentionally produce bio-weapon by developing the Covid-19 virus that killed thousands of lives. On the other hand, the US was also pointed by its political rival as the "actor" behind this catastrophe. The tension of the global leaders is rising in the early outbreak of a pandemic. There has been a claim from EU diplomats that medical device donation from China is no more than China's strategy called the "Politic of Generosity". The generosity of China under the

administration of President Xi Jinping had been portrayed as China's soft power to influence the recipients. Some politicians argue that China has portrayed itself as the chief cheerleader for multilateralism by assuring the global community that China has the essential power and capacity to provide personal protective equipment as a public good (Verma, 2020). US-led politicians however argue that China has not come this far without political intention. China needs to fix the global narrative about its country and also boost China's geopolitical ambitions and influence. Italy which signed a Memorandum of Understanding with China in 2019 regarding its participation in the Belt and Road Initiative has been a major recipient of personal protection equipment from China. Many global leaders argue that China might play a zero-sum geopolitical game by sending PPE to its allies despite their domestic needs to appear altruistic and advance their political interests. Ironically, rejecting Chinese-made PPE led to a greater consequence where Health Care Workers finally ended up wearing bin bags to cover their hair and body which is worse than a so-called substandard Chinese-made PPE (BBCNews, 2020).



Picture 4.4. Health Care Workers in England wearing Bin Bags (BBC News, 2020).

Health Care Workers in New York Hospitals (US) and the UK ended up wearing bin bags or even raincoats since the hospitals run out of medical gowns and hair cover (Inside Edition, 2020). There was a cherry-picking method in importing, exporting, receiving, and donating PPE. The US government signed into the "Taiwan Allies International Protection and Enhancement Initiative Act" that makes the flow of ventilators and testing kits from the US to Taiwan or vice versa become easier. It is not only China that experienced rejection from the US, but a 60-ton shipment of PPE from Russia to New York was also allegedly imposed "needlessly difficult" objections. This situation is possibly due to the US reluctance to diplomatically engage with Russia (BBCNews, 2020). Politicizing the PPE supply chain will continue to have serious public health implications by delaying its use for non-allies countries and incentivizing sub-standard production for allied countries, which fosters an unjust distribution.

A Restart of GVC amid the Peak of Pandemic Crisis: Strengthening Interdependency

Before the onset of the COVID-19 pandemic, breathing appliances with relatively high technology such as ventilators and N95 respirators were mostly produced by 3M, a Minnesota-based conglomerate that makes over 60,000 different products and has 96,000 employees around the world. In the pre-Covid-19 period, the United Nations trade data for 2018 revealed that ASEAN countries not only manufactured Personal Protective Equipment to be distributed regionally but also to be exported to the rest of the world

(JakartaPost, 2020). This article argues that the changing pattern of medical devices is associated with the global efforts to gain mutual dependency. Date back to early January 2020 when several countries confirmed their first positive cases, international trade slowed down on an unprecedented scale. There was no sign of effective and cooperation initiated by the global leaders. In contrast, the US and China tension was building up following the Trump accusation if China was intentionally unleashing the virus. European Union also accused China and Russia of a concerted effort to spread disinformation about the coronavirus (Washington Post, 2020).

However, political actors have decided to disregard their ego-centric interests and inclining to a more collective based action. As the state of global health is excaerbating and the global economy is about to collapse. By the end of July, states have started to open its market on medical devices. The US also releases tariffs on medical devices especially personal protection equipment (WTO,2020). The Alibaba Foundation and the Jack Ma Foundation have already provided medical assistance to France, Spain, Italy, Belgium, Ukraine, and other counties. Jack Ma Foundation has also published a handbook to help countries fight Covid-19.

The GVC in PPE and breathing appliances will soon restart with a renewed architecture. China is no longer the main producer of low-tech medical devices and personal protection equipment. For most of the past two decades, China's exports were predominantly low-tech medical goods. In addition to changing patterns of FDI, China's rise along the medical device GVC is also

reflected in the composition of the country's medical device exports. During 2001–2011, disposable devices were China's largest category of medical device exports, accounting for more than one-quarter of the sector's overall exports over that period (Gereffi, 2020). The pattern of investment projects shifted away from low-value-added activities (manufacturing and assembly) and towards high-value-added segments (R&D, distribution, marketing and sales, and post-market services) (P. Torsekar, 2018). Surprisingly after its exported PPE experienced massive restrictions, at the peak of the pandemic crisis China's exports climbed steadily following the rise of global demand (CNBC, 2020). Moreover, China production sharing is also now more focusing on medium and high technology equipment such as diagnostic equipment (Aguilar, 2020).

Meanwhile, the GVC of personal protection equipment (Low-technology) shift to South East Asia Countries. Vietnam becomes the producer of medical gowns, hair covers, masks, and gloves. The total value of global exports of personal protection equipment products was US\$47.5 billion in 2018. (Jakarta Post, 2020). Non-woven materials are sent from China to Vietnam, Indonesia, and Thailand to be sewn as surgical masks. Meanwhile, in the ventilator segments, the US started to find its new pattern through switching the main suppliers. Automobile industries are about to potentially switch their production towards ventilators and equipment as the number of Covid-19 cases keep rising all over the world. Cars and medical equipment are both made of stainless steel that makes some companies able to switch their production. President Trump

requested the global automotive company to develop a machine that will be able to produce ventilators. Ford and GE Healthcare quickly agreed to attest and crank up production of a simpler version of GE's full-featured machines to help hospitals and states that were preparing for treating Covid-19 patients. These corporations then brought a small Florida manufacturer called Airon, which produces a simplified ventilator that is cheaper, easier and faster to produce in a massive scale (Forbes, 2020). Elon Musk as the CEO of Tesla said on Twitter "we have extra FDA-approved ventilators. which will shipped to hospitals globally that is in the tesla delivery region. Device and shipping costs are free, albeit all deliveries of vents could be directed towards patients and not for the means of storage" (Tech Insider, 2020). Amidst the uncertain condition, these automotive industries have switch their expertise to the production of much-needed ventilators in the US. Surprisingly, it is not only global companies that succeeded in restructuring their production, local automotive industries in Russia, Czech Republic, and China have also adapted to such an unexpected crisis. Rojek Wide Belt Sanders (RWT), is one of the Czech automotive companies that originally produce automotive machines, but it has shifted its production to the making of ventilators (BBC, 2020).

Firms also have strategies to improve their resilience, for example, their ability to return to normal operations in an acceptable period after being disrupted. Firms generally try to combine the advantages of domestic supply with the opportunities offered by off-shoring, international trade, and supplier diversification.

Hence, GM and Ford also shift their production commodity to support the making of ventilators by expanding their diversification. Those two big automotive companies partnering with GE Healthcare to set up ventilators assembly. Production lines were set up and customized in a unique way where GE healthcare in charge of the R&D of ventilators. Meanwhile, Those car companies in charged to produce the ventilators. The massive production involved several suppliers and subcontractor parties in Latin America and Asia (Forbes, 2020). The distribution is done through the company distribution centers worldwide.

The Disruption of PPE Supply and how it affects the Low and Middle-income Countries

At the early stage of the Covid-19 outbreak, where interdependency is no longer desirable, states used individualistic approaches to secure medical devices and personal protective equipment for their countries which then disrupted the medical device supply chain. Amid the global shortage of medical supply chain and trade protection, there was also reported cases where medical supply are sold to the country which could pay the highest bid (Nielson, 2020). This asserts low and middle-income countries into several complications. Even before the Covid-19 pandemic outbreak, the low and middle-income countries does not have any adequate medical equipment. The data obtained from Afghanistan, the Democratic Republic of the Congo, Haiti, Nepal, and Tanzania, the hospital general clinics confirms limited quantities of personal protection equipment, with only 24%

to 51% of hospitals reporting any type of face mask, 22% to 92% medical gowns, and 3% to 22% eye protection. Sanitation supplies were also scarce, with 52% to 87% of hospitals recording soap plus running water and 38% to 56% alcohol-based hand sanitizer. A further gap was also found in the ability to provide respiratory care. The hospitals analyzed lacked pulse oximeters (12%–48% available), oxygen tanks (10%–82%), and bag masks necessary for basic resuscitation (28%–45%) (McMahon, Peters, Ivers, Freeman, 2020). With the global shortage of medical supply experienced by high-income countries, the low and middle-income countries would likely have it worse.

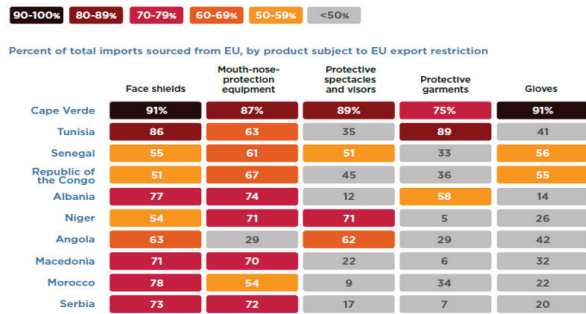
The increase in demand for personal protection equipment and medical equipment at the early stage of the Covid-19 outbreak left the low and middle-income countries in bewilderment. The country cannot suddenly produce a massive amount of personal protection equipment and medical equipment due to the lack of technology. And choosing to import is not an option either, because during the early stage of the Covid-19 outbreak the masses demands personal protection equipment such as face mask, hand sanitizer, and medical equipment which cause inflation to the prices of these items. It would be difficult for low and middle-income countries to afford them. Moreover, the countries no longer desiring interdependency and choose to secure the equipment for their own needs made it even harder for the low and middle-income countries to have the access to them.

As it is aforementioned, the countries which become the pioneer in producing medical supplies are; The United Kingdom, Germany,

United States, France, Mexico, and China. In this section, we will explain how those countries contributed to the global shortage of medical supply chain and how it affects the low and middle-income countries.

China was the main contributor to the global shortage of medical supply chain. Before the pandemic, China was the major global supplier of personal protection equipment. However, when the first case of Covid-19 was reported in China and transmitted widely to its people at an alarming rate, China needed a lot of personal protection equipment for its very large population, thus contributed to the global shortage of personal protection equipment supply.

In March 2020, French requisitioned domestic production of respirators for French health care workers. Whereas Germany imposed its national export restrictions on masks, face shields, and other personal protection equipment, which subsequently led to the shortage of medical equipment among EU countries. On March 12, 2020, The European Commission set a restriction on the export of five pieces of personal protective equipment: face shields, protective garments, mouth-nose-protective equipment, hospital gloves, as well as protective goggles and visors (Bown, 2020). However, a problem emerged when the European Commission set export restrictions. The European countries which are not members of the European Union, such as; Norway and Switzerland. But not long after, the Commission announced modification of the restriction which no longer impacts the trade with the non-European Union countries.

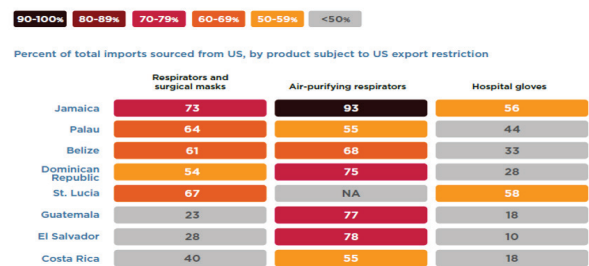


Picture 5.5. The Percentage of Product Subject to EU Export Restrictions from December 2019 (Bown, 2020)

From the table above, we could see that some Northern African, and Sub-Saharan African states are dependent on the European Union for their exports of personal protection equipment medical devices. This export restriction impacts several developing countries; such as those from, Eastern Europe, Northern Africa, and Sub-Saharan Africa. These countries rely heavily on their needs for personal protection equipment and medical devices from the European Union. Since most developing countries rely on the European Union for the imports of their protective equipment. It is highly unlikely for them to alter and produce their medical equipment.

As one of the countries which composed of firms that are leading in the production of medical equipment, the US has issued an export restriction on personal protection equipment. The Trump administration issued a request to 3M, an American manufacturer of respirators and other personal protection equipment, to halt its exports on respirators that are currently exported to the Canadian and South American market. In the latter, the Trump administration issued the request as a memorandum that postulates on the US’ position in restricting

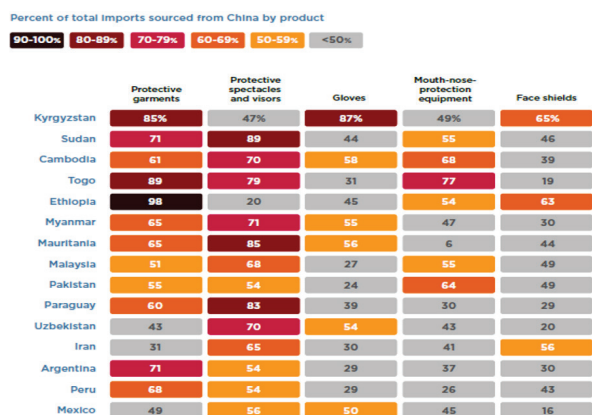
exports of personal protective equipment under the Defense Production Act (DPA). The request was put into motion by the Federal Emergency Management Agency (FEMA), thus limiting the exports of respirators, surgical masks, and hospital gloves. The policy starts to take effect on the 7th of April until the 10th of August; hence, lasting for 120 days (Bown, 2020). Since the policy was announced formally, South American States are at most disadvantaged from the policy.



Picture 6.6. The Percentage of Product Subject to US Export Restrictions from December 2019 (Bown, 2020)

From the table above we could see that several South American countries rely on their imports of personal protection equipment and medical devices from the US. The export restriction made it impossible for hospitals to purchase personal protection equipment from American manufacturers via a commercial transaction. Thus, putting South American countries at risk. Their need for personal protection equipment and medication cannot be fulfilled due to the policy. The other cause for a global shortage of medical supply chain was caused by China. China was one of the main contributors to the global shortage of medical supply chain. Before the Covid-19 outbreak, China supplied 40% of world imports for five categories of personal protection equipment.

Many states rely on China for their need for personal protective equipment, such as face masks and face shields.



Picture 7.7. The Percentage of product imports sourced from China from December 2019 (Bown, 2020)

From the table above, we could see that many developing countries are dependent on medical supplies from China, specifically African states, such as; Ethiopia and Sudan. As well as Southeast Asian countries, such as Malaysia and Cambodia. After mitigating the increase of new cases of Covid-19 transmission, China began to export its low-cost medical supply equipment. However, the sudden increase of global demand for personal protection equipment and medical devices made it difficult for low and middle-income countries to compete for their needs of the equipment due to the price increase. Subsequently, low and middle-income countries which do not have the market power to purchase such equipment may find difficulties in coping with inflation. Therefore, prompting a shortage on their needs for medical supplies.

Despite the PPE supply shortage that is imparted by the COVID-19 pandemic, the phenomenon of limited medical equipment and

the disruption of the PPE supply chain is very much apparent among low and middle-income countries; before the Covid-19 outbreak. Due to the surging demands for PPE equipment, inflation on medical equipment causes a constraint for low and middle-income countries to compete in the PPE market. Thus, by reflecting the shortage phenomenon of medical supplies among low and middle-income countries, the forethought of Covid-19 vaccines shortage among low and middle-income countries might be probable. Therefore, widening the disparities of accessibility for medical supplies among the Global South.

Conclusion

Prior to the pandemic, the production of global medical devices is largely led by the core firms in the United States, Germany, UK, and Ireland. Whereas, medium to high technology medical devices such as ventilators and MRIs are mostly made in lead firm countries; such as the US, UK, and Germany. With the exception of several compartments needed in producing medical devices that are supplied by China and South America, that is regulated under strict standardization given by lead firms. Meanwhile, low-technology medical devices such as PPE, surgical masks, and N95 respirators are mostly produced in China.

At the early stage of the Covid-19 outbreak, states become wary towards one and another. China as the epicenter of the initial pandemic transmission had been accused of intentionally producing bio-weapons by developing the Covid-19 virus that killed thousands. On the other hand, the US accused its political rival (China) as the “actor” behind

the Covid-19 catastrophe. Tensions among the global leaders are rising in the early outbreak of the pandemic. There has been a claim from EU diplomats that PPE donation from China is no more than a strategy by China that is described as “Politic of Generosity.” The generosity of China under the administration of President Xi Jinping had been portrayed as China’s soft power to influence its recipients. The sourcing of medical devices including personal protection equipment that is supplied overseas has become increasingly challenging. There is a range of direct and indirect impacts, which affect medical devices GVCs to differing degrees. There is a supply chain impact when production in one location requires inputs from another and when this other location is directly impacted. Besides the direct impacts, there have been indirect impacts that also impede the GVC of medical devices, such as tariff barriers, trade war, and political framing.

The interdependency on global trade architecture is not desirable in the early stage of the Covid-19 pandemic outbreak. The changing pattern of medical devices is associated with the global efforts to gain mutual dependency. Not to mention, the international community has finally disbanded its ego-centric goals and favoring a much more collective action-based approach as a means of pursuing a global economic recovery.

The US and EU have finally stopped their export and import restrictions by July and August 2020 respectively. The tension among global leaders has sown to be minimizing, which is reflected through their public speeches. President Donald Trump has issued a memorandum with the CEO of Ford and GM to

help medical industries in producing ventilators. Ford, GM, and Tesla were also allowed to distribute their FDA-approved ventilators globally. These automotive industries were given the liberty to choose their component suppliers and contracting parties. Hence, providing a chance for developing countries to participate in GM and Ford’s production chain.

However, there is a shifting of the PPE supply chain that is expressed by China’s actions in moving up to a higher production chain by producing ventilator screens and air compressors. Even though China is still the largest exporter of Face masks (HS 630790), China is now sharing the plastic apparel and textile-based masks market share with South East Asian Countries such as Indonesia, Vietnam, and Thailand.

From the Covid-19 health crisis, we can learn that a singular state cannot single-handedly manufacture all the demands for personal protection equipment, hence interdependence among states is of paramount importance. The individualistic approach that was used by many countries during the early outbreak of the pandemic tends to disrupt the global value chain, which eventually hinders the global effort to mitigate this Covid-19 pandemic. The politicization of the PPE supply chain leads to unjust distribution that impedes states’ efforts in fostering GVC resilience in PPE sectors. State governments should be sensitive to the bottleneck issues in international trade when it comes to essential goods such as medical devices. There should be a practice of knowledge-sharing platforms to facilitate discussions among corporations, governments, academicians, and civil

societies. Open communication may assist corresponding stakeholders to identify the best practices in mitigating risks and building a resilient global value chain. The sharing of knowledge and information among private sectors also imperative to address such issues. The Covid-19 pandemic will not be contained without international solidarity and coordination. Therefore, governments should prioritize health recovery among communities above their political sentiments. The capacity to continue the production and distribution of adequate medical devices to consumers during a health crisis should be of utmost importance.

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