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GLOBAL SUPPLY CHAINS VULNERABILITY AND DISTORTIONS AMIDST COVID19 PANDEMIC: ANTECEDENTS FOR BUILDING RESILIENCE IN DOWNSTREAM LOGISTICS

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ABSTRACT

COVID-19 outbreak surprised the world completely since it is affecting lives, businesses and supply chain operations tremendously. Businesses have been closed, production operations disrupted and physical distribution halted. Given that, the study aimed to determine the distortions caused by the COVID-19 pandemic in upstream and downstream supply chains as well as identify approaches for building resilience in the supply chain. The study was guided by the Principal-Agent Theory and Resource Dependence Theory. A qualitative approach based on literature survey methodologies guided the study whereby systematic literature synthesis was conducted to collect secondary data from published scholarly articles and grey literature. A total of 58 published articles were reviewed after a rigorous screening in line with the pre-established objectives and theoretical underpinnings. Basic coding was done based on the key themes and thereafter constant comparison analysis was performed for data analysis. Findings indicate that the outbreak has caused disruptions throughout the global supply chains and paralysed several businesses, particularly in the manufacturing, transportation, and hospitality sectors. The majority of global manufacturing companies are currently facing serious shortages of supplies from their supply networks. Transportation and third party logistics have been largely distorted since cross-border and domestic freights are hardly working or operational. Therefore, to build resilience companies should consider resorting to local sourcing and/or multiple sourcing, increase supply chain agility and build inventory buffers. Likewise, there is a need for developing partnerships or strategic alliances to share resources towards building resilience jointly but also diversification of business operations where possible to produce the required supplies for fighting against COVID-19.

Keywords: Supply Chain, Logistics, Vulnerability, COVID-19, Downstream, Resilience

1. INTRODUCTION AND VULNERABILITY CONTEXT

Manmade or natural disasters account for great and unwarranted losses of human lives, properties as well as finances at the micro and macro level in both developed and developing economies. Over the years, human history has experienced numerous public health incidents where epidemics and pandemics have occurred such as the *Spanish Influenza*, *Severe Acute Respiratory Syndrome* (SARS-COV), *Malaria,* and *Ebola*. The incidents all together have caused tremendous sufferings and life losses. The incidents meant all the available resources must be deployed rapidly and managed in conjunction with available information and financial resources to contain the epidemics before reaching uncontrollable or disastrous proportions (Dasaklisn *et al.,* 2012). Recently, SARS-COV2 (Avetta, 2020) also known as Coronavirus (COVID19) outbreak surprised the world causing downturns in business operations, disruptions in manufacturing industries, and dwindling global supply chains (Betti and Ni, 2020).

Just like SARS, COVID- 19 is also thought to come from the animals (Zoonotic Virus) (Avetta, 2020). While SARS-COV was originally reported in the Chinese province of Guang – Dong in 2002, this newly identified virus (COVID-19) was first observed in China (Wuhan) which happens to be the capital of Hubei Province. The

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World Health Organization (WHO) on December 31, 2019 declared COVID-19 as a public health emergency of international concern (Avetta, 2020). As of April 7, 2020, almost1279,722 people were infected worldwide while almost 10,268 infection cases were from Africa and the number is still counting (WHO, 2020). Unlike other outbreaks that are endemic to specific geographical regions, COVID-19 has become pandemic with serious repercussions to national economies, state of affairs and wellbeing of the citizens (Delivorias, and Scholz, 2020).

COVID -19 outbreak has spread rapidly unlike SARS (2003) and it is estimated that the consequences will be much more though, at this stage it is difficult to predict all the risks augmented by globalization and highly integrated supply chains (Hippold, 2020, Farrah *et al*, 2020). As of now, it is apparent that COVID-19 has a more severe impact than SARS since SARS took more than six months to infect 5000 people while COVID-19 affected more than 5000 people in less than a month (Avetta, 2020). Regardless of the significant efforts done by governments to contain the spread of the virus, it has already spread globally and cases are growing significantly putting communities, businesses and supply chains at risk due to disruptions. Countries' economies have been impacted through several channels including the health, trade, transportation, tourism (hospitality) and agricultural sectors. The World Health Organization and World Bank estimated that the impact of COVID - 19 could bring a loss of approximately US$3 trillion of global Gross Domestic Product (GDP). Approximately, South Asia's GDP could potentially fall US$53 billion while Sub-Saharan Africa's GDP by US$28 billion (Delivorias, and Scholz, 2020). Amid the outbreak, the International Monetary Fund (IMF) emphasised that collaboration between countries and investments are critical as counteract measures towards protecting their respective GDP or regional GDPs.

Corona Virus pandemic has caused a major disruption in the global supply chains coordinated and integrated across borders since product logistics and associated services highly depend on fast, agile and lean supply chains. The outbreak started China (Wuhan City) which is a strategic location in the coordination of global supply chains since it has been a base for manufacturing and modern industrial change. The presence of major industries in medical high technology (pharmaceuticals, biology engineering adopt-electronic technology) and modern manufacturing (steel and iron manufacturing and automotive) has made the city an important and strategic point of global supply chains (Kilpatrick and Barter, 2020). As a result of the COVID- 19 outbreak and pandemic in Wuhan City, global industries dealing with the production of medical equipment and supplies, automotive, consumer goods and electronics have been affected significantly (Betti and Ni, 2020). Immediately after the outbreak become epidemic in China, manufacturers were not allowed to operate on a full swing which in turn impacted the production and supply of goods to international markets via global supply chains. Also, physical distribution systems that were required to move goods distribution centres were disrupted by government regulations which directed full 'lockdowns' of certain areas (Manners-Bell, 2020).

Globally, the People's Republic of China (PRC) accounts for 13.45% of the global export figures and is among the leading economies in manufacturing. Since 2003 China has grown as the largest manufacturer and supplier of raw materials, assemblies, components, parts and finished goods globally (Avetta, 2020). Therefore, as the country was experiencing longer plants shutdown or postponed productions, the emptier become the global distribution channels and pipeline of parts and components meant to feed producers, assemblers and distributors and retailers worldwide (Parsons, 2020). Despite some signs of recovery in the manufacturing sector across China, still the majority companies are yet to resume their normal productions due to shortage of parts from lower-tier suppliers; shortage of labour who might still be trapped due to the shutdown of their villages; and the slow recovery of transportation network capacity due to road closures (Betti and Ni, 2020). As a result, some manufacturers, producers and retailers across the global supply chain continue to experience shortages of key components and raw materials which lead to suspension or closure of their subsequent operations. For example, early this year Toyota announced that it has halted production because the steel shipments were affected. Also, express service providers operations were affected due to the crisis in the airfreight market mainly caused by the demand and supply disruptions (Manners-Bell, 2020).

Apparently, the outbreak left global supply chains exposed to vulnerabilities and limping from distortions in the upstream to the downstream networks which ultimately result in a shortage of necessary inventories for

industrial and domestic consumption. The upstream supply chain operations include activities and operations necessary for obtaining inputs needed for production from suppliers (producers) while downstream includes processes for distributing and delivering products to the final customers. Thus, the chains are interconnected and interdependent to achieve the expected deliverables through effective Supply Chain Management (SCM). SCM encompasses planning, coordination and management of activities relating to sourcing, procurement, production, and logistics management (Frankel *et al.,* 2008). Among others, the SCM operations focus on coordination and collaboration of participants across the chain in the form of suppliers, intermediaries, third-party service providers and customers (Ponomarov, 2012).Thus, planning and implementation of numerous managerial activities across the supply chain nodes is not a smooth undertaking as it requires efficient and effective coordination of material, information and financial flows that cross organisational and national boundaries (Mentzer *et al.,* 2008).

Amidst the COVID- 19 pandemic, it is obvious that there are inbuilt risks associated with each of the supply chain operations across the nodes from upstream to downstream supply chain networks worldwide. China is among the strategic hubs for global supply chain operations in terms of production and consumption hence, visibility to major suppliers is likely insufficient for most organisations that are currently required to manage supply disruption risks while completely unprepared. This has led to tremendous supply chain distortions and disruption across downstream logistics leading to disruptions and variability as orders move upstream in the supply chain (i.e., bullwhip effect). The bullwhip effect refers to an inverse ripple effect of forecasting errors throughout the supply chain that often leads to amplified supply and demand misalignment (Wang and Disney, 2015; Hokey-Min, 2000). The orders placed to the upstream supply chain member normally tend to overstate the true consumption patterns of the consumer (demand) since each chain members' view of true demand can be blocked by its immediate downstream supply chain member (Hokey-Min, 2000).

Supply chains under *ceteris paribus;* have been designed to provide high quality supplies to customers conveniently based on relevant information (Buchmeister, *et al.,* 2008). As a result of the virus outbreak, tables have been turned and the bullwhip effect has left global supply chains stressed and vulnerable to distortions throughout. The lockdown, travel and quarantine restrictions on vendors and suppliers has caused massive disruption in supply chain worldwide (Avetta, 2020) since materials are stuck due to logistics limitations in term of capacity and availability of logistics services. The pandemic has also caused limited availability of labour mainly because of illness or quarantines restrictions as well as changes in consumer purchasing behavior due to quarantine restrictions and fear of potential exposure to the virus which in turn has led to sales decline and challenging logistic network since they have shifted to online purchasing (Hippold, 2020). Global supply chains engage diverse resources linking different chain members across the nodes that are interdependent but with different intentions and expectations. Thus, any distortion that results in the incompatibility of expectations and intention between supply chain members creates uncertainty and distortions in the whole supply chain (Sharma and Modgil, 2013).Therefore, given that, the study aimed to profile the COVID- 19 pandemic and its implications on global supply chains; determine the distortions caused in global supply chain networks (upstream and downstream); and identify approaches for building resilience in the downstream supply chain. To concretise the analysis, the study was guided by Principal Agent Theory (Mitnick, 1975; Ross, 1973) and Resource Dependence Theory (Pfeffer and Salanchik, 1978).

2. THEORETICAL UNDERPINNINGS

Global supply chain operations depend on several participants at different nodes (working in collaborations based on contractual arrangements) as well as resources required to make the chains (upstream and downstream) effective and efficient. Therefore, the analysis was guided by Principal Agent Theory (Mitnick, 1975; Ross, 1973) and Resource Dependence Theory (Pfeffer and Salanchik, 1978). The theories jointly provided guidance towards understanding how members of the global supply chains work together based on the provided resources to maximize benefits as well as build resilience while taking into consideration the vulnerability context and disruption/distortions arising thereof. Agency theory relates to relationships in business operations that consist of a principal and an agent who is engaged in cooperative behaviour, although they have different goals and attitudes toward risks uptake. Similarly, global supply chains are networks that put together suppliers, manufacturers, distributors, retailers, and consumers in business relationships. The participants (actors) must

cooperate and work together for the chain to perform however; they have different goals and attitudes toward risks uptake.

As such, global supply chain coordination is becoming increasingly complex and logistics operations cannot be achieved until the principals (lead firms) and agents (subsidiary firms) are motivated to commit resources (human, financial and physical) and work together. Thus, the performance of supply chains highly depends on the joint efforts and commitments of the enterprises across the chain nodes from upstream to downstream through the sharing of resources and information as well as the commitment to contractual responsibilities between the principal and agent. Therefore, in managing supply chain operations at a global scale it is important to establish the appropriate coordination mechanism for participating enterprises to achieve the maximisation of the overall profit of the supply chain (Oliveira, *et al.,* 2013).

Principal-agent theory is grounded on the trade-off between the cost of measuring behaviour and the cost of measuring outcomes while transferring risk to the agent (Eisenhardt, 1989). As such, the principal will always seek to minimise the agency costs by specifying what has to be done, monitoring progress of implementation, rewarding good performance and evaluating the agent's behaviour. Similarly, the agent should always work towards maximising rewards and reducing principal control by building trust and confidence (Fleisher, 1991). Hence, efficient management of agency problems including information acquisition and communication; moral hazard; conflict of interests and adverse selection associated with the agent is also imperative as observed by Fayezi *et al.* (2012) and Fleisher (1991). As upstream and downstream supply chains amidst COVID-19 pandemic are dwindling, the theory assumptions can be integrated in global supply chain undertakings to address the contractual relation challenges based on the rational choice model.

Assumptions of the theory are useful to participants in the global supply chain to understand supply chain undertakings by focusing attention on power and conflicts between participants; dynamics of risk sharing, development of complex organisational relationships; costs and benefits of supply chain integration as highlighted by Stock (1997). Accordingly, the principals must conduct comprehensive analysis of actors' (agents') decisions towards understanding their changing roles and power positions so as to avoid asymmetric information between the principal and agent (Gong *et al.,* 2017). This will avoid disruptions in the production and distribution of the required supplies to the agents while at the same time hedge against adverse selection and moral hazard in contracting with intermediaries.

Resource Dependence Theory (RDT) on the other side presents inter-firm governance as a strategic response to conditions underlying uncertainty and dependence among exchange partners in business undertakings (Pfeffer and Salanchik 1978). The theory further contends that actions among organisations are fundamentally driven by resource considerations but also the relationships and interactions among organisations to a large extent are explained by the resource complementarity (Hillman *et al.,* 2009). Among others, the theory assumes that variations in uncertainties arising in the organisation business environment are responsible for both internal power and external power distribution between market participants (Hillman *et al.,* 2009). Such undertakings make some enterprises to become dependent for needed resources to support their operations including goods, human resources and services which create asymmetric interdependence so often considered critical for the reduction of uncertainties in the business environment (Pfeffer and Salancik, 2003; 1978).

In the context of global supply chains, resources mismatch creates dependencies among chain participants at different nodes either in the upstream or downstream logistics services. Most often this influences participants to work together so as to achieve common objectives and become increasingly dependent on each other for the missed resources. Thus, the theory indicates the scope to which enterprises in the supply chain need to maintain information and resources exchange with fellow supply chain participants (Gulati and Sytch, 2007). The theory also provides three faces in the supply chain milieu namely; supplier dependence, buyer dependence and mutual dependence (interdependence) (Gulati and Sytch, 2007). As the COVID-19 outbreak continues to spread worldwide and crippling supply chains, the interdependence among chain participants is increasingly becoming vital for survival through sharing resources where possible.

3. METHODOLOGY

A qualitative approach guided the study based on literature survey methods mainly for secondary data since it was not possible to collect primary data conveniently amidst the outbreak. Thus, the documentary review approach was used to source secondary data from published scholarly articles, non-scholarly articles and grey literature. The grey literature normally makes available data that is not found within published literature for commercial purposes (Paez, 2017; Pappas and Williams, 2011) which helped to reduce publication bias and fostered a balanced picture of available evidence. A Systematic Literature Synthesis (SLS) was conducted extensively to draw data from articles published from 2002 to 2020in order to get reflections from similar contagious pandemics such as SARS (2002) which impacted national, regional and global supply chains. The publications were basically sourced from Google Scholar, Scopus and Research Gate that were used for data sourcing based on the keywords and thematic areas of the study.

Data sourcing primarily was guided by the topical keywords which among others included global supply chain, corona virus, COVID- 19, supply chain distortions, supply chain vulnerability, bullwhip effect, supply chain resilience, upstream and downstream logistics. Analysis of abstract was done comprehensively to establish the focal problem that probed the study along with the objectives as well as the key findings and conclusions. Therefore, based on the aforementioned keywords and cut-off period a total of 58published articles were reviewed after a rigorous screening in line with the pre-established objectives and theoretical underpinnings. Basic coding was done (open, axial and selective coding) and thereafter constant comparison analysis was performed for data analysis as put forward by Onwuegbuzie *et al.* (2012) and Leech and Onwuegbuzie (2008). Coding was guided by the key themes to ensure consistency but also similarity and differences between the codes were scrutinised and examined to allow grouping and coherence.

4. FINDINGS AND DISCUSSIONS

4.1 Implication of COVID- 19 Outbreak on Upstream and Downstream Logistics Services

Supply chains to some extent are susceptible and affected by some risks whether information, financial, legal or technological (Knemeyer *et al.,* 2009). Such risks if not properly circumvented might interrupt and distort the smooth flow and delivery of materials from original suppliers to the ultimate consumers. COVID-19 since its outbreak in China has caused distortions and disruptions throughout the global supply chains and paralysed many businesses particularly in the manufacturing, transportation and hospitality sectors. For example, the Japanese automotive manufacturer Toyota in the earlier days of the outbreak halted production because their steel shipments were highly affected from some of the largest producers in the country (Manners-Bell, 2020). Similarly, FORD and IKEA reduced their operations and idling their production unit while FIAT Chrysler is going to shut down the European manufacturing plant because of reduced supplies from suppliers in China (Avetta, 2020). The express courier sector found itself in an unprecedented position while some parts experiencing shocks as a result of the near collapse of the airline services since their distribution normally uses belly freight for the movement of consignments. Also, there has been a downturn in the purchase of household consumables through electronic retail channels since consumers were gradually more dependent on sophisticated downstream supply chain networks as a source of essential everyday commodities (Manners-Bell, 2020).

China is highly regarded as a prime market for consumer goods and services coming from domestic suppliers and those from different countries worldwide. Thus, anywhere worldwide where the local economies depended on the Chinese market are currently suffering. At some point, household consumers limited their travel and consumption while manufacturing industries slowed down or suspended their production (Parson, 2020). The absence of essential supplies and long stretches of empty supermarket shelves are among the visible implications of Corona Virus outbreak to commodity logistics. Likewise, given the extended closures as well as delays observed towards getting workers back to the production plants due to travel restrictions and health quarantines within regions, production operations are restarting at an unprecedented scale. As a result, intermediaries across the supply chain networks are suffering either from excess or shortage of inventories

which in turn has a multiplier effect on their respective businesses performance and national economy as well in a broader perspective.

The majority of global manufacturing companies are facing serious shortages of supplies including parts, assemblies and equipment in their supply networks mainly from upstream supply chains. Companies are scrambling and struggling to find alternative solutions to hedge for the deliveries missed from the primary source of supply (Betti and Ni, 2020). For example, original equipment manufacturers in China are facing the problems of resuming their operations capacity. They are experiencing a shortage of parts and materials from upstream suppliers, inadequate labour due to the shutdown of infected regions and unpredictable deliveries due to unreliable transportation. In South Korea, Hyundai had to shut down its seven (7) factories due to qualified vendor inability to deliver components timely (Farrah *et al* 2020). The vendor happened to be stationed in Hubei Province where a complete lockdown was implemented by the government as a result of the outbreak (EY, 2020). Also, Apple Company with an estimated 10,000 employees was affected since it depended on supplies from Wuhan. Consequently, the Company closed 42 stores in China and expect to ship 5% to 10% fewer iPhones compared to initial estimation before the COVID-19 outbreak (Farrah *et al* 2020).

Food supply chains in both upstream and downstream logistics have also been hit immensely though it is worse in the downstream since upstream supply chains are less likely to be vulnerable as they are capital intensive. As the virus spreads and cases mount, more lockdowns are experienced and the food systems are vulnerable and/or strained resulting to food supply chain shocks. Food supply chains are very complex as they include a web of interactions among actors including producers, inputs suppliers, transportation firms, processing plants, shipping agents to mentions a few. Thus, some countries consume what they don't produce while others produce what they don't consume which in turn creates a dependence syndrome across the global supply chains. As a result, the impact is felt widely but unevenly depending on the context (FAO, 2020). The distortions have created massive shortages of food supplies which are even more complicated by the disrupted distribution patterns across the downstream logistics mostly at retailing and consumption nodes. Downstream intermediaries and outlets such as supermarkets, wholesale markets and wet markets particularly in the urban areas face significant problem as they have little control of product distribution and consumption.

Physical distribution particularly transportation and 3rd Party Logistics (3PLs) operations globally have been largely distorted since cross-border and domestic freights are hardly working or operational. For instance, American Airlines, Delta, British Airways and KLM cancelled their flights to China which were responsible for almost 70% of air imported goods to North America and Europe (Farrah *et al*, 2020). Road transport is also having great pressure on truck capacity which consequently affects the delivery and distribution of everyday products including home supplies, pharmaceuticals and industrial supplies. Since customers in the downstream logistics have been accustomed for being dependent on convenience and timely delivery of essential products, the corona virus outbreak has led to impulse buying and stock piling which created serious shortages. Thus, the increased reliance on physical distribution to deliver the required products timely and conveniently means that if the transportation system breaks, so do supply chains domestically and globally (Manners-Bell, 2020). The air cargo industry is the most hit since travels are halted and planes grounded thus, the delivery capacity of household and industrial supplies is severely affected worldwide. For example; Apple Company has re-routed its supply chain which resulted to the temporary closure of the facilities in China (Avetta, 2020).

4.2 Approaches for Supply Chain Resilience in Downstream Logistics

Supply chain resilience refers to the adaptive capability of the organisations supply chain towards preparedness for unexpected events, respond to disruptions and recover from the same promptly (Ponomarov, 2012). For the past two decades, an important buzzword in SCM has been resilience through detecting early signs of disruption and responding by reallocating production to alternative locations (Parsons, 2020). Unfortunately, the immediate COVID-19 outbreak and its ramifications exposed global supply chains to the extent where the best-laid contingency plans failed or proved inadequate. Therefore, among other, short term measures are needed to respond to the immediate challenges in the downstream logistics where the majority have been affected by the pandemic. Among the approaches, one is for companies to designer integrated supply chain risk management program that will enable them to respond to high impacted areas and potential supply chain exposure in the

upstream network and below. Companies also need to study customers spending and how they were affected to make sure that inventories are within reach and outside impacted areas (Hippold, 2020).

The most effective approach for building resilience in the supply chain and hedge the risk exposure is multiple sourcing. Amid the COVID-19 pandemic, companies over relying on a single geographical location or a single supplier for 'bottleneck' products have suffered the most since they did not have enough visibility across the extended supply chain network (Kilpatrick and Barter, 2020). Therefore, companies need to re-strategise and broaden their supplier base or consider local/near-shore sourcing to put up resilience and reduce the risks arising from overdependence on few suppliers. Multi-sourcing of key commodities or strategic components is essential towards reducing reliance on few suppliers who may not deliver due to halted production operations and/or constrained transport arrangements due to lockdown. Companies may think of moving quickly to activate relationships with alternative suppliers and secure additional inventories and improve their operational capacity. For instance, companies with suppliers having significant exposure in the impacted countries may identify alternative suppliers in less or non-impacted countries since alternative sources of supplies vary greatly by supply capacity and expertise in manufacturing (Hippold, 2020).

Companies should increase supply chain agility as a strategy to hedge against disruptions and distortions. This can be done through improving the ability to quickly respond to unexpected circumstances in supply and demand as well as building inventory buffers (safety stocks) of bottleneck components (McKinnon, 2014). As global supply chains are becoming more complex due to the increased interconnectedness, companies need to build agility in production, stocking and distribution. With the COVID-19 pandemic, there is a need for more rethinking of stocking operations particularly in the downstream supply chain through setting inventory buffers (safety stocks) or widening the parameters of the existing ones. Buffers will hedge the normal demand and supply variability which is increasing significantly. Alternatively, companies with dependent demand can set up demand driven material requirement plans to address the same. Fortunately, some companies in Europe and America some companies inflated their buffer stocks in anticipation of increased consumer purchasing propensity during the summertime which in turn gave them an upper hand towards hedging against disruptions and distortions.

Affected companies should resort to the formation of partnership and strategic alliances whether on short term or medium term arrangements to share resources, experience and build resilience jointly. The companies need to assess and work together with informed experienced freight forwarders, to find out and leverage alternative routes and alternative modes of transportation to move out more vital materials and goods out of impacted areas, at the same time to get prepared when shipment resume (Hippold, 2020). This will enable companies to build resilient relationships with strategic suppliers and put systems in place to provide more visibility across the supply chain networks and shared resource pools for raw materials. The undertakings will also be potential for joint risks management and drive diversification of operations based on the available resources among partners and allies. For instance, CATL and Tesla recently announced their strategic partnership whereby CATL supplies EV batteries to Tesla's Model-3 and moving away from the sole supply by Panasonic Batteries. Panasonic and Toyota also announced their joint venture agreement to produce EV Batteries while BMW signed a major contract to purchase EV batteries from CATL (Betti and Ni, 2020).

Diversification of business operations by retooling and redesigning of production systems is another strategy towards building resilience in terms of making alternative and/or different products. The COVID-19 outbreak may have created room for economic, socio-cultural, and technological innovations in the point of more long term climate, biodiversity and global resources crisis (ICLEI, 2020). Consequently, some companies have become more innovative and diversified their production operations with assistance from their partners. The companies through sharing of technologies, equipment, distribution channels and staff have been able to produce products demanded amid the outbreak such as N95 masks, sanitizer and their dispensers, protective gear, ventilators and other household consumables. For example, in China when the automotive business was down substantially, Shanghai-GM-Wuling (SGMW) quickly retooled its production system and resorted to the production of medical face masks, which positively contributed to the mitigation of the COVID-19 spread (Betti and Ni, 2020) which in turn generated revenues as well as creating a positive reputation for the company.

Companies also need to prepare and implement robust production and supply chain plans that include strategic suppliers who account for the company's greatest commercial vulnerabilities. Similarly, there should be an integrated supply chain risk management plan which includes feasible insurance packages which altogether increase the level of preparedness and business continuity. The resilience plans once harmonised with the inventory system(s) will increase the agility potentials of companies' downstream logistics. This will enable companies to oversee their current inventory status at different stock holding units, strategise replenishments for fast moving inventories in advance. Supply chain risk management strategies will enable the companies to forecast stock-outs of bottleneck and critical materials required for production, timely monitor customers consumption patterns and project stock-outs of finished goods in the downstream logistics. In turn, this will increase flexibility in business networks towards ensuring effective flow of goods and services profitably while hedging the probable risks in the vulnerability context before affecting business continuity.

5. CONCLUSIONS AND RECOMMENDATIONS

Over time nations will be able to stop the spread of the corona virus and get back to normal daily activities. However, the disruptions caused by the pandemic will take time to heal as the business in the global supply chains will not be able to return to normal operations over time. Businesses associated with global supply chains take time to be established and once operational the probability of changing them quickly to cope with unpredictable disruptions is difficult since it depends on the vulnerability context. Therefore, it will take companies probably more than six months to revive their lost operations and supply chain networks in the midst of crippling economies let alone the need to qualify potential suppliers for capacity, delivery, quality, cost and their ability to timely respond changing demands and associated risks. It is argued that global supply chains cannot be established overnight, companies need to consider building strong relationships with existing strategic suppliers and intermediaries in upstream and downstream supply chains respectively. Also, there is a need for putting system(s) in place to increase visibility in the global supply networks for a better understanding of risks and improved order fulfilment performance based priorities. COVID- 19 pandemic has provided a lesson that no supply chain is immune to risks and disruptions through preparedness for such pandemics is paramount towards minimising the likely repercussions unlike when unprepared. Likely, companies need to embrace new digital technologies in supply chain management to illuminate supplier network(s) and gain visibility to important equipment, components and parts supply on a timely manner from Tier 2 or Tier 1 suppliers locally or worldwide.

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