LOCUS

COVID - 19 and Supply Chain: Disruptions and Actions

COVID – 19: A 'Pandemic'

The year 2019 ended with China reporting the existence of a new virus, in the city of Wuhan in its Hubei province. It has been three months since and the virus, now officially known as SARS-CoV-2, has spread its wings beyond the Chinese boundaries, with more than 693,224 cases, across 170+ countries as of March 30, 2020[1].

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a novel virus, which is closely related to the original SARS-CoV. SARS-CoV-2 is the cause for the Coronavirus disease 2019 (COVID – 19)2. Both SARS – CoV and SARS-CoV-2 come from the same family of viruses that inhabits animals generally, but can be transmitted from animals to humans. In the past few decades, China has experienced multiple disease outbreaks. The last one being SARS Coronavirus outbreak in 2003. Compared to all the other previous disease outbreaks and pandemics the world has seen, COVID – 2019 is the most feared outbreak due to its rapid infection rates. It has been declared as a pandemic by the WHO. It took 67 days from the first reported case of Covid-19 to reach 100,000 cases, 11 days for the second 100,000, and just four days for the third 100,000.[3]

It is evident that COVID – 19 is going to have a significant economic impact. Global financial markets are already seeing huge drops in trading and it has pushed many economies into a financial shock. However, long term effects are yet to be seen and the impact has not been measured. Industries will be impacted from this outbreak in multiple ways, though the impact varies from sector to sector. There are certain sectors like aviation that have lost their demand, while there are multiple sectors like _FMCG_ which will see delayed demand. The market demand is uncertain and historical forecasts are no more relevant.

Firms will struggle to meet the changed market demand in days to come, majorly due to the broken supply chain network. Multiple countries have imposed restrictions on trade and movement. The current supply chain network of most of the multi–million dollar companies is distributed across the globe, with China being at the center of the network. On one hand, production might stop due to the non-availability of intermediate goods putting players in the upstream of the supply chain under pressure and on the other hand, distribution of goods from one country to another will be difficult due to the existing restrictions.

In this paper, we will first examine the economic impact of COVID – 19 on China's economy and see how the global economy is deeply integrated with China and with the rest of the Southeast Asian economies in terms of production and supply chain. We will then dissect the impact of the crisis with respect to the supply chain and ways to mitigate it through technology.

Economic Lessons from the Past:

The exact economic impact from the outbreak of COVID – 19 is difficult to estimate. While the only comparison available right now is with SARS (2003), China has grown rapidly from 2003 to 2019. China quickly rebound from its crisis in 2003 and hit a 10% growth rate, higher than the previous year's 9.1%. But China's GDP was 1.6 trillion USD in 2003, and has grown to 13.6 Trillion USD in 2018[4].

According to an analysis by Bain & Company[5], Tertiary Industries were hit the hardest during the 2003 SARS outbreak. Though the rebound of industries from the crisis was quicker in 2003, the same cannot be expected in 2020. **A quick supporting fact here is that the tertiary industries that were hit the hardest in 2003 make up 54% of the Chinese economy today, when compared to 42% in 2003[6].** Also, there are other macroeconomic factors in 2020 like the global economic slowdown and the recent trade war, which had had a significant impact on China, before the outbreak. All these factors lead to a hypothesis that there might be significant increase in the economic effects from the COVID – 19 when compared to the SARS outbreak in 2003.

According to an estimate by Weiwen Han, *et. al.* published by Bain & Company, Coronavirus would cost China more than all the previous outbreaks. It could run upto an amount of RMB 300B – 500B[7]. In the global front, McKibbin and Fernando estimate the impact of COVID - 19 on GDP of different countries by simulating seven scenarios. Scenarios 1-3 assume that COVID - 19 is isolated to China. Scenarios 4-6 are the pandemic scenarios where COVID - 19 infections occur in all countries to differing degrees. Scenario 7 is a case where a mild pandemic is expected to be recurring each year for the indefinite future. Based on the model, we are currently at Scenario 4, rapidly heading towards 5 , with COVID - 19 being spread to almost all the countries in different degrees[21].

In the most severe scenario (scenario - 6, with very high infection rates), McKibbin and Fernando estimate that China will face a loss of USD 560 Billion in GDP. Japan is the country with the highest hit of almost 10% GDP loss, upto USD 113 Billion, followed by Germany (USD 78 Billion) and the US (USD 314 Billion) with losses of about 8% each[22]. Japan's potentially sorry state can be explained with the already underlying structural weakness in the economy. Figure 1 indicates the deviation from the baseline of GDP losses that several global economies might face in case of scenario 4 - 7.
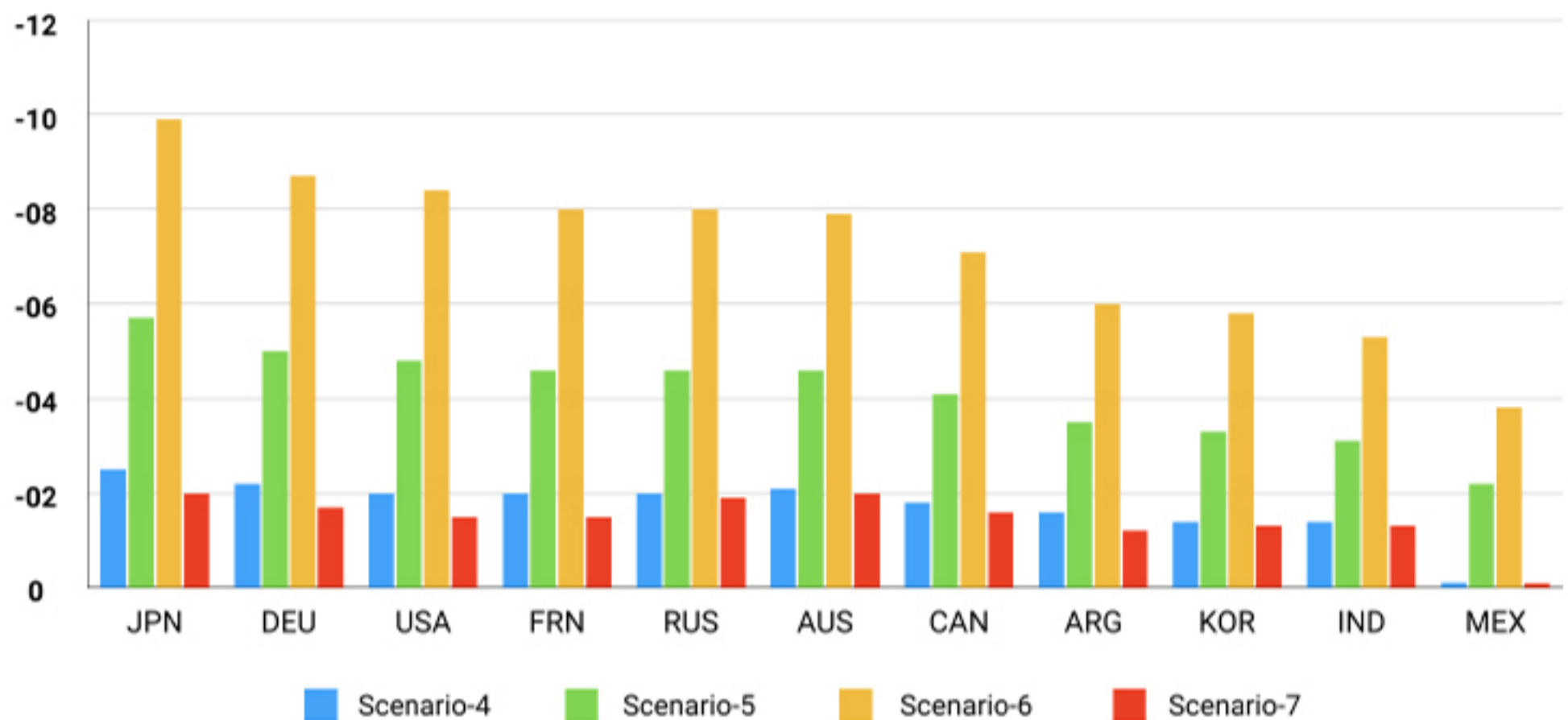

Figure 1: GDP loss in 2020, deviation from baseline
Estimates by McKibbin and Fernando (Results from the Simulation]

China's official Purchasing Manager Index(PMI) is an index that measures the factory activity with respect to the firm's production, employment and orders. February PMI came out to be 29.6 for services and construction and 35.7 for manufacturing, which is the lowest ever recorded. A PMI of less than 50 indicates contraction and more than 50 indicates expansion[8]. The low PMI indicates the difficulty that businesses are facing to start back the production and set up the supply chain again[9].Services seem to be hit the most other than manufacturing. **This is the first economic contraction in the Chinese economy since 1976, despite all the epidemics, pandemics and the financial crises China has seen.**

There is no consensus among the global community about the predictions on the impact from the virus. The predictions vary from pessimists to optimists. While optimists are undermining the impact of the virus compared to the previous pandemics the world has seen, pessimists are predicting it to be the largest viral outbreak the human kind has ever seen, both in terms of the number of infections and also in terms of the economic impact.

When the World's Factory shuts down, Global Supply Chain Scrambles

China is a global superpower in terms of economy. It became the world's largest economy in terms of Purchase power parity in 2014. However, the dynamics of China's relationship with the rest of the world has changed significantly. China's dependency on the world has

reduced, while international exposure to China has increased considerably (McKinsey, 2019). **An illustration to this is the fact that China is home to 111 Global Fortune 500 companies, but 80% of the revenue of these companies is from China**[10]. Also, integration of China's consumer market with global players is high. China acts as an attractive market with high growth potential for global players. Along with this, rapid industrialization because of cheap availability of labor, low cost, and globally integrated technological value chain has resulted in China being an attractive manufacturing or production hub for global players, who look for *cost optimization* in their production process. This has made China a central power in terms of global supply chain.
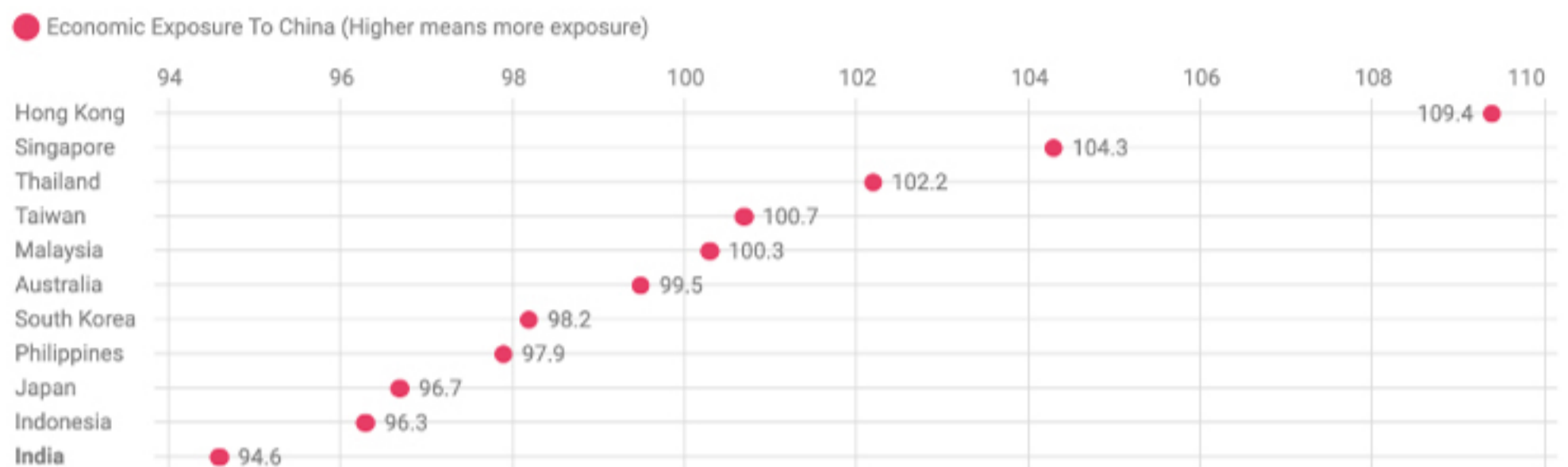

Figure 2: Economic Exposure of Different countries to China

Pressure to reduce supply chain costs have forced many manufacturers to pursue strategies like offshoring, that globalized the supply chain. In a modern global supply chain, the production processes are interconnected and are undertaken in multiple countries and with multiple partner firms. **Any disruption in one link of this network would halt production** because of a lack of required raw materials and intermediate goods. For example, an automobile would generally consist of 30,000 parts[11]. Each of these parts are sourced from different parts of the world to be finally assembled at a pre-decided location. **Fiat Chrysler, for instance, had to shut down its production unit in Serbia in February, just two months after the outbreak, due to non-availability of parts from China**[12].

There is no clear picture of the contemporary supply chain network as it is highly diverse and complex in nature, varying from company to company. It was expected that this network is flat and distributed in nature. However, the current scenario is different. The global supply chain network is hierarchical and concentrated in nature. This concentration has led to an increased exposure to disruption in the global network in case of crisis and pandemics. When a crisis hits any part of this network, it will disturb the entire production process, both upstream and downstream suppliers and consumers. **Also, internally, many companies don't have an idea on their risk exposure in terms of supply chain.** We were just not ready to face this - a global pandemic of this scale in three months was new to every business. Most Business Continuity Plans never factored in a global pandemic of this magnitude.

Figure 3 indicates how the world has become more dependent on China economically, but how the vice – versa is not the same and China is not dependent on the world. It can be seen that China's share in the Global trade in the **export of Intermediate goods** is around 15% and in capital goods is around 23%. However, the percentage of import with respect to global trade is much less than the export for all the class of goods. World looks to China for intermediate goods.

Share of China in Global Trade(by stage of production, %)
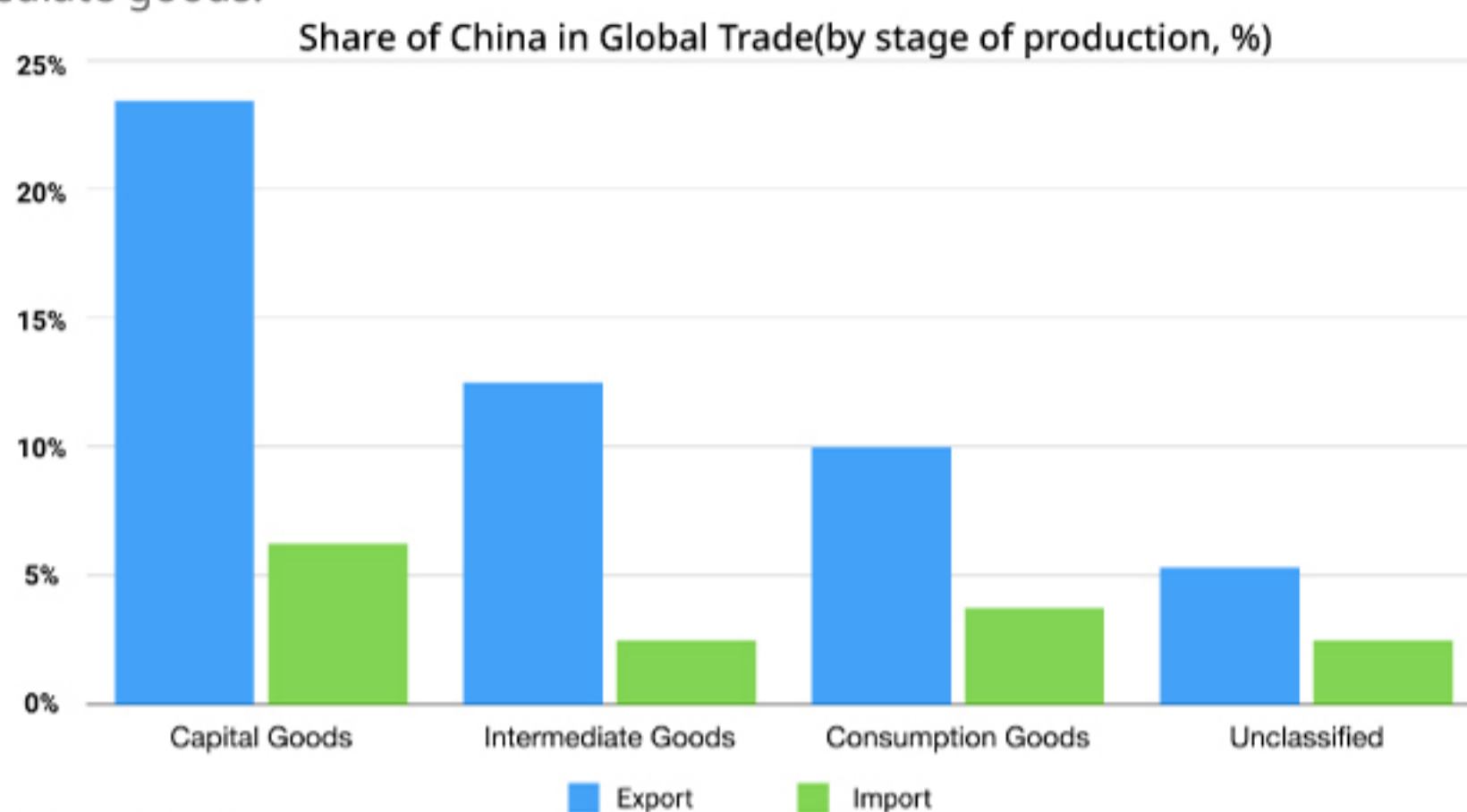
Soure: Natixis, UNCTD

Note: Products classified under the Broad Economic Categories. Unclassified products consist mainly of food and live animals

Figure 3

Network between China and the rest of Asia is much more close. Asia plays a significant role in the global supply chain context as a production and manufacturing hub due to its cheap labor and low cost of production. It is expected that **Vietnam will be the worst hit** due to the crisis in China, given its high dependency on the Chinese supply chains. It can be estimated that the impact on **economies like Singapore, Japan, and Hong Kong will be more severe, due to the already lying structural weaknesses in the economy.** These developments also indicate the flaws in how many Southeast Asian's economies have grown. Many of the southeast Asian countries are extensively dependent on the China-centric external demand and on the Chinese supply chain. China acts as an intermediate destination in most of the global supply chains and thus, many global supply chains were always vulnerable and the exposure to risk is high; COVID - 19 has just come as a realization.

COVID – 19 outside China: Story So Far

COVID – 19's economic effect on China and on other economies due to their high dependence on China-based products makes the situation grimmer. In the current scenario, China claims that it has almost won its fight against SARS – CoV – 2 and has been mostly successful in containing the spread of COVID – 19. However, more than 190 countries are being affected by COVID – 19 as of 24th March, 2020. The hotspot is now Europe, and not China.
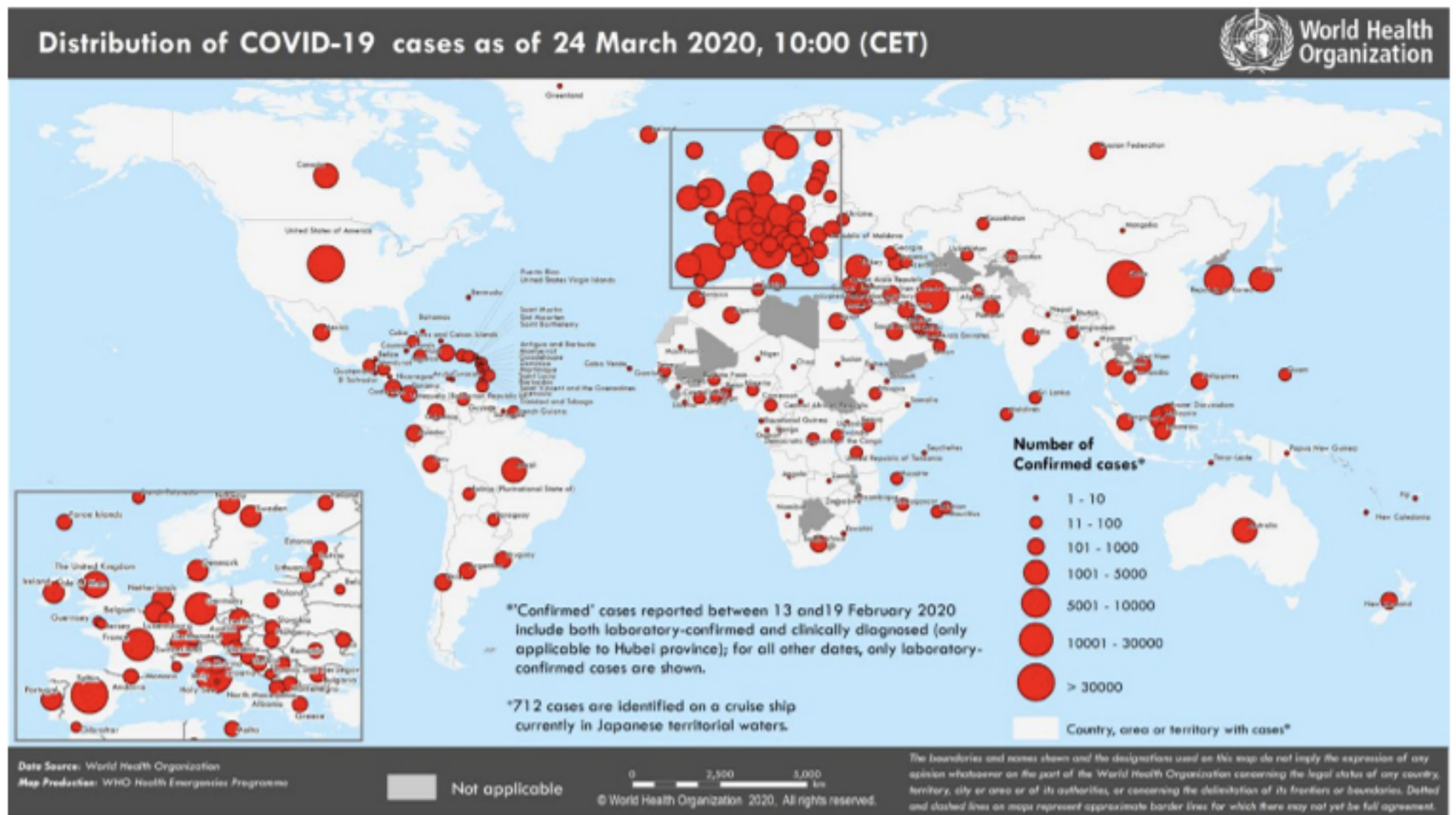
Figure 4

Outside China, countries like Italy, Spain and Germany, in the far Europe are struggling to contain the spread of COVID - 19. European Centre for Disease Prevention and Control predicts that the risk associated with people in EU/EEA and UK getting infected with COVID – 19 is moderate to high, as of March 9, 202013. Many European nations have a significant number of cases reported and this has forced multiple governments to impose drastic restriction on movement, in some cases within the country and in most cases from outside the country. The United States is struggling to control the pandemic as well. Almost all countries have cancelled visas and have imposed travel restrictions. It is evident that these restrictions would have significant impact on trade, internally on sectors like tourism, hospitality, transportation, etc. and on external trade and international business in sectors like FMCG, consumer electronics, _pharmaceuticals_, etc. Negative impact on trade would have a _direct effect on the economy of the world_ and countries in the long run.

The current focus of most of the governments and political leadership is to contain the further spread of COVID – 19. Also, the magnitude of impact is not clear, as it affects the current and future economic status of people, companies, and countries. The bigger economic shock is yet to come. Financial shocks like bearish market and liquidity crisis aside, the immediate shock to many businesses is the broken supply chain and managing uncertain demand that is about to come. In the following section, we will analyze the impact of COVID – 19 on supply chains and ways to mitigate it.

How is COVID - 19 affecting the Global Supply Chain

While most firms are struggling to tackle the current crisis by pushing hard to fill up retail shelves and their factory furnaces, a medium-term and long-term supply chain vision is important to become more resilient and equipped to the current and other such black swan events in the future. COVID-19 has impacted supply chains across different geographies and industries and its sensitivity needs to be dissected. To understand various pain points and risks associated, enterprises need to first look at supply chains from a network design perspective, followed by breaking it down into its individual functions like procurement, manufacturing, warehousing, inventory, distribution, and demand planning.

Supply chain network design and risk concentration:

China has been deeply integrated with global supply chain networks due to its cost-effective manufacturing capabilities and other pro-trade policies. Businesses with heavy reliability on Chinese capabilities could not have possibly anticipated such unprecedented disruption in their Business Continuity Plans and the associated risk exposure. Hyundai, one of the largest automakers, had to stop production in its factories in South Korea due to a shortage of supply of parts from its Chinese suppliers, within a month of the outbreak in China[14].

While shortage of parts due to a disrupted network is only one part of the problem, the larger problem is transportation and distribution. China has been largely integrated with global network of transportation - redirecting and reorganizing this flow has had a significant effect on the cost for various industries. Also, considering that it is not a localized problem to China anymore, the problem has become more serious. Analysts Pierre Haren and David Simchi-Levi in HBR wrote that **"activity at the French port of Le Havre is also slowing and could drop by 30% within two months. And the anticipated impact on U.S. ports is starting to be factored into financial analyses"**[16]. The Global shipping Index in Figure 5 shows a sharp drop in the vessel leasing rates since the start of the COVID - 19 outbreak. The x - axis shows the months elapsed since the indicated event, with t = 0 being the initial impact month. This drop was not seen in recent epidemics or after the 9/11 attacks.
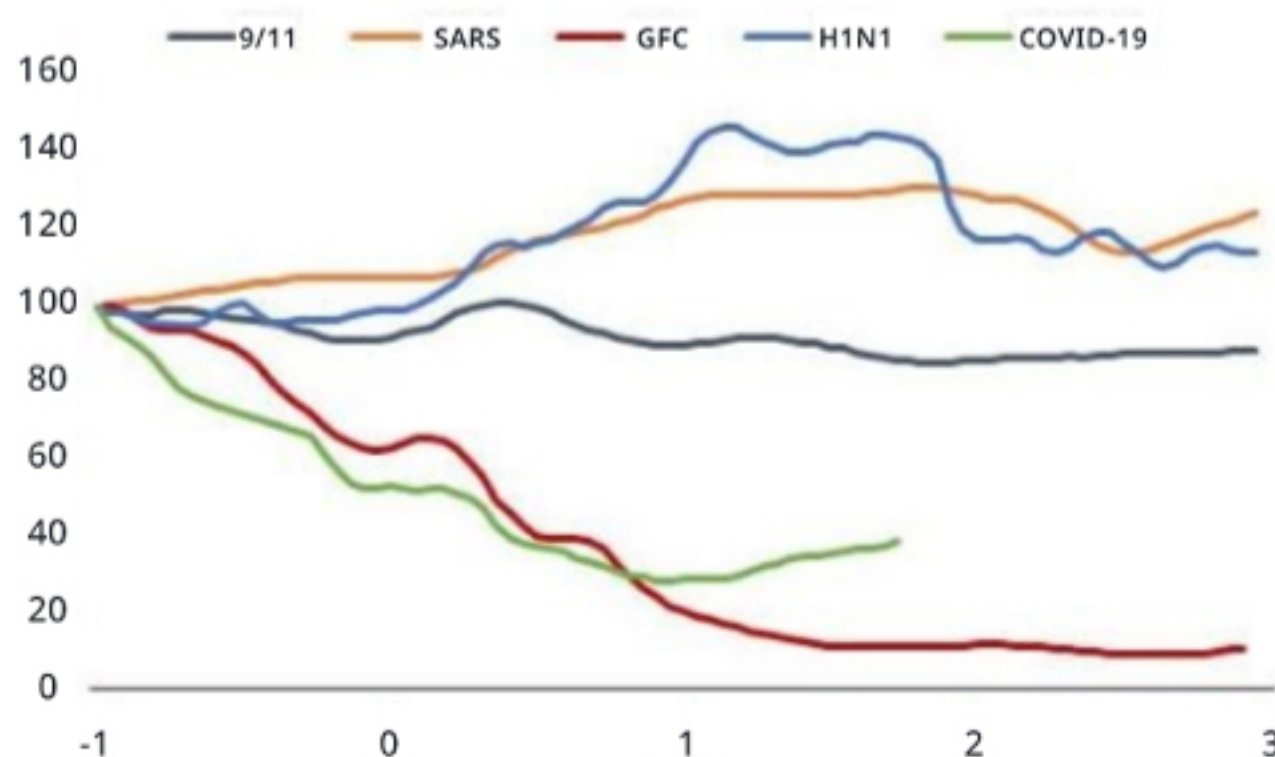

Figure 5: Global Shipping Index [GFC Indicates Global Financial Crisis]   *Source: Haver Analytics and IMF*

Supply chain networks in large companies are so complex that they cannot be visually represented with basic tools and there is no end-to-end visibility. This coupled with COVID - 19 impact is proving to be devastating already. A solution for these problems is to **optimize the existing network** to be more flexible, agile, and have low-risk concentration across nodes and processes, combined with full-scale visibility of the organization's supply chain network. Single sourcing point of crucial raw materials, majority of the production capacity confined to one geography or simply adopting outdated forecasting techniques are factors that exposes supply chain to risk. All these factors lead to increased dependencies on a particular node in the network or to a particular process in the supply chain, which has to be eliminated to become shock-proof. An understanding of risk exposure enables business leaders to understand trade-offs and make smart decisions to mitigate risk and disruption.

Artificial intelligence coupled with domain supply chain knowledge is enabling businesses to build virtual models (also referred to as digital twins), which replicates an organization's supply chain, and is capable of simulating pre-defined scenarios. These simulations and visualizations help business leaders in understanding the sensitivity at the nodes of the supply chain network, to strategically plan the core (Eg: value chain of the product) and associated entities (Eg: fleet requirement). Being able to visualize the entire network, optimize it to save cost, quantify the sensitivity of the supply chain to risks and disruption, and being able to re-optimize the network considering the disruption and risk exposure will give an edge to a firm over its competitors.

Demand Fluctuation: Bullwhip Effect and Inventory Crisis

Demands across industries are seeing an all-time dip, except for essentials and pharmaceutical products. On one side of the spectrum, we have pharmaceutical and sanitization products whose demand has splurged, and the firms are struggling to meet the demand. **According to Nielson, in Malaysia, sales of hand sanitizers hit almost RM1 million (US$ 237,176) in the week ended Jan. 26, 2020, which is more than 800% above the weekly average**[17]. On the other end of the spectrum, we have industries like electronics, aviation automobiles, etc. whose demand has decreased considerably. Apple has released an investor update in which it announced that it will not be able to meet the revenue guidance it published for the March quarter[18]. This is both because of supply and demand. Apple's production units are strained due to the high dependence on Chinese suppliers for intermediate goods. Also, demand for Apple's products in China has reduced due to the prevailing public health crisis. McKinsey predicts that the impact on demand slows down the growth of the global economy – between 1.8-2.2% instead of the 2.5% growth predicted at the start of the year.[19]

Multiple industries are soon going to face a bullwhip effect in their demand forecasting. A bullwhip effect is a phenomenon of overestimating the fall in market demand which starts with the retailer on the minor scale and amplifies as it passes through the supply chain.

Thus, the actual demand forecast that the producer or manufacturer receives would be much smaller than the actual demand forecast from the retailer who sells on the ground. A rudimentary demand forecast would result in revenue loss/stocked capital due to the error from the bullwhip effect.

Leveraging technology with advanced forecasting techniques that does not stick to one algorithm, but instead uses forecast errors to find the best-fit forecast, should be adopted to have a near accurate forecast of demand to balance out resource utilization, inventory management, and lost sales of demanded products. Figure - 6 indicates the expected impact of COVID - 19 on demand for various sectors relative to baseline forecast. While certain sectors like Smartphones and Automotive are going to see a sharp drop, there are sectors like _Online retail with a surge in demand._ There are multiple factors like supply outages, movement restriction, etc. for the varied demand and it is evident that demand is highly uncertain in days to come.
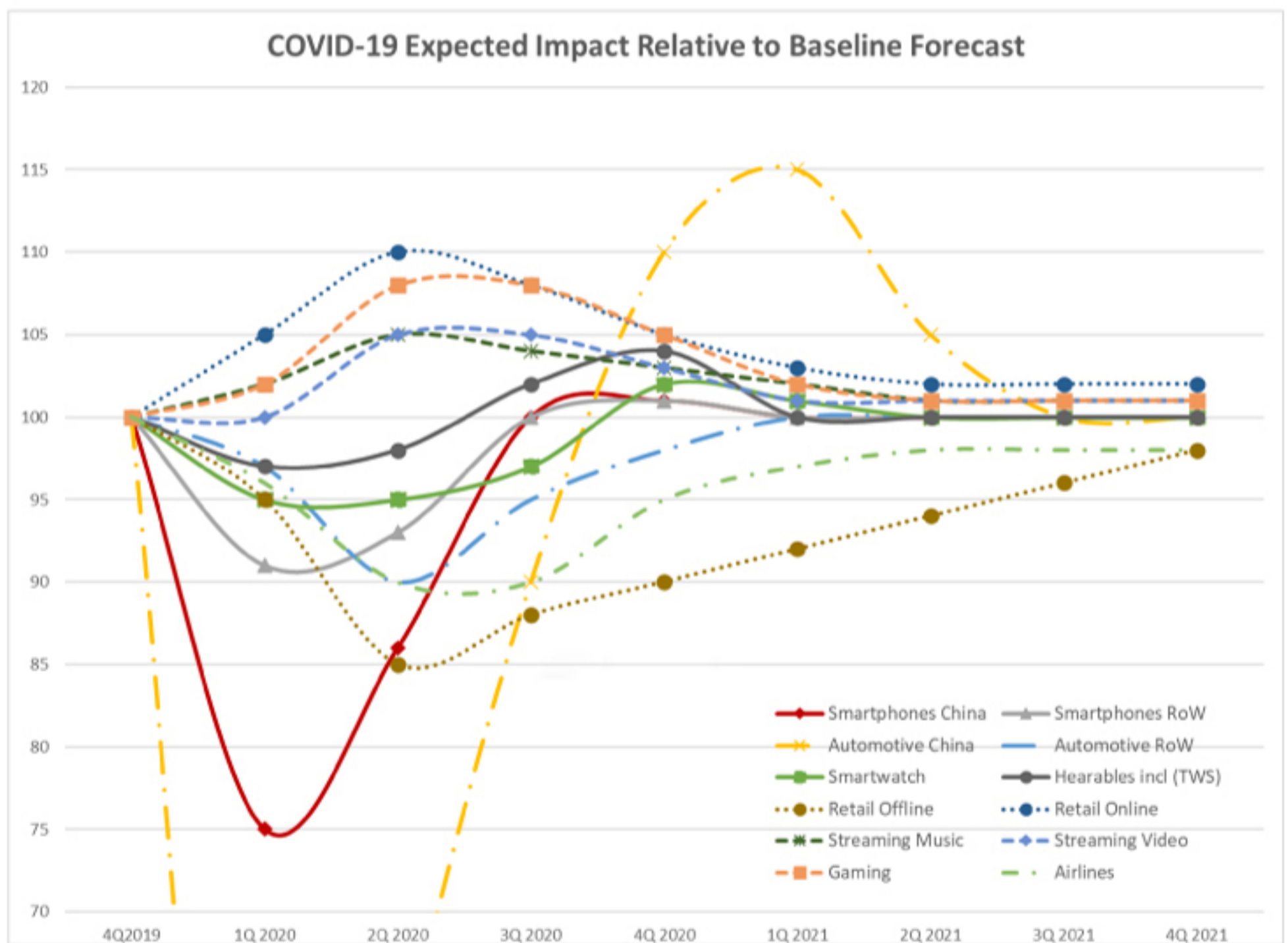
Figure 6 COVID - 19 Expected Impact Relative to Baseline Forecast   _Source: Counterpoint Research_

The disrupted network will also have a significant impact on the supply lead time and this problem is yet to emerge in most parts of the world. Shipping by sea to the United States or Europe from China would take around 30 days. This indicates that the shipment from China that started from Chinese ports before the closure for the Chinese holiday in January would arrive in the US or Europe in the last week of February. Firms usually store large inventory due to long Chinese holidays during their New year celebrations. This might give firms some breathing space.

However, this indicates that there might be a large scale shut down in manufacturing and production in most parts of the world for at least a month, provided China recovers completely from COVID – 19 and production starts in Chinese firms before March ends. If not, the shutdown might prolong. Commercial data and analytics company Dun and Bradstreet estimate that there are around 22 million businesses (90% of all active businesses in China) within the regions impacted by COVID-19. This is likely to impact at least 56,000 companies around the world with suppliers either directly or indirectly[20]. Quarantines and lockdowns in the other parts of the world outside China are only going to increase the magnitude of this shortage in inventory of intermediate and finished goods.

Unpredictable demand spikes and possible inventory shortages call for optimizing the inventory using advanced algorithms which can consider not only demand variability but also supply variability to generate adequate inventory levels and policies. Historically, inventory optimization techniques were largely used to avoid the bullwhip effect. However, along with the bullwhip effect, the current problem would be to predict the safety stock level in the disrupted network (non-functional warehouses and factories). Leveraging technology will help enterprises to determine accurate safety stock levels for current, mid-term, and long term planning and decision making.

Optimal Sourcing

Along with determining the right inventory stock, another challenge that comes with a disrupted supply chain network is to look for alternate sourcing options. While suppliers in China and many parts of the world are unable to meet the demand for intermediate goods required for production, proactive firms are looking for options. Many U.S. buyers had already started moving their sourcing away from China to other Southeast Asian countries like Vietnam, in an effort to decentralize their supply chain. This effort is expected to increase its pace in days to come. However, COVID – 19 has turned out to be a global pandemic, not just disrupting networks in China, but also in many parts of Europe and Southeast Asia. Determining an optimal sourcing strategy is a challenge to any executive at times of such a crisis. If this challenge is avoided and not addressed immediately, the upstream of the supply chain will be soon broken and firms will not be able to meet the spike in demand which is probable in a month or two from now if we are optimistic on the global community being able to control the spread of the disease.

Being proactive translates to having an optimized distribution network, determining the right inventory levels and inventory mix, based on an accurate demand forecasting that avoids the bullwhip effect (which is not the same as the normal manual demand forecasting, which does not work in the times of uncertainties like this), and to determine the alternate optimal sourcing strategy, to exactly know which alternate place and suppliers to order from and how much to order to meet the uncertain demand, keeping optimization of cost in mind.

"we, at Locus, have developed an exclusive COVID-19 Delivery Guide to help businesses in logistics and supply chain so as to ensure smooth operations during this tough time." _Get your copy now!_

Manufacturing, Warehousing, and Distribution:

Communication channels should be established to gain complete transparency on existing assets and processes. Business leaders should be completely aware of the capacities and stock they hold in their arsenal. Armed with the right demand planning techniques, the next power play should be in securing capacities for manufacturing, warehousing space, and distribution. Since demand forecasting cannot be completely accurate, other edge cases like +10% or -10% of the forecast should be simulated to understand capacity requirements and understand the cost implications associated with it.
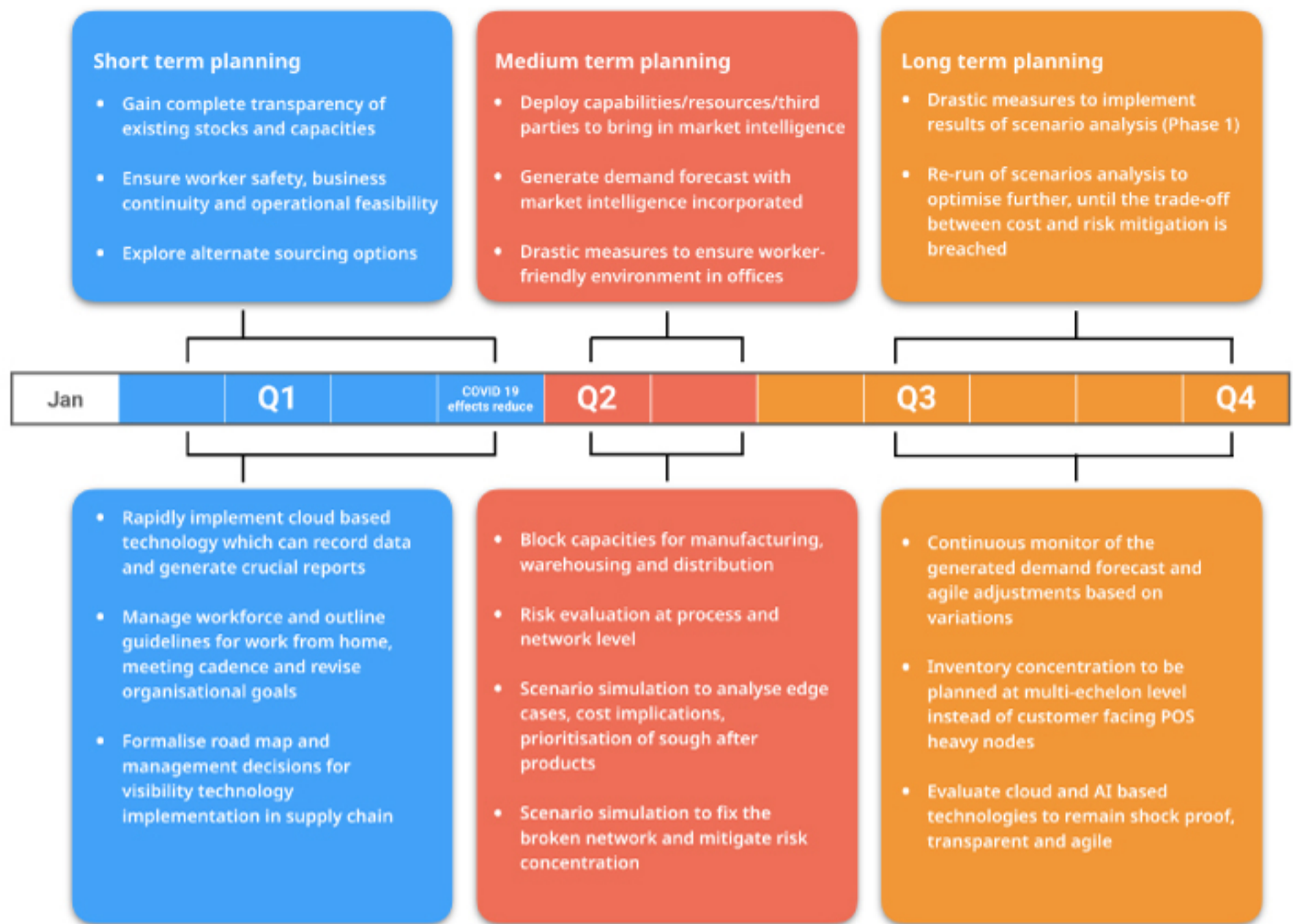
The analysis will draw on a cross-functional team that includes marketing and sales, operations, and strategy staff, and also individuals who can tailor updated macroeconomic forecasts to the expected impact on the business. An advanced S&OP platform can better match production and supply planning with the forecasted demand in a variety of circumstances. Once capacity is blocked and the required processes are set in motion, product prioritization needs to be strategized to manufacture high demand products which come under essentials and medical essentials for the short and medium term requirement.

In the time of crisis, understanding current and future logistics capacity by mode-and their associated trade-offs-will be even more essential than usual, as well as prioritizing logistics needs in required capacity and _time sensitivity of product delivery._ Consequently, even as companies look to ramp up production and make up time in their value chains, they should prebook logistics capacity to minimize exposure to potential cost increases. Collaborating with partners can be an effective strategy to gain priority and increase capacity on more favorable terms. Maintaining a nimble approach to logistics management will be imperative in rapidly adapting to any situational or environmental changes.

Point of Action: What should businesses be doing now, the next quarter and six months down the line?

Most companies have just felt a shock right now and are working on immediate stabilization. However, what might unfold in one or two months for industries like FMCG, 3PL, etc. is an unstable and unforeseen demand, shortage of suppliers for intermediate goods required to meet the market demand, inventory shortages and a broken supply chain network for distribution. Considering a likely scenario, neither optimistic nor pessimistic, that the world would recover from COVID - 19 by second quarter of 2020, what you should be doing as an executive right now to face the upcoming challenges?

Short term planning
- Gain complete transparency of existing stocks and capacities
- Ensure worker safety, business continuity and operational feasibility
- Explore alternate sourcing options

Medium term planning
- Deploy capabilities/resources/third parties to bring in market intelligence
- Generate demand forecast with market intelligence incorporated
- Drastic measures to ensure worker-friendly environment in offices

Long term planning
- Drastic measures to implement results of scenario analysis (Phase 1)
- Re-run of scenarios analysis to optimise further, until the trade-off between cost and risk mitigation is breached

| Jan | Q1 | COVID 19 effects reduce | Q2 | | Q3 | | Q4 |

- Rapidly implement cloud based technology which can record data and generate crucial reports
- Manage workforce and outline guidelines for work from home, meeting cadence and revise organisational goals
- Formalise road map and management decisions for visibility technology implementation in supply chain

- Block capacities for manufacturing, warehousing and distribution
- Risk evaluation at process and network level
- Scenario simulation to analyse edge cases, cost implications, prioritisation of sough after products
- Scenario simulation to fix the broken network and mitigate risk concentration

- Continuous monitor of the generated demand forecast and agile adjustments based on variations
- Inventory concentration to be planned at multi-echelon level instead of customer facing POS heavy nodes
- Evaluate cloud and AI based technologies to remain shock proof, transparent and agile

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NetOpt is Locus' proprietary machine learning-based algorithm, that replicates a company's end-to-end supply chain from bottom-up and creates a digital twin. This digital twin is then used to analyze, tweak, and optimize the network of a given supply chain for location intelligence, optimized inventory holding costs, and value chain flow of the product. The digital twin also considers associated requirements like the right fleet size, capacity, and all other possible _real-time constraints,_ while coming up with recommendations.

Locus supply chain strategy consulting is committed to transforming supply chains from traditional cost centers to market differentiators. We help organizations optimize their supply chain and strategize sustained business growth through data-aided decision making. Locus consulting is the perfect fusion of supply chain expertise and cutting edge Artificial Intelligence capabilities to drive innovative and contextual solutions.

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