PSA TRANSFORMING THE SUPPLY CHAIN

COVID-19 HEALTH SUPPLY CHAIN IMPACT-PRELIMINARY EVIDENCE FROM AFRICA

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Acknowledgements

The authors wish to thank Dr. Gamal Khalafalla Mohamed Ali and Mr Andrey Levitskiy who supported through providing information and feedback.

Suggested Citation

Nayler, J., and Subramanian, L. (2021). Covid-19 Health Supply Chain Impact-Preliminary Evidence from Africa. Pamela Steele Associates Ltd.

Executive Summary

The Covid-19 pandemic has had a devastating human impact and exerted unrelenting pressure on pharma and healthcare supply chains. At the same time, supply chain preparedness is crucial to overcome any challenges presented by the ongoing pandemic. This study aims to understand the impact of Covid-19 on health supply chains in Africa and the level of preparedness across the various levels.

The study methodology includes a desk review of literature and an online questionnaire, which was circulated through multiple channels including the International Association of Public Health Logisticians (IAPHL) platform and the South-South Knowledge Network (SoSoKe). The survey received 41 responses, 88% of whom were from Africa, 10% from Asia and 2% from South America. 41% of respondents were from organisations at the national level, 15% from the state level, 5% from the local level and the remaining 39% were 'other.'

Impact of Covid-19 on Health Supply Chains in Africa

The literature review identified key areas of impact of the Covid-19 pandemic, which include production stoppages, shortages of raw materials and finished goods, transportation disruption, delayed shipments and stockouts. Survey respondents also highlighted key areas impacted by the pandemic, the most frequently mentioned being procurement, supply chain planning, and distribution. Other common areas of disruption included sourcing, inventory management and forecasting and quantification.

Supply Chain Preparedness for the Impact of Covid-19

10% of respondents stated their organisation had no planning in place prior to the pandemic beginning. 46% stated they had either some degree of, or limited, planning. Only 17% of respondents said that they were fully prepared. Respondents appeared to state that their current preparedness is better than previously: 39% of respondents said they are now prepared (compared to 17% who stated they were prepared previously).

Regarding recovery, 29% of respondents believe it will take greater than 12 months. 61% believe it will take 3 – 12 months. No respondents thought that supply chains would never recover.

The tentative recommendations include: the need for improved forecasting tools; consolidating supply and demand planning through an integrated approach; designing continuity plans outlining a range of disaster scenarios; the need to have concrete, comprehensive readiness plans; use of technology to simulate similar supply chain disruptions; design contingency plans focussed on multi-facility, multi-country shut down; better knowledge and access to the readiness plans of supply chain partners; and embracing transparent communication, collaboration, and information exchange among key supply chain partners.

1. Background

Covid-19 is an unprecedented crisis. Globally, as of 23rd February 2021, there were 111 million confirmed cases of Covid-19, including nearly 2.5 million deaths. Alongside its devastating human impact, the pandemic has exerted unrelenting pressure on pharma and healthcare supply chains.

Government interventions, such as social distancing and lockdowns, have led to disruptions in the health supply chain. A recent modelling study predicted that low-and-middle-income countries (LMICs), especially in Africa, are particularly vulnerable to the indirect effects of Covid-19 on supply chains (Roberton et.al., 2020). The increasingly interconnected and interdependent global economy have left countries vulnerable to external shocks, including in Africa. This is the second report in a series of research papers that Pamela Steele Associates (PSA) is creating on the impact of Covid-19 on health supply chains in Africa. The new data collected is based on a master survey, which also informed PSA's recent study on African countries' supply chain readiness for the Covid-19 vaccine.

Modern management strategies and innovations aimed at streamlining systems and maximising profits, such as lean manufacturing, Just-In-Time, and strategic inventory tend to reduce flexibility and are more susceptible to external shocks. African countries' close economic and manufacturing ties with China have also been impactful.

Supply chain preparedness is crucial to overcome any challenges presented by the ongoing pandemic (particularly given the emergence of new Covid variants, such as that which emerged recently in South Africa) and other external events which may happen in the future. This review will examine and answer the following research questions:

- What areas of the supply chain have been most impacted by the pandemic?
- How were supply chain organisations prepared to face a major supply chain disruption prior to Covid-19 and what is the level of preparedness for future effects?

2. Literature review

This section discusses the impact of Covid-19 on supply chains (as well as some tentative steps which are being taken to address any challenges) and explores the concept of supply chain resilience. Whilst the data analysis section focuses specifically on Covid-19 and health supply chains in Africa, the literature adopts a broader focus on global supply chains. This is to track ongoing events and learn and scale-up lessons from the wider supply chain sector.

2.1 Impact of Covid-19 on Health Supply Chains

Forecasting: Accurate forecasting supports the effective management of the pandemic and also contributes to balancing demand and supply needs of global supply chains. The pandemic has led to panic buying and overstocking, which has been aggravated by the bullwhip effect and led to serious implications for overall supply chains (Wang & Disney, 2016).[1] Therefore, forecasting is necessary to support robust evidence-based governmental decisions, for managing resources, and guiding unpopular, yet critical, decisions like lockdowns, social distancing, etc. However, this can be a complex task for the government and supply chain managers, as several factors may emerge that could increase the severity of the pandemic and worsen the impact (Nikolopoulos, 2020).

[1] According to the Chartered Institute of Procurement and Supply (CIPS) the bullwhip effect is defined as the demand distortion that travels upstream in the supply chain from the retailer through to the wholesaler and manufacturer due to the variance of orders which may be larger than that of sales.

Sourcing and procurement: Shortages of essential supplies are a visible impact of the pandemic on consumers, yet there are also many less visible impacts, including production stoppages and shortages of raw materials, sub-assemblies, and finished goods. Quarantines, lockdowns, and restrictions on the mobility of people and resources lead to supply shortages and affect manufacturers globally. Restrictions on raw materials and finished products being imported also disrupt global supply chains. To address this, there has been an initial refocus on regional sourcing and promoting local pharmaceutical manufacturing (Steele, et.al., 2020).

Transportation: The restrictions embraced by all countries to combat the spread of the novel coronavirus have negatively impacted the transportation of goods, passengers, and information. In an integrated world, well-functioning supply chains are enabling factors for economic growth and prosperity. The pandemic is emerging as a primary risk factor for supply chains. It will have an irreversible impact on how transportation networks are used at different levels across the supply chains (Ivanov, 2020a). Covid-19 has also caused significant negative impacts on travel behaviour, transport volume, and freight capacity (de Vos, 2020; Loske, 2020).

Inventory management: Covid-19 has resulted in major supply chain disruptions with substantial impact on inventory management. Supply chain managers at different levels have found it difficult to maintain sufficient levels of inventory and avoid stock-outs. This issue is exacerbated further by consumers' panic buying and other supply chain bottlenecks. The pandemic has created gaps in inventory control and inventory management, and businesses are struggling to maintain optimal ordering policies. To help with this, companies are modifying supply chains by carefully managing interdependent factors, like localisation, complexity reduction, dual-sourcing, and investing in advanced manufacturing technologies (Garvey and Carnovale, 2020).

Warehousing: The pandemic has necessitated the need for warehouses to function optimally amidst reduced workforces and social distancing (Singh, et.al., 2020). This can have a trickle-down impact on supply chains, resulting in stockouts and delayed shipments. Staffing issues, pre-existing orders that still need to be fulfilled, and a sharp increase in demand are accelerating the idea of doing more with less. This has paved the way for automation technology in warehouses enabling businesses to thrive amid today's changing conditions.

Distribution: The pandemic has created challenges for distributors; continuing business as usual may put employees in harm's way or abandon ground to suppliers. There is a sharp decline in the demand for distribution as it is a sector hit hard by physical distancing and government-recommended isolation guidelines. On the other hand, distribution demand for some products and services, including medical supplies, sanitisation products, toilet paper, canned food, delivery apps, videoconferencing, headsets, and home entertainment has skyrocketed (Abdelnour, et al., 2020). This has increased the exposure of employees to the virus amidst the growing demand. The pandemic has forced distribution to shift to e-commerce, prompting companies to invest in digital-sales training and online capabilities (Guan, et.al., 2020).

Manufacturing: The pandemic will have a financial impact on the manufacturing sector, aggravated by plummeting oil prices and demand, supply chain bottlenecks, spending slowdowns, and credit market jitters. Many industrial facilities have also been forced to close facilities and are considering staff layoffs to help curb the spread of the virus, as well as for economic reasons. Manufacturers understand that the pandemic will cause long-standing shifts in the industry and introduce greater automation and technological revolution. The pandemic resulted in a spike in demand for medical supplies, although the healthcare industry struggled with procuring these during the pandemic. Demand for consumable personal protective equipment is likely to continue for some time, benefiting manufacturers of medical supplies across the board (Okechukwu, et.al., 2020).

Commodity pricing: Commodity prices have reacted strongly to the crisis, reflecting changes in supply and demand due to policy measures to limit contagion (Van der Ploeg and Poelhekke 2017). This has resulted in unprecedented shocks, especially for economies dependent on such commodities. The pandemic has impacted the global prices of oil and minerals, decreased income levels due to rising unemployment, and depressed the global demand for manufactured goods. The Covid-19 outbreak in commodity-producing countries has also interrupted agriculture, directly affecting the supply of these commodities (World Bank, 2020). Therefore, the turmoil in commodity prices, an economic slowdown, and health catastrophes create multiple crises that mutually reinforce each other and can exceed countries' response capacities (Tröster and Küblböck, 2020).

Human resources: Covid-19 has significantly affected the profitability levels of organisations due to deterioration in efficiency and productivity of human resources. The Covid-19 pandemic has created a great need for human resource managers to innovate and adapt in order to combat the challenges. Remote working is one of the new emerging methods that most organisations are adopting as a way of maintaining smooth operations and quality services to clients (Carnevale and Hatak, 2020).

Data and information management: Covid-19 has presented major risks for crisis management, remote work support, and cybersecurity for all key stakeholders. The pandemic has also caused an information overload, leading to a challenge in maintaining data quality and authenticity. The value of evidence-based decision-making has expanded significantly, not only for the healthcare sector, but for all industries along the health supply chains. Open sharing of data and fostering a culture of information sharing has been an emerging trend, where lessons learned from across the globe are being scaled up (Ma, 2020).

2.2 Supply Chain Resilience and Readiness

Pandemics are an example of high impact, low frequency events posing considerable risks to supply chains (Kinra et al., 2019). The Covid-19 virus resulted in downstream disruptions, including closure of production facilities, distribution bottlenecks, etc. However, unlike global risks like natural disasters and manmade hazards, the pandemic has quite unique implications for supply chains. In contrast to geographically centred, singular disasters, a pandemic is not limited to a particular region or confined to a particular time period. Different components of a supply chain are affected concurrently, and markets can become paralysed within overlapping time windows. The most widely cited definition of resilience is by Christopher and Peck (2004): "the ability of a system to return to its original state or move to a new, more desirable state after being disturbed." It is important for key stakeholders to understand the fine line between what influences supply chain resilience and what constitutes resilience itself. This remains an active area of ongoing research among researchers and practitioners from diverse perspectives (Kamalahmadi and Parast, 2016).

Some of the key antecedents of supply chain resilience have been identified as supply chain collaboration, agility and risk management techniques, and the role of social capital (Scholten and

Schilder, 2015; Johnson et al., 2013) Other factors include firm innovativeness, information sharing and visibility, and supply chain connectivity. (Gölgeci and Ponomarov, 2015; Brandon-Jones et al., 2014). In terms of resilience measurement, several dimensions have been explored in literature, including density, complexity, number of suppliers, level of integration, information frequency, inventory levels, management culture, etc. (Pal et al., 2014; Juttner and Maklan, 2011). A survey by Mckinsey revealed that an overwhelming majority had weaknesses in their supply chains that they are working to address, and 75% had faced problems with production and distribution (Alicke, 2020). For future resilience, the authors argued that leaders should take this moment "not just to fix their supply chains temporarily, but to transform them."

Supply chains require response and recovery ability to reduce the impact and to bounce back from the post-disruption state (Ponomarov and Holcomb, 2009). Failure to develop required readiness, response and recovery abilities make the supply chains vulnerable, which adversely affects both revenue and cost of the whole chain. It is worth noting that supply chain readiness, response and recovery are interdependent to each other; as increased in preparedness of supply chains accelerates response and recovery from the crisis (Grotsch et al., 2013). Stakeholders must also be aware of the overall supply chain environment, as the different elements and metrics required to ensure readiness and resilience are dependent on this.

3. Methodology

The study aims to understand the impact of Covid-19 on health supply chains in Africa and the level of preparedness across the various levels. It uses data from the master survey that supported PSA's recent paper on supply chain readiness in Africa for the Covid-19 vaccine, and therefore follows a similar methodology. This methodology includes the following components:

- A desk review of relevant literature was carried out on the Covid-19 impact on supply chains, the challenges it causes them, and supply chain resilience. This includes peer-reviewed articles, and global project reports and studies.
- An online questionnaire was prepared to collect responses across a wide group of stakeholders, particularly logistics providers at the central, district, and state levels, as well as

implementing partners and private sector participants in the health supply chain. Invitations to complete the survey were circulated through multiple channels, such as the International Association of Public Health Logisticians (IAPHL) platform and the South–South Knowledge Exchange network (SoSoKE). The survey included questions on impact of Covid-19 on supply chain operations, resilience of operations, preparedness of health supply chain participants, and issues around vaccine logistics. The questionnaire follows a 5-point Likert scaling.

The study follows the non-probability sampling. We used the selective, or judgment sampling. This technique relies on the judgement of the researcher when choosing who to ask to participate. Researchers may thus implicitly choose a "representative" sample to suit their needs, or specifically approach individuals with certain characteristics. Judgement sampling has the advantage of being time-and cost-effective to perform, whilst resulting in a range of responses (particularly useful in qualitative research). We also expect this to snowball to other key informants. The study follows a detailed research protocol and ethical consent.

4. Results

This section analyses the survey responses (41) and highlights the key trends that emerge across the various dimensions of vaccine readiness and supply chain logistics.

4.1 Respondent profiles

The survey details the responses in order of the geographical location and the type of the organisation the respondents represent.

Geographical profiling: 88% of the responses were received from Africa, 10% from Asia, and 2% from South America. This highlights an increased uptake of the survey in countries in Africa. The geographic distribution of the survey responses can be seen in Figure 1.

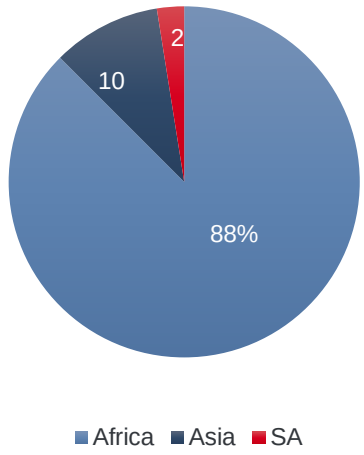

Figure 1 Geographic distribution of survey responses

Within Africa the survey elicited 47% of responses from Nigeria, 29% of responses from Ethiopia, 6% of responses from each of Burundi, Liberia, and Kenya respectively, and 3% of responses each from other countries including Togo, Sierra Leone, Ghana, Chad, Mali, and Zimbabwe.

Type of organisation

This survey included 41% responses from organisations at the national level, 15% from the state-level, 5% from the local government level, and the remaining 39% from organisations not belonging to the national, state, or local level. The distribution can be seen in Figure 2.

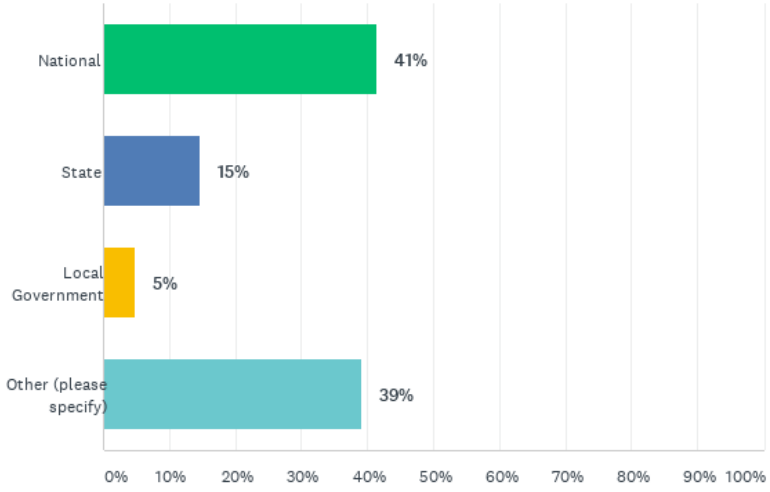

Figure 2 Type of organisation of survey responses

The private sector, non-profit organisations, non-governmental organisations, quasi government institutions, international agencies, etc. constituted the 37.5% of the other organisations in the survey responses.

4.2 Supply chain areas most impacted by the pandemic

Survey respondents were asked the question: "which areas of your supply chain have been most impacted by the pandemic?" and the results were not surprising. The top two areas were procurement and supply chain planning with 49%, and distribution with 46%, respectively. This can be seen in Figure 3.

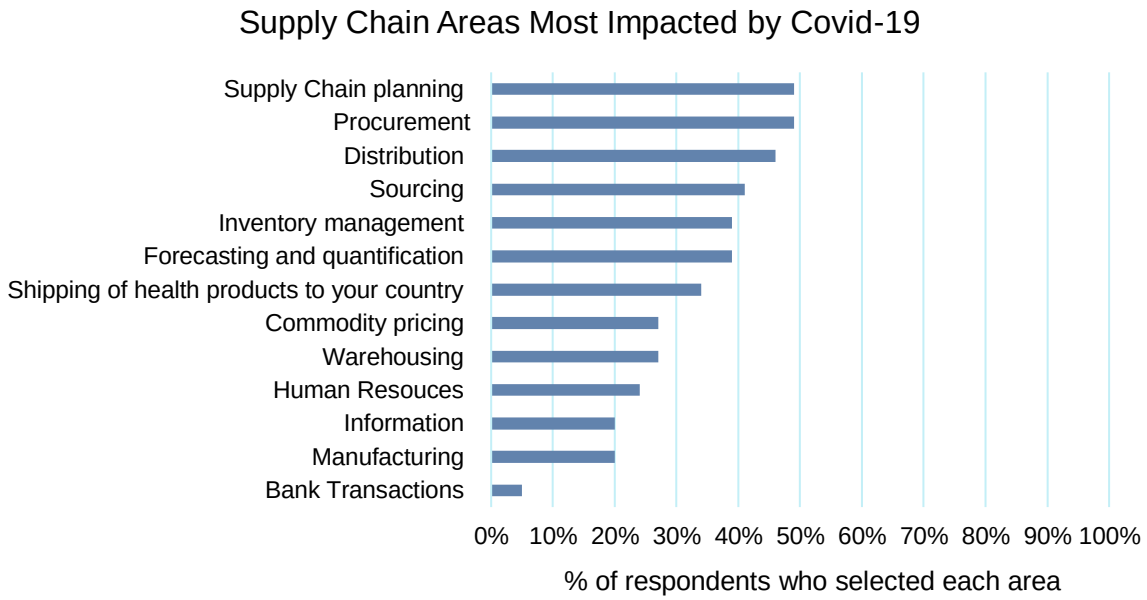

Figure 3 Supply Chain Areas Most Impacted by Covid-19

The continuing severity of the Covid-19 outbreak has exacerbated the disruption and uncertainty within supply chains. Respondents observed that other areas, including sourcing (41%), inventory management, and forecasting and quantification (39%) were also impacted to varying degrees. Similar disruptions were felt along other dimensions of the supply chain, as seen in Figure 3.

4.3 Preparedness for the crisis

Respondents were asked how they would have rated their organisations' preparedness to face a major supply chain disruption prior to Covid-19, and how they would rate their preparedness now based

on their organisations' performance during the pandemic. This can be seen in Figure 4. In the pre-pandemic assessment, 10% claimed that their organisations had no readiness plan in place, while 17% claimed that they had readiness plans in place and were prepared to face any disruptions. 39% of the respondents recognised some degree of planning, while 17% stated limited planning had been completed at their respective organisations, and 15% were unsure. Unsurprisingly, the respondents with no readiness plan in place would have been completely unprepared for the supply chain disruptions brought about by Covid-19, while those on the opposite end of the spectrum would have felt that their organisations were strongly prepared to face these disruptions.

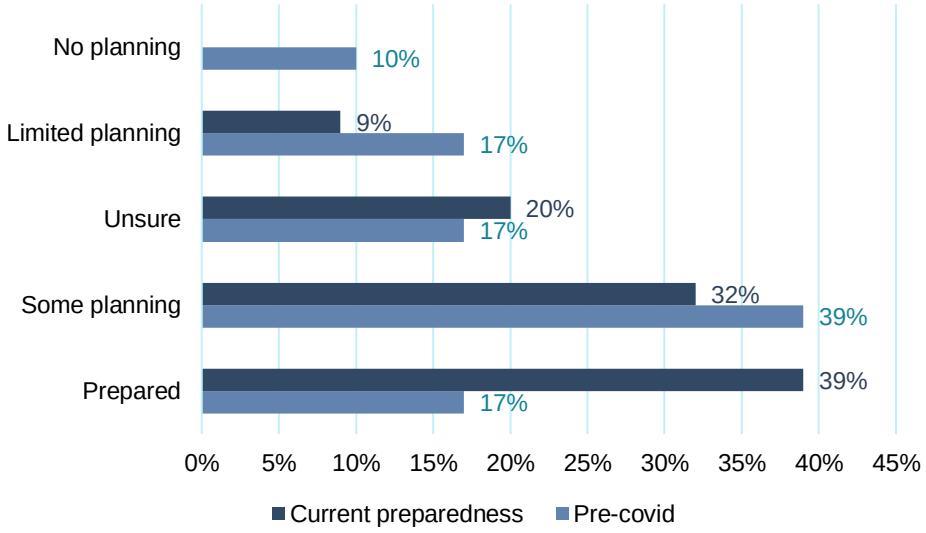

Figure 4 Preparedness for the crisis

When reassessing their organisations' preparedness after facing pandemic-related disruptions, 39% of the respondents felt they were prepared to face similar disruptions, highlighting an improvement in their preparedness compared to the pre-pandemic scenario, and 20% of respondents claimed that they were neither prepared nor unprepared for these events, indicating that the exact impact of Covid-19 on their supply chains was not yet apparent. 32% rated their organisations as somewhat prepared to face supply chain disruptions, and 9% claimed to be somewhat unprepared ("limited planning").

4.4 Time required for recovery

While it is clear that Covid-19 has had an impact on supply chains worldwide, what is not clear is how long it will take for supply chain organisations to recover from this pandemic. Our respondents had varied opinions on this topic, with roughly 61% believing that recovery will take between 3 to 12 months and 29% that it will take greater than 12 months. 10% of the respondents believe that recovery will take place in less than 3 months and none believe that their supply chains may never recover. This can be seen in Figure 5.

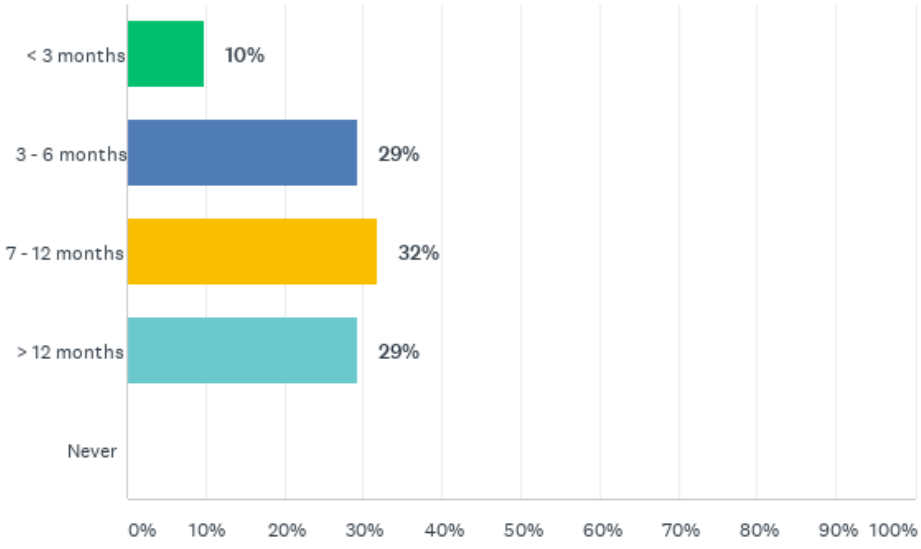

Figure 5 Time for recovery

5. Discussions

Survey respondents provided insights on the extent that their supply chains had been affected by the Covid-19 pandemic. The two most common answers were procurement and supply chain planning (selected by 49%), followed by distribution (selected by 46%). Other commonly impacted areas were sourcing, forecasting, and quantification and inventory management. Figure 6 provides details on how the various supply chain dimensions are impacted by Covid-19 at various levels.

Respondents were asked whether specific areas were a challenge for their organisations. Procurement emerged as a key challenge for both national stakeholders and the group of 'other' stakeholders,

which includes private sector, with 35% of respondents selecting it in each group. Supply chain planning is impacted the most at the national level, with 55% selecting it. This can also have a knock-on impact across the other stakeholders as well. National and state level participants have faced distribution challenges the most, with 42% and 32% respectively; while sourcing bottlenecks was significant for state level (35%) and other stakeholders (47%). Forecasting of future demand has been most difficult for national stakeholders (50%), and inventory management has been equally impacted at the national level (41%) and for the private sector, international agencies, etc. (41%). National stakeholders were negatively influenced due to shipping blockages with 46% highlighting it as a challenge. Warehousing resulted in supply chain disruptions at the national level (64%). Human resources shortages were identified at the national (56%) and state level (22%). Manufacturing appeared as a critical challenge at the national level (50%), and information flow was affected at the most for the private and international stakeholders (49%).

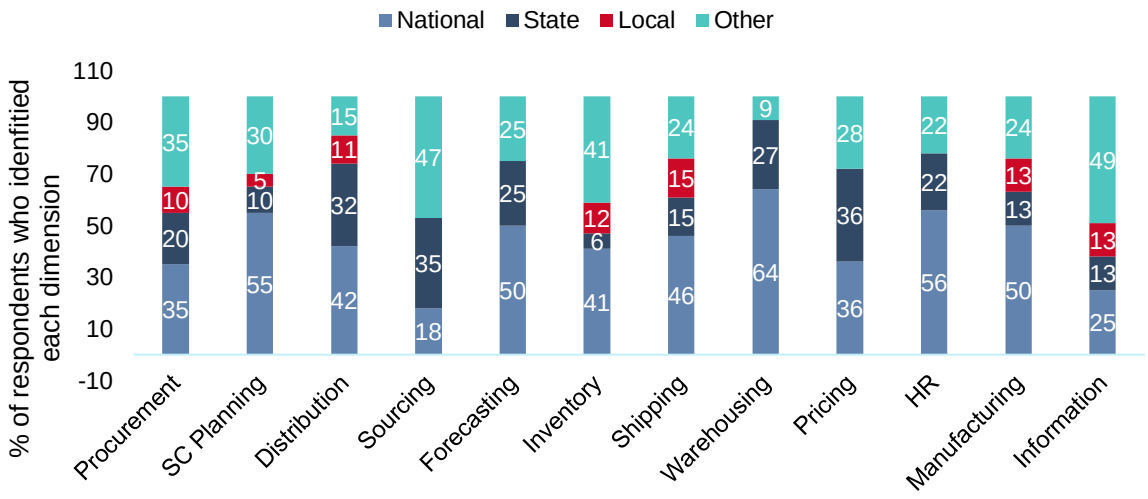

Figure 6 Supply chain dimensions vis-à-vis stakeholders

Survey respondents also provided information on their supply chain preparedness and recovery. 25% of the state and local stakeholders, and 50% of the other stakeholders felt that recovery would take less than 3 months. 58% of the national stakeholders believed that recovery would take 3-6 months. It is understood that 38% of the national 31% of the state, 8% of the local, and 23% of the other stakeholders thought that recovery would take 7-12 months. 42% of the national stakeholders thought that recovery would take greater than 12 months. Figure 7 highlights the recovery periods as identified by various stakeholders.

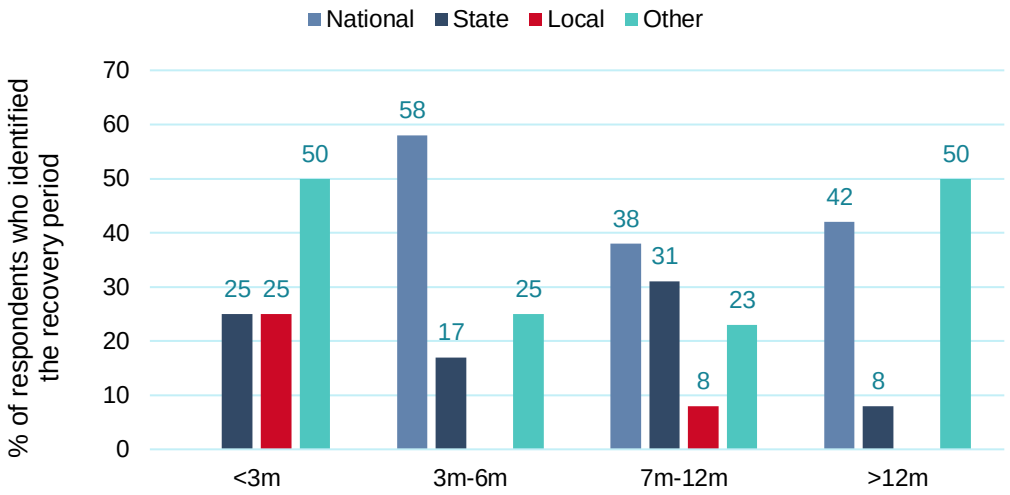

Figure 7 Recovery periods across different stakeholders

6. Recommendations

Insights into the various supply chain dimensions suggest that the pandemic caused extreme fluctuations in demand (both reduction and an exponential increase). Although this might appear to be an isolated event, the survey highlights the **need for improved forecasting tools** across the supply chains. It might also be argued that demand planning alone may not be enough. **Integrating supply and demand planning through an integrated approach** will help to respond more quickly to rapid disruptions (Ivanov, 2020b). Similar to how banks undergo stress tests, organisations should **design continuity plans outlining a range of disaster scenarios** to formulate policies to minimise the harm.

The difference between being somewhat prepared and fully prepared can significantly determine supply chain partners response, recovery, and future actions. Including amongst survey respondents, there may be a risk of organisations overestimating their ability to face disruptions; it needs to be reiterated that only organisations with **concrete comprehensive readiness plans** can assert with certainty that they are ready for major supply chain disruptions. The survey's analysis of the pre- and post-assessment of supply chain preparedness makes a persuasive case for the **integration of technology to simulate similar supply chain disruptions** to identify potential bottlenecks and leverage strengths. This will pave the way for **contingency plans focussed on multi-facility, multi-**

country shut down. Advanced planning tools and simulator software can help supply chain managers develop readiness plans to support organisations through major disruptions. The pandemic has also highlighted the need to know and **access the readiness plans of supply chain partners** as significant impact can also be felt from the unpreparedness of other supply chain stakeholders. This necessitates the need to continually evaluate supplier performance and create contingency plans involving partners.

The road to recovery presents several challenges. Although most of the survey respondents were optimistic regarding a speedy recovery, restabilising links with suppliers that have been affected by the pandemic can be an organisational challenge. **Transparent communication, collaboration, and information exchange among key supply chain partners** will be critical to recovery. The survey insights and recommendations can help supply chain leaders, executives, business partners, customers, etc. better understand the industry and how Covid-19 has impacted supply chains in the global economy.

7. Conclusion

The study was undertaken to understand the areas of the health supply chain that have been most impacted by the pandemic. Results also showed the level of preparedness of supply chain organisations before and after Covid-19. Procurement and supply chain planning, and distribution, were the top two areas cited as being affected. The escalating severity of the Covid-19 outbreak among countries has intensified supply chain disruption and uncertainty. The survey showed varying levels of readiness prior to the outbreak of the pandemic. However, respondents seemed to think that their present preparedness is better than it was before. The study supports the need for improved forecasting tools and an integrated approach to respond to supply chain disruptions. The pandemic has reiterated that only organisations with concrete comprehensive readiness plans can assert with certainty that they are ready for major supply chain disruptions. The integration of technology to simulate similar supply chain disruptions and being cognisant of supply chain partners' level of preparedness will also be helpful.

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