

## **Personal Protective Equipment Manufacturing in India:**

### **Lessons in Crisis Management, Interdepartmental Coordination and Public Leadership**

#### **Introduction**

The beginning of January 2020, was an alarming time for all countries across the globe, including India. The Ministry of Health was worrying about increasing cases of COVID-19 across the world. Information about the new virus was very limited and governments were frantically trying to catch up with the growing crisis. Health Ministry was suddenly faced with the requirement of Personal Protective Equipment (PPE) for doctors across the country. It was a daunting task in normal circumstances as India had a manufacturing capacity was very limited at that time. With the threat of the pandemic, rising demand for PPE, Ministry of Health approached the Ministry of Textiles. Mr. Ravi Capoor, Secretary Textiles under the guidance of Ms. Smriti Irani, Union Minister of Textiles, took up the daunting task and led one of the most challenging and successful intervention during the pandemic. Starting from scratch he led the team which began gathering information and had broad questions in front of them: What is needed for manufacturing of PPE? Was there an established standard for PPE manufacturing? Can textile manufacturers in India be able to make PPE with no prior experience? What support would be needed from the government?

While the ground was being prepared, the demand for PPE was estimated to be around 70,000 initially and as the first phase of pandemic grabbed the country in March, the demand was constantly rising. The challenges were huge and the manufacturers who could make PPE were requested to make samples to be tested but only one lab existed in country at the time. Added to this demand surge was the fact that India went into a complete national lockdown in March 2020 which made movement of raw materials, samples and finished product very difficult. In addition, WHO was revising guidelines for the PPE as more information was coming out regarding the virus. The challenges faced by industry at the same time were quite dire as well. Just as samples were passing laboratory tests and going into manufacturing, the lockdown shut everything down. Some manufacturers depended on labour from other cities and villages who could either not make it to the factories or refused to do so. Amidst all of this chaos, Mr Capoor

and his team had to meet the increasing demand for PPE during the pandemic and had reached 5,00,000 PPEs a day. The case study attempts to capture the steps taken by the Ministry of textiles to overcome this unprecedented crisis, and covers aspects around multiple stakeholders, operations management aspects, coordination between the public and private sectors, crisis management and leadership.

## **2.0 Global Chaos and Disruption of Global Supply Chains**

The end of 2019 and 2020 was an unprecedented period of confusion for governments, citizens and industry alike. The COVID-19 virus was spreading at an alarming rate and World Health Organisation and governments across the globe, were scrambling to find the necessary tools to deal with the spread of the virus. One of these tools was Personal Protective Equipment (PPE) which includes gloves, medical masks, goggles or face shields, gowns, and N95 respirators – all of which demonstrated efficacy in reducing respiratory infections among healthcare workers. PPE which was not an important and disposable part of hospitals around the world, had quickly become the most important line of defence for healthcare workers dealing with the rising number of COVID-19 cases. However, this new demand for PPE also meant that a commodity which was mostly imported by countries faced global disruption of the supply chain. Manufacturing of PPE in most countries was scarce and minimal, but with the COVID-19, the manufacturing had to be scaled up in a matter of months for a process which would take years.

A very telling sign that things were getting worse across the globe, was a press release by the WHO in March of 2020. In that press release, the WHO urged industry and governments to work towards increasing their own manufacturing capacities by 40% in order to meet the growing demand for PPEs. The WHO went on to point out that a severe and ever-growing disruption of global PPE supply chains was underway caused by (a) rising demand; (b) panic buying; (c) hoarding; and (d) misuse. This, the WHO argued was putting the lives of healthcare workers in risk around the world. WHO called on industry and governments to boost supply and ease up export/import restrictions along with taking measures to stop hoarding and other detrimental activities. The WHO warned that since the start of the outbreak prices for equipment which forms part of PPE had surged – for example, WHO highlighted that surgical masks has seen a six-fold increase in price while N95 respirator prices trebled and gown prices doubled. The WHO said it was taking months to deliver COVID-19 critical equipment and

market manipulation was widespread. In March 2020, WHO estimated 89 million medical masks and 76 million gloves and 1.6 million goggles would be needed monthly. Based on these estimates, the WHO said that industry would need to increase manufacturing by 40% (WHO, 2020).

In early 2020, when WHO was sounding the alarm bells with regards to the availability and manufacturing capacity for PPEs, medical journals and academia were similarly alarmed by the situation faced by healthcare workers who would suffer the most due to the shortages of PPE. A call for solutions published in a prominent medical journal in early 2020 said that PPE which were hitherto not a very important part of the hospital environment had now become a precious commodity for healthcare facilities (Livingston et al., 2020). The paper expressed concern that the rising demand of PPE will need to be met with an increase in supply of PPE which could take time which many healthcare systems did not have with the spike of cases around the world (Livingston et al., 2020). Other academic papers tried to study the causes of PPE shortages. One study, while looking at shortages in the US, identified four major reasons for shortages of PPE (Cohen and Rodgers, 2020). The two reasons relevant on the global shortages of PPE include (a) Major demand shock: which was created due to healthcare needs as well as panicked marketplace; (b) Major disruptions to the PPE global supply chains: this was enabled by sharp reduction of PPE exported to countries which were already highly dependent on globally sourced PPE.

### **3.0 Problem Solving in Ministry of Textiles**

One of the first things that Secretary, Ministry of Textiles did once the manufacturers were in place was to constitute four teams which were all led by Joint Secretary level officers with Mr Capoor, Secretary, coordinating all the activities of the teams. Each of the four teams had specific roles as described below:

#### **3.1 Intra-Department Coordination**

**3.1.1 Team for Development of new vendors:** After the initial challenges of lockdown and getting garment manufacturers to make PPE, a team was established to increase the number of manufacturers to meet the rising demand in 2020. The team was focussed on increasing manufacturing of both the fabric and the manufacturing of the complete PPE as well. The

responsibility of this team was to approaching new manufacturers, encouraging them to start manufacturing. This team was along with Mr Capoor was personally in touch with major garment manufacturers who were making PPE such as Birla, Welspun, and Gokuldas among others to find out how they did on a daily basis and find out roadblocks hindering their manufacturing process.

**3.1.2 Team for Logistics:** The logistics team was constituted with the express purpose of ensuring movement of labour, material, and samples during the lockdown phase and navigating international challenges such as importing machinery and other requirement for manufacturing. In the initial stages of the manufacturing, only one lab existed which could test samples being produced by the factories and the lockdown meant that police were stopping samples from reaching the labs. The logistics team in conjunction with the Central Control Room ensured smooth movement of samples and materials. As the testing labs grew to 10 spread across the country, this role also got enlarged. The logistics team was also tasked with coordinating the flying of special flight, internationally and domestically to ensure the manufacturing processes and testing was not interrupted. For example, the logistics team coordinated the operation of special locomotives to move samples to the lab established in Gwalior from Delhi.

**3.1.3 Team for Operations:** By far the biggest challenge facing the manufacturing of PPE in India was the lockdown imposed in March 2020. It brought the manufacturing of PPE in India, which was picking up pace until then, to a standstill. Factories were closed, labour and material were not allowed to move. In order to keep the manufacturing going, around 150 officers at the peak were deployed at every factory unit to ensure that manufacturing was not interrupted for any reason. The operations team was responsible for making sure the labour from villages reached the factory, and talking to manufacturers constantly to solve their day to day operational issues.

**3.1.4 Control Room:** A central control room was established in Delhi to coordinate and troubleshoot issues faced by all the other teams. Around 10 officers were sequestered in the Minister's office and operated 24\*7 to solve officers working in operations, logistical problems, and development teams. The factories and other teams faced constant issues and so

two joint secretaries were put in charge of the control room with 10 junior officers, who would try to solve the issue or escalate it to their higher officers and ultimately the Chief Secretary.

### **3.2 Inter-Departmental Coordination**

#### **3.2.1 Ministry of Health and Textiles Coordination**

In the early stages of the COVID preparations, the Health Ministry wanted to procure 50,000 PPE kits. However, rising demands globally meant that the PPEs could not be procured from elsewhere and the Ministry of Textiles was contacted to help and support with resources needed for PPE within India. At the time, there were no manufacturers of PPE in India and only three multinationals who had supplied PPEs which themselves procured the PPEs from abroad. Thereafter the ministry of textiles contacted the protective textiles companies, such as, Dupont, 3M. The requirement of 50,000 PPEs was fulfilled within 2-3 weeks and were stocked by the Ministry of Health. February 2020 saw the demand rise and the Ministry of Health estimated that the requirement would be lakhs of PPEs. The next challenge in coordination was testing the fabric for the PPE and making sure it could be used by health care workers on the frontline. The Ministry of Textiles organised and sent the samples to be tested at SITRA (South India Textile Research Association), Coimbatore, India. SITRA was initially using the standard for testing PPE for Ebola which was prescribed by the WHO. In February 2020, about 10 samples were tested with each sample taking about 2-3 days on average to be tested. Most of the samples, while successfully passing the blood penetration test, did fail in passing the viral penetration test at the required pressure. The WHO, seeing the global constraint on the PPE supply chains, passed fresh guidelines. Here again, the coordination between the ministry of textiles and health became very important in forming a Technical Committee of the Ministry of Health and revised the standards for testing on 2<sup>nd</sup> March 2020. Subsequently, the Ministry of Textiles worked with SITRA towards testing with the new standards and the samples started passing the tests.

#### **3.2.2 Ministry of Health and HLL Life Care Limited (HLL)**

The standards in place, the Public Sector Unit HLL issued open tenders to invite manufacturers to supply PPE, Coveralls, and N-95 masks on behalf of the Ministry of Health. The Technical Committee of HLL decided the rate of the coveralls based on previous projections and opened

the tender. The companies would need to first pass the tests approved by the Government in the laboratories designated for testing PPE. The first 110 firms registered got orders on the first-cum-first server basis in about 4 month's time. At the same time coordination from the Ministry of Textiles through the Joint Secretary Mr. Nihar Ranjan Dash (Ministry of Textiles) worked with fabric manufacturers to develop new manufacturing capability across the country. During March-April 2020, new manufacturers joined the race to adding up to about 10-11 fabric manufacturers. The majority of the fabric was made from Polypropylene non-woven material coated with polyethylene, a few fabric manufacturers were produced women fabric out of polyester and nylon combination. While every month new PPE manufacturers and fabric manufacturers were increasing thanks to the coordination between ministries and PSUs, the demand was rising and in April 2020 was around 71 lakhs. The next level of challenges arose at the same time, just as the manufacturing capabilities were building it was discovered that the PPE had to pass two tests, one test was to ensure the seams were 100% sealed to stop blood penetration and the other was for the fabric itself. However, to produce such a high level of sealing during the manufacturing stage, specialised machinery was needed such as thermal seam sealing machines and specialised tape put on the seams to finish the stitch. These machines were in short supply and manufacturing companies did not have access to these machines. Process to start placing of orders for the specialised machinery and tapes was begun.

### **3.2.3 Department of Financial Services and Ministry of Textiles Coordination**

As the number of fabric manufacturers rose and about 11 companies were producing PPE based on approved quantities there was another challenge that came up. The companies were struggling with working capital to continue manufacturing caused by the pandemic itself. The Ministry of textiles approached the Department of Financial Services alongwith the details of the banking arrangements of these manufacturers and with a request for special working capital to be sanctioned to these companies to continues manufacturing of PPE. These were followed up by the Ministry of Textiles and Department of Financial Services with the banks of these companies to release additional working capital. Even at this stage the total production reached a figure of 1000 per day.



### **3.2.4 Ministry of External Affairs, Ministry of Aviation and Ministry of Textiles Coordination**

At the end of March, the COVID pandemic was getting worse and the Prime Minister convened various meeting one of which was concerning the ramping up of PPE manufacturing at a bigger scale. After the meeting with the Prime Minister the Secretary, Ministry of Textiles personally spoke with the biggest manufacturers such as Arvind, Reliance Group, Gokuldas, Mahindra Shahi Exports, Aditya Birla etc. A routine was established where the Secretary would call twice a day to find out issues and review progress made with regards to issues raised by the companies. One of these issues was that Indian manufacturers were placing orders for stitching machines and tapes from China. These machines and tapes were crucial for ensuring the 100% sealing required for the PPE to prevent blood and virus penetration. The logistics group within the Ministry of Textiles coordinated with the Embassies in China and Singapore through the Ministry of External Affairs. At the same time the Ministry of Civil Aviation organised special flights to air-lift the required specialised machinery, and material and tape to enable manufacturers to scale up manufacturing.

### **3.2.5 Police Department and Ministry of Textiles Coordination**

A central control room was setup within the Ministry of Textiles to troubleshoot and coordinate between the different intra department teams (each tasked with a specific role). The control was comprised of 10 officers led by two Joint Secretaries, Shri Shantamnu, DC (Handicrafts) and Shri Sanjay Rastogi, DC (Handlooms). Additionally, three JS level officers along with a support team of about 100 field officers from the office of Textiles Commissioner, Textiles Committee and National Silk Board whose full-time job during the pandemic was to station themselves in the factories to facilitate the production of PPE. The field officers were empowered under the Essential Commodities Act and to coordinate with local authorities under the provisions of the Act. This step of empowering the field level officers was essential because of the total national level lockdown which was implement. Factories and manufacturing facilities were also locked down. In these circumstances, coordination between Ministry of Textiles officers and state governments and district authorities was required. Movement of labour required permission from the local police. The Transport Department was organised to move labour from place of stay to place of work. The field officers and additional control room

headed by 14 officers in the Textiles Commissioner from the HQ of Bombay and Bangalore contributed hugely by working around the clock.

### **3.3 Building an enabling end-to-end ecosystem**

Mr Capoor through the operation of the four teams within the Ministry of Textiles ensured that manufacturing in the factories never stopped as long as the demand was rising. He also ensured that the from the first phase of approaching manufacturers to rolling out of the PPE from the factory went on smoothly. Additionally, the Ministry of Textiles put in place incentive mechanism to keep existing manufacturers to continue production and bring in more manufacturers to produce PPE. In June 2020, the Ministry has asked Hindustan Latex Ltd., which is a public sector company to issue an open tender. Under the tender, the price was fixed and any manufacturer who is able to supply at the price and the quality to meet the CITRA Coimbatore certificate could go ahead and manufacture PPE. This incentive system helped foster the PPE industry in India and increase supply to meet demand. Since it was an open tender, no procedural red tape was required and manufacturers came forward and took the opportunity in bigger numbers than at the start of the year. Price was fixed at 700 - 750 INR which was what the Ministry was procuring at and this was a big margin as the Ministry found out later. However, the incentive system worked and by June 2020, 4,00,000 PPE kits/day were being manufactured and by August 2020, 1100 manufacturers were producing PPE. Further, to ensure the manufacturers did not cut corners or misuse the open tender system, the Ministry communicated to the manufacturer at some point all the manufacturer produced PPE would be tested in the government labs and thus emphasis on safety was equally important apart from increasing supply. Workshops with the quality council and the 1100 manufacturer were asked to join virtually and webinars were conducted to ensure international standards were maintained.

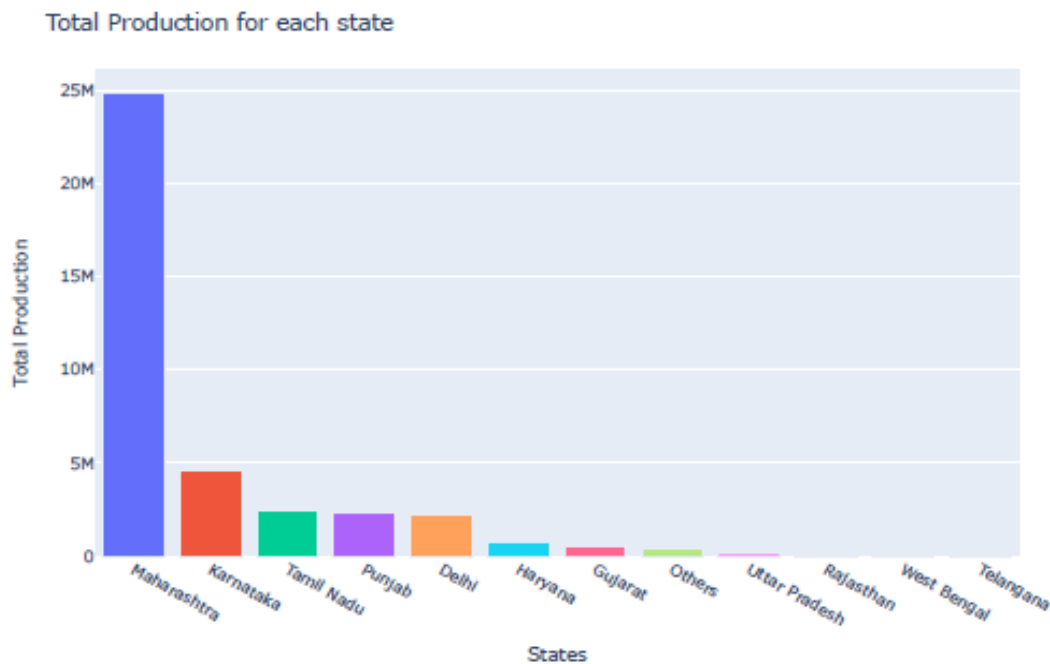
### **4.0 Ramping up Manufacturing Capacities to Meet Demand**

Mr Capoor and textiles ministry monitored the manufacturing of PPE on a daily basis through the peak of the first wave in 2020 to ensure that supply was as close to the demand as possible. The Ministry maintained meticulous data of every unit produced in factories across different districts, states and manufacturers. Data analysed to capture the scaling of PPE manufacturing from April 2020 – June 2020 shows the scale of increase of capacities in the country. In mid-



June of 2020, India was manufacturing 400,000 PPE kits a day with about 1100 manufacturers involved with the ministry of textiles coordinating. This is significant jump from pre-COVID period where a handful of technical fabric manufacturers were making PPEs for a small number of specialised labs and hospitals. PPE were being manufacturing at scale for the entire country. Maharashtra state lead the way – where total production of PPE from March 2020 – June 2020 was 24 million units of PPE. The state led production of PPE by a long margin with Karnataka producing about 4.5 million PPE for the same period. Tamil Nadu, Punjab and Delhi all produced about 2 million units for the same period. Figure 1 provides these numbers.

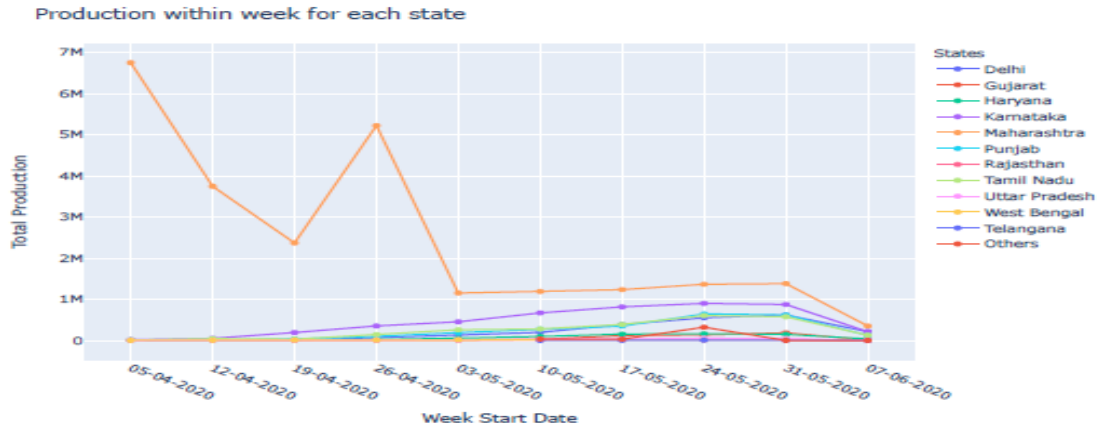
Figure 1: State-wise Production of PPE



Source: Data from Ministry of Textiles, Govt of India

The scaling up of manufacturing in a limited period of time was remarkable with one state taking the burden initially and other states ramping up slowly until a consistent supply was ensured across different states. Maharashtra dominated the production at the start of April, but if we see the weekly figures for the states in Figure 2, we can see that week over week other states such as Karnataka, Delhi, Tamil Nadu all converged in terms of production numbers by May and June of 2020.

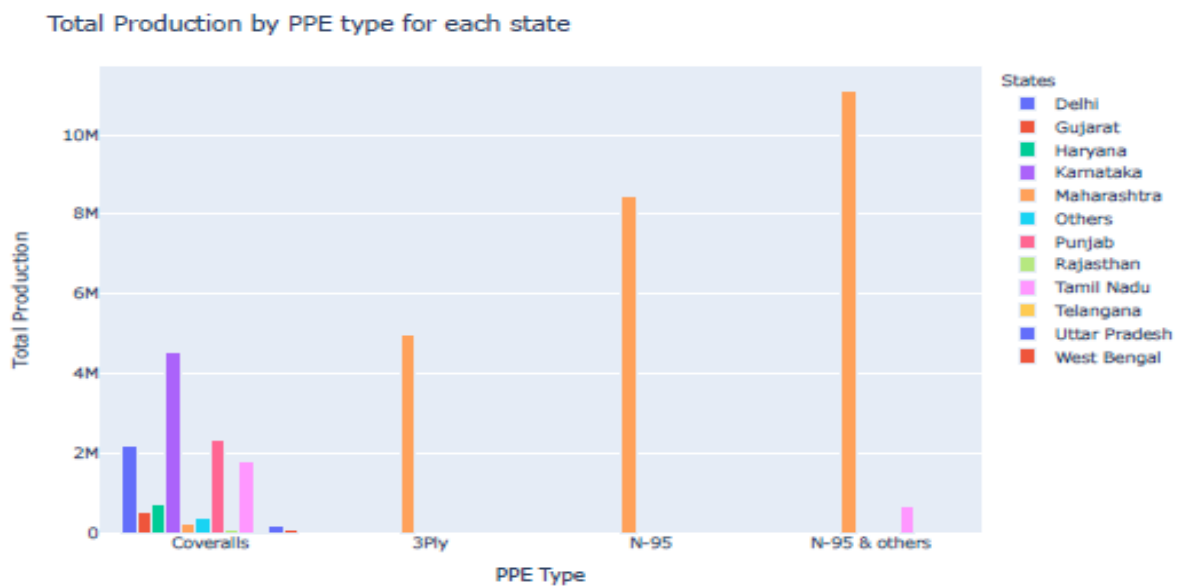
Figure 2: Production within week for each state



Source: Data from Ministry of Textiles, Govt of India

Personal Protective Equipment itself comprises of many components such as coveralls, N-95 masks and other equipment. The manufacturing of these different components spread over different states is also interesting to observe. Figure 3 shows how coveralls were predominantly manufactured in states like Karnataka, Delhi, Tamil Nadu and Punjab while N-95 masks were produced predominantly in Maharashtra. Showing how different states' manufacturing capabilities were leveraged to complete the PPE.

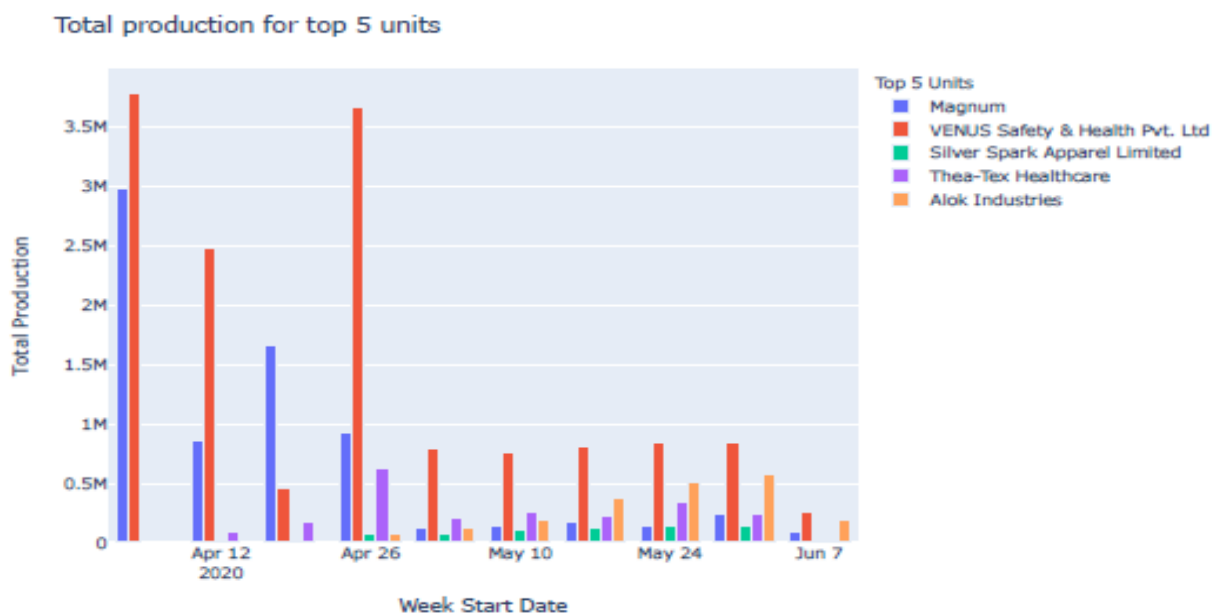
Figure 3: Total Production by PPE Type for Each State



Source: Data from Ministry of Textiles, Govt of India

To get another picture of how production was scaled up, the top 5 units of production will be examined. We can see from Figure 4, that in the first few weeks of April 2020, two manufacturing units produced a majority of the PPE in the country. However, towards the end of May 2020 and first week of June 2020 – other units had ramped up their capacities with the leading manufacturers scaling down.

Figure 4: Total Production for Top 5 Manufacturers (weekly)



Source: Data from Ministry of Textiles, Govt of India

### 5.0 Industry-level Challenges and Resolutions

The industry had challenges not only in terms of capacity building and technical know-how but also in terms of maintaining standards and pandemic lockdown across the country. Industries which were making one component of PPE for purposes other than PPE had to reorient their business models to fit the situation. For example, Venus Safety and Health Pvt. Ltd. has been in the business of making N-95 masks and respirators. However, the manufacturer was making N-95 for industrial use before the pandemic for domestic and international industries. The first change came about when exports were stopped which the company depended on majorly. Secondly, the masks were now being used for medical purposes which requires changes to the manufacturing process. The company faced backlash for not supplying to common people and NGOs and instead was sending 80 – 90 % of the manufactured

PPE to the government for distribution to frontline workers etc. Additionally, the national lockdown in March 2020 meant that the manufacturing which was in its nascent stage was shut down. Mr Capoor and his officers ensured that in a short time all the roadblocks to manufacturing were removed. From the industry side it was ensured that no interruption was caused to the supply of masks. Venus also had labour staying at the factories to ensure supply was not interrupted. This meant that Venus, which was making about 15,000 N-95 masks a day before the first wave of the pandemic was making 300,000 during the first wave. Similarly, during the second wave again the capacity was increased to 1.4 million masks a day.

Another manufacturer, Ankur Kothari from Kusumghar speaking on the manufacturing of PPE during the pandemic details the challenges they faced. Ankur is a fabrication unit where the fabric manufacturing itself is sub-contracted. The unit is a DRDO sponsored entity which normally makes technical fabrics as per requirements for the government body. However, from April 2020 to June 2020 they made coveralls for medical purposes which is a very different operation from their normal manufacturing. Mr Capoor and his team ensured that the unit was able to keep their manufacturing facility open during the lockdown and monitored the production numbers as they scaled up operations for the pandemic. Among the various challenges faced by Ankur was the initial start up of the fabrication of coveralls which need a reorientation of their capabilities and technical skills. Another challenge faced by the manufacturer was lack of government coordination and clarity during the initial phases of the pandemic in terms of information needed by industries etc. The owners of the unit see the need for building the entire value chain and ecosystem to manufacture PPE in the country in the future to avoid another crisis. Firstly, the fabric needed for manufacturing technical textiles is usually in other countries which makes manufacturing units in India vulnerable to competition from industries internationally. The raw material not being made in India means that industries are at the mercy of manufacturers in other countries. An ecosystem where indigenous manufacturing of raw materials is essential to build indigenous PPE capacities in the future.

## **6.0 Conclusion**

The COVID-19 pandemic was witnessed towards the end of 2020 and continues with third waves across the world in the beginning of 2022. As soon as the initial cases were rising, governments imposed the necessary lockdowns and restrictions and despite this, the healthcare protective equipment's requirement exceeded the available resources in both developed and

developing countries. Healthcare systems faced inexperienced pressure as supply chains disrupted, economies collapsed, and an immediate reaction was demanded from the countries to fight these devastating times. Several major challenges were faced by countries while accommodating the necessary medical supplies including the lack of Personal Protective Equipment (PPE). Unavailability of PPE kits exposes the healthcare workers to the risk of occupational hazards and infection.

It is in this context that India embarked on increasing manufacturing capabilities aimed at self-sufficiency in terms of PPE. At a time when WHO was warning governments and industries about the rising scarcity of PPE and global disruptions of PPE supply chains, in India, the Ministry of Textiles was proactive in gathering around 5 textile manufacturers to find out if they are capable of manufacturing PPE. The samples from the manufacturers were sent to labs to find out their efficacy. However, all the samples failed the lab tests which led to an air of panic. At the same time demand for PPE increased from 70,000 to 5,00,000. Manufacturing of PPE in India was almost non-existent and the country had depended on the global supply chain for PPE imports which was now disrupted. The challenges faced by India and solutions found have been described in the case.

**Questions for Class Discussions:**

To be added

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