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## Roadmap for Improving PPE Production in Egypt

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2020

*Disclaimer: The views expressed in this paper are those of the author based on his experience and on prior research and do not necessarily reflect the views of UNIDO.*



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## Executive Summary

The unexpected outbreak of COVID-19 in early 2020 has resulted in a significant increase on the personal protective equipment (PPE). This has essentially posed a threat to health care systems and has critically threatened the public health and safety of populations. Whatever regulations governing the PPE industry fell to pieces with Covid-19, and what used to be a commodity produced for health workers became in huge demand for citizens globally. Globally, PPE manufacturers were on the one hand striving to cope with the new production demand, while other medical non-PPE manufacturers began planning on adding new PPE production lines or on building new PPE factories so as to reserve a share in the market. Hospitals or demand agents on the other hand resorted to procuring PPE from new manufacturers with manufacturing specifications that are often lower than what they commonly adhere to.

The pandemic has forced many countries to rethink their PPE supply chains, and Egypt is in need and has the potential to do the same. On that basis, this study attempts to provide a roadmap for Egypt to enhance its PPE supply chain. The study conducted 10 In-depth interviews (IDIs) with representatives from the medical, pharmaceutical and PPE sectors. In addition to another 5 IDIs with different stakeholders including: 1 with the Ministry of Health, 2 interviews with large private hospitals owners/managers and 1 with the medical export council. The data collection was carried out by two lead researchers using face to face and phone interviews from the 24th of June to the 13th of July. Results show that by investing in the technology and equipment needed to produce the medical raw material needed for PPE production using a technology called “spun-melt”, Egypt would have an opportunity to become one of the major global market players in the PPE industry.



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## List of Acronyms

|       |  |
|-------|--|
| IDIs  | In-depth interviews  |
| PPE   | Personal Protective Equipment  |
| WHO   | World Health Organization  |
| MOH   | Ministry of Health   |
| AUPP  | Egyptian Authority for Unified Procurement, Medical Supply and Technology Management |
| ICT   | Information and Communications Technology  |
| UNIDO | United Nations Industrial Development Organization                                   |
| ICU   | Intensive Care Unit  |
| USD   | United States Dollar   |
| EUR   | Euro   |
| EU    | European Union   |
| MENA  | Middle East and North Africa   |
| UV    | Ultraviolet  |
| US    | United States of America   |
| UK    | United Kingdom   |
| NIH   | National Institute of Health   |
| VA    | Veterans Affairs Department  |
| FDA   | Food and Drug Administration   |



## Introduction

The unexpected outbreak of the covid-19 pandemic has created a severe global shortage of personal protective equipment (PPE). PPE refers to a wide range of products including fluid-repellent masks, aprons, gloves, face shields, respiratory masks, surgical masks, long sleeved gowns, goggles, cumulative facial protection, drapes (used in ICU) and sanitizers. Most of PPE products (except for sanitizers and goggles mainly) are based on the use of non-woven polypropylene sheets using spun-melt technologies. The shortage of those sheets has led to a shortage in the production of PPE globally.

With a significant increased demand that went from primarily targeting health care workers to targeting citizens all over the globe, shortage effects and impacts have been felt and acknowledged by everyone, starting from the citizen up to the top of the supply chain hierarchy of both public and private sectors. The pandemic has exposed vulnerabilities across the PPE production industry on a global level. Cooperation between worldwide PPE supply chains as well as decreasing export restrictions were consequently pinpointed as live-saving precautions. Even though the intensity of the shortage faced by each country corresponded to the country's manufacturing and production capacity, all countries in one way or another have faced unexpected increases in demand, including the MENA region and other developing countries.

This report attempts to provide an analysis of the PPE industry in Egypt with the aim of developing a roadmap for Egypt to enhance its PPE supply chain and to benefit from the rising local and global demand.

## Methodology and Sampling

The research design for this study was a qualitative design that is more relevant to the study's exploratory nature to tackle the decision-making, perceptions, opportunities and the challenges faced in enhancing the PPE supply chain in Egypt in light of Covid-19. The study was carried between June and July 2020 and relied on qualitative research using standard methodologies. The qualitative research was conducted using the following research tools:

### Desk Review:

A comprehensive desk review of secondary resources was conducted to understand the challenges facing the PPE supply chain globally and what practices and measures were adopted. The review also included the current PPE situation in Egypt in light of Covid-19.

## In-depth interviews:

### Sample Summary

Based on the project's objectives, a sample criterion of **14 IDIs** was identified. 10 IDIs were conducted at enterprises across targeted sectors classified by size and compliance level. In addition, 5 IDIs were also conducted to address different stakeholders, which included: 1 with the Ministry of Health, two interviews with large private hospitals owners/managers, and 1 with the medical export council.

*Table 1 Research Sample Summary*

| <i>Targeted Sample</i>    | <i>Number of IDIs</i> | <i>Medical</i> | <i>Pharmaceutical</i> | <i>PPE</i> |
|---------------------------|-----------------------|----------------|-----------------------|------------|
| Manufacturing Enterprises | 10                    | 4              | 2                     | 4          |
| Business associations     | 1                     |                |                       |            |
| Local organizations       | 2                     |                |                       |            |
| Demand Stakeholders       | 1                     |                |                       |            |
| <b>Total</b>              | <b>14</b>             |                |                       |            |

## Development of the research tools and the data collection

### Research tools:

- A qualitative discussion guide (in Arabic and English) was developed to use with the study participants. The developed discussion guide was sent to the UNIDO team for feedback and approval and finalized accordingly. The data is collected, recorded and transcribed for analysis and reporting.

### Data collection:

- The data collection was carried out by two lead researchers using face to face interviews and phone interviews. Most interviews conducted lasted 45-60 minutes.
- The fieldwork started on the 24<sup>th</sup> of June and ended on the 13<sup>th</sup> of July.

## I. PPE Demand post Covid-19: A global overview

### Excerpts from global efforts

Personal protective equipment includes surgical masks, fluid-resistant masks, disposable plastic aprons, disposable gloves, face respirators, disposable fluid-repellent gowns, and eye/face protection<sup>1</sup>. The WHO has estimated the global demand of PPE supplies by frontline health care workers during Covid-19 to be approximately 89 million masks in order to stay protected and protect others<sup>2</sup>. With the advent of the Covid-19 pandemic, most countries have faced a form of disruption in their critical supplies including personal protective equipment (PPE). Prior to the pandemic, China produced approximately half of the world's face masks<sup>3</sup>. With the rapid spread of the virus, China decided to halt its exports<sup>4</sup>. The pandemic has certainly been successful in exposing vulnerabilities across the PPE production industry on a global level. The geographical and regional concentration of PPE production has been found to be the main reason for the currently strained supply chains, where it evidently has not taken global emergencies, virus outbreaks, or events that may lead to a strain in global exchange and supply chains into account<sup>5</sup>. Other bottlenecks in the supply chain globally include the price increase, the time needed for assembling the machine production lines, the transport and shipping constraints set under the pandemic's precautionary measures, in addition to the enforced quarantine measures which have led to manufacturing shutdowns and export bans by almost 23 different countries during early 2020.<sup>6</sup> The WHO has outlined three strategies to optimize the availability of PPE which are<sup>7</sup>; a) Minimize the need for PPE, b) Ensure PPE use is rational and appropriate, and c) Coordinate PPE supply chain management mechanisms. In addition, a number of proposals have been suggested by health system experts to address the shortage of PPE and to

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<sup>1</sup> Government of UK,

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/903695/T4\\_poster\\_Recommended\\_PPE\\_additional\\_considerations\\_of\\_COVID-19\\_July-2020.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/903695/T4_poster_Recommended_PPE_additional_considerations_of_COVID-19_July-2020.pdf)

<sup>2</sup> Supplies (PPE) needed by healthcare workers every month COVID-19 pandemic 2020 | Statista. (2020). Retrieved 8 July 2020, from <https://www.statista.com/statistics/1119103/supplies-needed-by-health-responders-against-covid-19-worldwide/>

<sup>3</sup> The New England Journal of Medicine, "Critical Supply Shortages- The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic", 2020, p. 1

<sup>4</sup> *ibid*

<sup>5</sup> Global Shortage of Personal Protective Equipment amid COVID-19: Supply Chains, Bottlenecks, and Policy Implications. (2020). From <https://www.adb.org/sites/default/files/publication/579121/ppe-covid-19-supply-chains-bottlenecks-policy.pdf>

<sup>6</sup> *ibid*

<sup>7</sup> WHO, "Rational use of PPE for Covid-19", March 2020, [https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPPE\\_use-2020.2-eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPPE_use-2020.2-eng.pdf)



ensure its conservation and management. Some of the suggested proposals include the following<sup>8</sup>:

- **Import:** This suggestion proposes purchasing PPE from international suppliers such as China which has a wide experience and capacity in PPE production.
- **Reuse:** Some of the suggestions for this proposal include using re-using elastomeric respirators which have exchangeable filters. Other suggestions offer using disinfectants for PPE to enable their re-use such as: Heat (eg, autoclave), UV, ozone, ethylene oxide, hydrogen peroxide, bleach, isopropyl alcohol, gamma or e-beam radiation, microwave, copper sulfate, methylene blue with light, sodium chlorine, iodine, zinc oxide impregnation (gowns), hypochlorous acid, commercial laundering (for cloth).
- **Repurpose:** This suggestion proposes the repurposing of some items to be used as PPE. Examples include:
  - Prefabricated masks: snorkel and scuba, 3D printed, welder's, civilian military grade gas masks, ski buffs
  - Eye and face shields: sports eye protectors, motorcycle helmets with visors, balaclavas
  - Gowns: plastic ponchos or poly bags, bedbug sheet material
  - Adhesive bandage as nasal PPE
- **Reduce nonessential services:** This suggestion proposes to reduce questionable contact and take isolation precautions by cancelling elective and ambulatory procedures.
- **Adopt Government solutions:** This includes regionalizing care and supply, importing international supply, rationing supply, loosening import regulations, and commandeering business to accelerate supply.
- **Reduce patient contact:** This proposal suggests taking a number of measures such as using e-consults, utilizing mobile and out-of-room monitoring and device controls, and placing barriers for visits.

Since the onset of COVID-19, more than 100 countries have implemented 128 temporary export measures, and 134 countries have implemented 157 temporary import measures<sup>9</sup>. Country efforts have also included mobilizing manufacturing towards critical supplies. Australia for example performed a mapping of its domestic production capability to produce medical PPE, while the US worked to enhance and mitigate its PPE supply after facing a remarkable shortage in light of the pandemic. The Indian Government collaborated with the private sector and succeeded to manufacture PPE kits and ventilators exceeding

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<sup>8</sup> JAMA, "Sourcing Personal Protective Equipment During the COVID-19 Pandemic", March 2020

<sup>9</sup> International Trade Center, July 2020, <https://www.intracen.org/covid19/Blog/Global-chain-reaction-Unprecedented-trade-measures-to-tackle-COVID-19/>

their local demand and exporting its surplus of production to other countries including the US, the UK, Nigeria, Germany, Spain, Russia and Uganda<sup>10</sup>. Other efforts pursued by countries such as Ireland and the US include:

- Developing and launching online and volunteer-based initiatives to mitigate the PPE shortage<sup>11</sup>.
- Reprocessing and reuse of PPE through sterilization or disinfection<sup>12</sup>.
- Using technologically smart channels to facilitate communication within the supply chain<sup>13</sup>.
- Producing locally adapted PPE<sup>14</sup>.

### The repurposing challenges

The UNIDO has referred to repurposing manufacturing facilities as a rapid temporary response to help addressing the shortage of Covid-19 critical supplies. A study estimated that over 2700 manufacturing facilities owned by large firms in the US could be repurposed to produce Covid-19 critical items<sup>15</sup>. The WHO has listed the facilities that could be repurposed to produce PPE which include<sup>16</sup>:

| Critical PPE items identified by WHO  | Examples of facilities that can be repurposed   |
|---|---|
| <ul style="list-style-type: none"> <li>○ Gloves, examination</li> <li>○ Gloves, surgical</li> <li>○ Goggles, protective</li> <li>○ Gown, protective</li> <li>○ Face shield</li> <li>○ Mask, particulate respirator</li> <li>○ Mask, surgical</li> </ul> | <ul style="list-style-type: none"> <li>○ Textile factories</li> <li>○ Garment plants</li> <li>○ Yarn spinning mills</li> <li>○ Electronics assembly plants</li> <li>○ Injection moulding facilities</li> <li>○ Prototyping shops (including 3D printing)</li> </ul> |

<sup>10</sup> The Print, “Modi govt to allow PPE, ventilator exports as Indian companies are mass-producing them now”, June 2020

<sup>11</sup> Mehrotra, P., Malani, P., & Yadav, P. (2020). Personal Protective Equipment Shortages During COVID-19—Supply Chain-Related Causes and Mitigation Strategies. Retrieved from <https://jamanetwork.com/channels/health-forum/fullarticle/2766118>

<sup>12</sup> *ibid*

<sup>13</sup> J. Rowan, N., & G. Laffey, J. (2020). Challenges and solutions for addressing critical shortage of supply chain for personal and protective equipment (PPE) arising from Coronavirus Disease (COVID19) pandemic—Case study from the Republic of Ireland. *Science Of The Total Environment*, 725. Retrieved from <https://www.sciencedirect.com/science/article/pii/S0048969720320453?via%3Dihub>

<sup>14</sup> *ibid*

<sup>15</sup> UNIDO, “COVID-19 critical supplies: the manufacturing repurposing challenge”, April 2020, <https://www.unido.org/news/covid-19-critical-supplies-manufacturing-repurposing-challenge>

<sup>16</sup> *ibid*



China has for example repurposed state-owned enterprises to manufacture Covid-19 critical supplies, in addition to providing loans to firms producing critical supplies such as masks, medical clothing, disinfection machines, disinfectant solutions and infrared thermometers<sup>17</sup>. Other countries such as Japan provided financial and fiscal support to help manufacturers repurpose production lines to produce masks<sup>18</sup>. The UK set up a “ventilator challenge”, which has received responses from aerospace, automotive, and ICT firms, while the US already issued ventilator contracts to automotive firms<sup>19</sup>.

Despite governments calling on manufacturers to temporarily repurpose their manufacturing lines to meet the shortage in PPE demand, a large number of products from repurposed facilities have been rejected for failing to meet the required medical standards<sup>20</sup>. Manufacturers have also faced other significant challenges in determining the feasibility of the project, defining the business case itself, developing the product, validating the repurposed product, and implementing and scaling-up the production<sup>21</sup>. The UNIDO has accordingly proposed the following recommendations<sup>22</sup>:

- Policymakers need to ensure that the produced specifications are technically sound and validated by health experts and practitioners.
- Product safety specifications, standards and type approval must be clearly defined.
- Regulatory agencies should be adequately resourced to test and certify new designs and fast-track applications.

## II. Situational analysis of PPE production in Egypt: A Roadmap for development

### Context Overview

During the early months of the outbreak, several governments and organizations have stressed the importance of PPE availability for frontline health workers fighting the virus and preserving lives. As early as of March 2020, the World Health Organization (WHO) released a warning about the disruption of the PPE global supply caused by increasing

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<sup>17</sup> University of Cambridge, “Covid-19: International Manufacturing Policy Responses”, March 2020, <https://www.ciip.group.cam.ac.uk/reports-and-articles/covid-19-international-manufacturing-policy-respon/download/2020-04-07-COVID19A.pdf>

<sup>18</sup> *ibid*

<sup>19</sup> *ibid*

<sup>20</sup> *ibid*

<sup>21</sup> *ibid*

<sup>22</sup> *ibid*

demand, panic buying and stockpiling<sup>23</sup>. According to estimates released by the WHO, global production of PPE needs to surge by 40% in order to meet the additional global demand<sup>24</sup>. For Africa for example, this would imply that 15.3 million masks, 5.2 million gowns, 13.1 million gloves, and half a million liters of disinfectants would be needed every month<sup>25</sup>.

In Egypt, demand over PPE, mainly in face masks and sanitizers, witnessed an unprecedented increase. Given that face masks are declared as a necessity to beat Covid-19 and with the rising number of asymptomatic carriers of the virus, face masks have become strongly recommended or obligatory to wear in public in order to prevent the spread of the virus. Face masks as a result have been witnessing a dramatic increase in local demand, unlike other PPE which did not face the same demand.

What used to be a commodity used in specific cases by health workers has become urging demand for all citizens around the globe. Regulations governing the PPE industry became subject to daily tampering, and many of the new market players produced PPE which was not in compliance with the global technical guidelines or with Egypt's MOH guidelines (which is to be further explained in the challenges section below). PPE manufacturers were on one hand striving to cope with the new production demand, while other medical non-PPE manufacturers began planning on adding new PPE production lines or on building new PPE factories in order to reserve a share in the market. According to the interviews conducted, many hospitals or demand agents on the other hand who were severely affected by the challenges of procuring PPE from new manufacturers, with lower manufacturing specifications than they commonly adhere to.

Since the onset of the recent pandemic, hospitals and healthcare providers have repeatedly reported PPE supply chain challenges and have been vocal about the risks they are exposed to considering the production capacity of PPE. In April 2020, 13% of coronavirus infections were by frontline doctors and healthcare workers, amounting to 350 cases and 19 deaths.<sup>26</sup>

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<sup>23</sup> Who.int. 2020. *Shortage Of Personal Protective Equipment Endangering Health Workers Worldwide*. [online] Available at: <https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>

<sup>24</sup> Intracen, April 2020, <https://www.intracen.org/covid19/Blog/Strengthening-African-value-chains-in-medical-supplies/>

<sup>25</sup> *ibid*

<sup>26</sup> Alaa Ghannam; Ahmed Azab; Al Shorouk, 2020

<https://www.shorouknews.com/columns/view.aspx?cdate=03072020&id=9f1c6f3d-fa81-48e8-9f30-4fc522fae75b>

Internal healthcare reports indicate that the total number of frontline healthcare workers who were infected by covid-19 amounted to 1500 as of June 2020.<sup>27</sup>

In 2019, Egypt's import value for covid-19-related medical supplies amounted to a little more than three million USD, while its export value to 408 thousand USD<sup>28</sup>. According to the International Trade Centre, Egypt is in the 13<sup>th</sup> place (out of 16 countries) for trade balance in Covid-19-related medical supplies, with a negative balance of -2,594 million USD for 2019<sup>29</sup>.

The Egyptian government has taken serious actions to increase the national production capacity of PPE in order to meet the growing demand. The Egyptian Prime Minister has issued an executive order to establish the Egyptian Authority for Unified procurement, Medical Supply and Management (AUPP), and the Department of Medical Technology, stressing on the unified importance of the field and its potential.<sup>30</sup> Further, some of the efforts pursued by the Egyptian government include:

- Temporarily banning export of masks and all types of alcohol as of March 2020.
- Issuance of ministerial decree enforcing the use of facemasks in public spaces and imposing fines for not obliging.
- Encouraging and urging the addition of new production lines to produce PPE, specifically masks in medical supply factories.<sup>31</sup>
- Encouraging textile and garment manufacturing to provide support in overcoming face mask shortage through the production of facial cloth masks.<sup>32</sup>
- Announcing a set of manufacturing guidelines/standards to be followed for producing cloth masks.

The report therefore focuses on the PPE industry in Egypt, and the main hindrances and challenges it has faced with the onset of covid-19. It attempts to provide a roadmap for enhancing PPE supply chain and enhance its capacity to capitalize on rising global demand. As the global demand for face masks had ultimately outweighed the standard

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<sup>27</sup> *ibid*

<sup>28</sup> International Trade Center, Trade Map, [https://www.trademap.org/Country\\_SelProduct\\_TS.aspx?nvpm=1%7c%7c22%7c%7c%7c117441%7c%7c6%7c1%7c1%7c3%7c2%7c1%7c3%7c1%7c1%7c1](https://www.trademap.org/Country_SelProduct_TS.aspx?nvpm=1%7c%7c22%7c%7c%7c117441%7c%7c6%7c1%7c1%7c3%7c2%7c1%7c3%7c1%7c1%7c1)

<sup>29</sup> *ibid*

<sup>30</sup> Gernam-Arab Chamber of Industry and Commerce, "Corona Virus in Egypt", 2020, <https://aegypten.ahk.de/en/corona-virus-in-egypt>

<sup>31</sup> *ibid*

<sup>32</sup> *Ibid.*

capacity for mask production; it is estimated that the global respiratory masks market will grow from 14,6 million units in 2019 to 33,4 million units at a compound annual growth rate of 22.9%<sup>33</sup>. Considering its dramatic increasing demand, the main focus of the report is placed on the production of face masks.

Essentially, most PPE including masks, gowns, hair caps, and hospital drapes use the same processed input material for manufacturing. Countries which do not locally produce the processed inputs used for PPE production and depend on exporting it such as Egypt could face shortage and price spikes for PPE. To overcome these challenges, Egypt could make use of the opportunity to capitalize on the current market demand through investing in the technology to produce spun-melt polypropylene sheets, which are the processed input material used to produce most types of PPE.

## PPE industry in Egypt

The production of PPE is mostly concerned with compiling imported medical processed material/input which uses a technology called “spun-melt”. According to fieldwork analysis, most PPE manufacturers in Egypt are originally medical clothing companies which produce medical gowns and PPE for health care workers. In addition, PPE manufacturers were found to fall under three categories a) Large manufacturers compliant to global technical specs, b) Large manufacturers semi-compliant to global technical specs, and c) Fragmented manufacturers non-compliant to global technical specs.

### Face Masks

Currently, the most important PPE production in light of Covid-19 is concerned with the production of face masks which faces highest demand, unlike other PPE products. The Centre for Disease Control and Prevention published the differences between the different types of face masks. Face masks are either respirators, surgical masks, and cloth masks.

#### *Respirators*

- Respirators are essentially tight-fitting masks which reduces the wearer’s exposure to particles including both small and large droplets by at least 95% depending on the type of mask<sup>34</sup>.

<sup>33</sup> The Business Research Company, June 2020, <https://blog.marketresearch.com/the-global-respiratory-masks-market-projected-to-grow-22.9>

<sup>34</sup> CDC, <https://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf>

- Certified N95 respirators can filter 95% of particles that are 100 to 300 nm in size<sup>35</sup>.
- N99 respirators can filter 99% of those particles<sup>36</sup>.
- N100 respirators can filter 99.7% of these particles<sup>37</sup>.
- Filters can sometimes be a source for infection; thus, it is not recommended to use respirators with filters except in hospitalized quarantine areas.<sup>38</sup>

### *Surgical Masks*

- Surgical masks are essentially loose-fitting masks that are fluid resistant, and which provides the wearer protection against large droplets, splashes, and sprays of bodily or hazardous fluids<sup>39</sup>.
- Surgical masks are single-use and are composed of breathable synthetic fabric<sup>40</sup>.
- Surgical masks do not protect the wearer from small particles<sup>41</sup>.
- Protection offered by surgical masks from pathogens ranges from 10-90%<sup>42</sup>.
- Despite differences in fit and filtration capacity, surgical face masks and N95 respirators reduced participant risk of various respiratory illnesses in similar ways<sup>43</sup>.

### *Cloth Masks<sup>44</sup>*

- Cloth masks are less effective at protecting wearer because of the porous fabric, and because of the gaps near the nose, cheeks and jaw which allow for tiny droplets to be inhaled.
- Although they are significantly less effective than surgical masks, wearing them can still help reduce the spreading of viruses, where they offer protection ranging from 30-60%<sup>45</sup>.

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<sup>35</sup> Healthline, <https://www.healthline.com/health/best-face-mask-2#types>

<sup>36</sup> ibid

<sup>37</sup> ibid

<sup>38</sup> Based on interview with medical expert

<sup>39</sup> CDC, <https://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf>

<sup>40</sup> Healthline, <https://www.healthline.com/health/best-face-mask-2#types>

<sup>41</sup> ibid

<sup>42</sup> ibid

<sup>43</sup> ibid

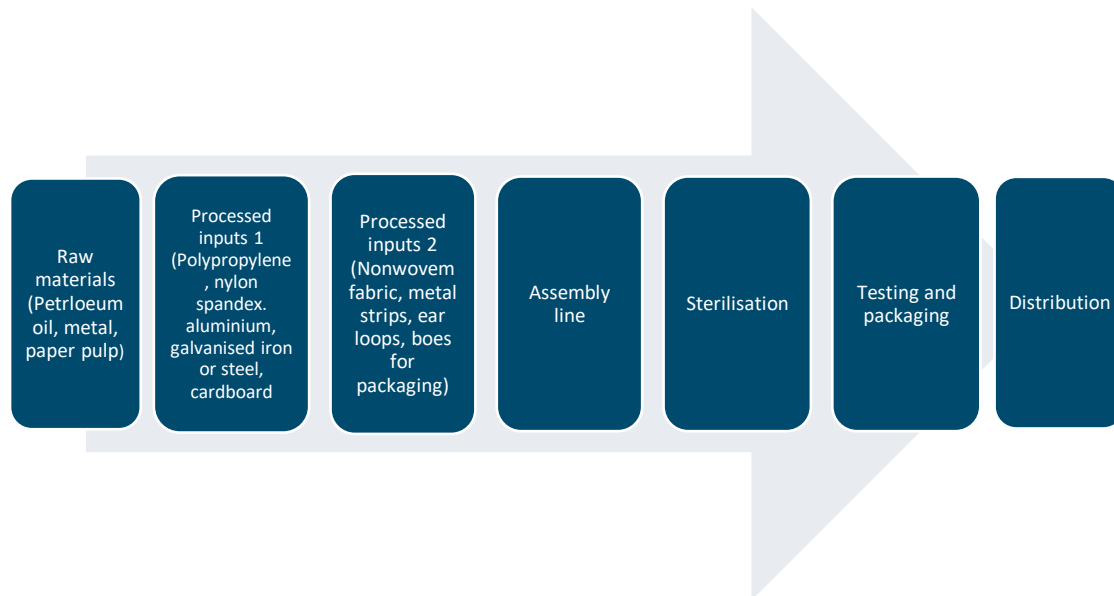
<sup>44</sup> ibid

<sup>45</sup> Based on interview with medical expert

## PPE Production overview in Egypt

### *PPE cost structure and supply chain:*

The face mask global value chain is illustrated as follows<sup>46</sup>:



The **cost** of producing PPE in Egypt comprises of purchasing the processed inputs (nonwoven polypropylene sheets using spun-melt technology), assembling them to manufacture masks, medical gowns, hair caps, ICU drapes, cover sheets, followed by sterilization, and finally packaging the product for distribution. The cost structure is measured by the cost of imported material and the tailoring and assembly process conducted locally. For example, in Egypt, a mask ideally costs 14 Egyptian pt., and is sold at 18 pt.

### *PPE production specification:*

The manufacturing of PPE is subject to two specification dimensions which manufacturers need to be mindful of:

- i. Size and usage of PPE produced

Effective and scientific production of PPE needs to be mindful of the different sizes and uses for PPE, where each of these sizes has its own usage and client or targeted subject. As a rule, the bigger the range and variety of PPE the manufacturer has, the bigger number

<sup>46</sup> OECD, 2020, <https://www.oecd.org/coronavirus/policy-responses/the-face-mask-global-value-chain-in-the-covid-19-outbreak-evidence-and-policy-lessons-a4df866d/>



of clients her/she is more likely to attain. Large PPE manufactures who are compliant with the global technical specs either use the CE specs (EU), or the 510K specs, which are higher in level than the CE certification and which indicate that the manufactured products are both fluid proof and fire proof. Most PPE producers in Egypt rely on two main sources of information for the produced specs, which are **a)** the clients, and **b)** the international medical expositions they attend which showcase the most recent products and solutions. Manufactures who are engaged in export activities, and who maintain high exposure in the international market tend to have better know-how for the technology used, and a more effective product quality than does the local manufacturer.

#### ii. Technical specifications of the fabric

When it comes to the technical specifications, none of the processed input material used for effective PPE production as mentioned before including the surgical masks, medical gowns, ICU drapes among others is available in Egypt. The raw material used for producing PPE are essentially metal and oil which are then processed to produce polypropylene fibers, which are in turn used to produce five different types of sheets to be employed in PPE production for specific uses. The PPE industry is essentially dependent on the spun-melt technology which does not yet exist in Egypt. Factories which utilize this technology to produce the polypropylene sheets are mainly present in Turkey, Saudi Arabia, China, and Europe. A significantly high investment cost is projected for introducing spun-melt technology in factories, with an estimate capital of EUR 14 million. The spun-melt technology produces two main types of nonwoven sheets which are the spun-bond and melt-bond sheets. Those sheets are used to produce five different types of integrated nonwoven sheets, each of which is used for a specific purpose (different types of PPE). The five types of sheets are:

1. **S**: one layer of spun-bond sheets is used.
2. **SS**: two layers of spun-bond sheets are used.
3. **SMS**: One layer of spun-bond, one layer of melt-bond, and a third layer of spun-bond.
4. **SSMS**: Two layers of spun-bond, one layer of melt-bond, and a fourth layer of spun-bond.
5. **SSMMS**: Two layers of spun-bond, two layers of melt-bond, and a fifth layer of spun-bond

### Challenges and malpractices in PPE production in Egypt post covid-19

The opportunity granted by the high demand on the PPE and lax in required specifications, has created an appetite for manufacturers of all kinds to embark on the business, which

has created a sense of saturation with the notable increase in supply. However, *such a saturation is suggested to be a false kind of saturation since a significant bulk of the provided protective masks do not abide by the required global safety guidelines* (EU, 510k) The following points summarize the challenges facing PPE production in Egypt and malpractices leading to lack of available proper and protective PPE products.

- Processed input material used for producing PPE products which use spun-melt technology is not available in Egypt.
- Due to the unprecedented global demand facing PPE processed input material manufacturers using spun-melt technology, Egyptian PPE manufacturers have as well faced shortages, in the beginning of the crisis, in the supply of input material due to challenges in importing PPE processed input material which uses spun-melt technology.
- PPE manufacturers are facing import delays for the medical PPE processed input material using spun-melt technology due to logistical challenges in distribution such as halt of seaports and decreased local distribution due to curfew imposition.
- The specs shared by the Unified Purchasing Committee are limited to requiring the mask to be three-layered regardless of the specifications of the layers, which has proved inadequate in preventing covid-19.
- Due to a lack of reference point of PPE specifications, new market players do not have knowledge of the industry, and some are unaware of their non-compliance, and thus are likely to produce products which are safety-compromised.
- The inflow of new players in the PPE market has created a false sense of “near saturation”, where the lax in required specs for PPE has allowed for a notable increase in supply of protective masks which do not abide to the global technical guidelines with lower protection rates.
- Most local producers of polypropylene sheets (PPE medical processed input material) in Egypt are not a part of the medical sector, but rather are a part of other industries such shoes, diapers, and sanitary pads, and thus do not use spun-melt technologies, which means that the sheets they produce lack any filtration effects, which essentially compromises the effectiveness of the PPE/mask produced.
- Some of the big factories, and all the fragmented manufacturers using the locally produced polypropylene sheets which do not use spun-melt technologies are possibly doing so without realizing that they are non-compliant to the global technical guidelines.

- Most large manufacturers of PPE are dependent on the export business. Factories outside the free zone are however facing export challenges due impositions by the Unified Purchasing Committee to halt any PPE export which has significantly affected their revenue.
- The medical sector follows the same registration procedures followed by pharmaceuticals including medical devices and including PPE products. Typically characterized and challenged by long term bureaucratic policies (approximately 2 years), hence leading to limiting the introduction of potentially innovative and effective products needed to solve pressing challenges.
- Increase in consumer demand over PPE has led to local manufacturers and retailers to increase PPE prices by multiple folds, which was particularly seen with facial and surgical masks which witnessed a price increase by around 10 times.

### Opportunities for the Egyptian PPE sector:

In a study conducted by the International Social Security Association to assess the costs and benefits of investing in occupational safety and health in companies in 15 European countries, it was found there to be a Return on Prevention ratio of 2.2<sup>47</sup>. In practice, this would mean that for every 1 EUR (or any other currency) invested by companies for each employee in workplace hazard prevention, companies could expect a potential economic return of 2.2 EUR (or any other currency). The study estimated the cost for investing in PPE to be 168 EUR per employee per year. In return, the estimate cost savings through prevention of disruptions were estimated to be 566 EUR per employee per year.

The Covid-19 crisis has directed the attention of several countries towards enhancing domestic production for PPE. Australia has announced its plan to establish the first manufacturing plant to produce nonwoven spun-bond and melt-blown sheets needed for PPE production<sup>48</sup>. Several US states have also announced massive investing in spun-bond nonwoven technology to enhance the production of PPE, particularly face masks<sup>49</sup>.

To conclude, the annual production of a single factory producing polypropylene sheets using spun-melt technology is estimated to range from 4k – 6k tons, which means that a single factory's production could easily cover Egypt's local PPE production demand, and could replace the same currently imported input material used in the manufacturing of

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<sup>47</sup> International Social Security Association "issa", 2011, [https://www.usp2030.org/gimi/RessourcePDF.action;jsessionid=V18wm6vrHv11q5Bt9ozFNYJihMc37DGvjRt\\_4FBgMz383pVEPEi711883341381?id=48441](https://www.usp2030.org/gimi/RessourcePDF.action;jsessionid=V18wm6vrHv11q5Bt9ozFNYJihMc37DGvjRt_4FBgMz383pVEPEi711883341381?id=48441)

<sup>48</sup> International Fiber Journal, 2020, <https://fiberjournal.com/covid-19/>

<sup>49</sup> ibid

other non-PPE products (e.g. diapers, sanitary pads). This, in addition to potential of exporting it to global markets for PPE and non-PPE products.

## The way forward: Recommendations to develop the PPE market and production in Egypt:

PPE, such as masks, gloves and sanitizers, have proven to make a big difference in the capacity to contain contagion among health workers, patients and citizens. Countries have thus sought different ways to meet the growing demand on PPE and which have been partially adopted by the Egyptian government such as export bans and encouraging the addition of new export lines to produce PPE. The absence of production of the raw material of the majority of PPE products amongst which face masks representing the highest shortage, Egypt could largely benefit by responding to the root cause of producing raw material. Egypt can also borrow from other international experiences such as temporarily repurposing manufacturing facilities to produce PPE products, and by forming official partnerships between the government and the private sector to maximize the production of PPE like the case in India (but only after responding to shortage of raw material). Further, the PPE industry is a labor-cost-dependent industry, and the demand over facial and surgical masks has only continued to soar over the past months since the onset of covid-19. Egypt enjoying both skilled and cheap labor has been presented with an opportunity to capitalize on this global demand with minor modifications in assembly lines of PPE production. The following proposed recommendations are tailored to fit the Egyptian context for enhancing the PPE supply chain in Egypt through availing the raw material and enhancing specification regulations among other supportive tools.

### a. Invest in spun-melt technology

The global spunmelt nonwoven fabrics market is expected to reach \$US 47.8 billion by 2026, with an estimated compound annual growth of 8.7%. Some of the key players in global spunmelt nonwoven fabrics market are DuPont (US), Fitesa (Brazil), Berry Global Group (US), Glatfelter (US), Freudenberg (Germany), Kimberly-Clarke (US), Suominen Corporation (Finland), Johns Manville (US), Ahlstrom-Munksjo (Sweden) and TWE Group (Germany)<sup>50</sup>. It is recommended to:

- Initiate the spun-melt technology industry in Egypt through encouraging investment in factories and equipment to produce all types and sizes of polypropylene sheets using spun-melt technologies in order to be able to meet

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<sup>50</sup> Innovation in Textiles, August 2019, <https://www.innovationintextiles.com/testing-standards/spunmelt-nonwoven-fabrics-market-to-reach-4748-billion/>

the needs of the market. One of the leading Egyptian medical companies which was a part of the study is currently considering using this technology, thus encouraging this factory and providing it with all the needed support is highly recommended.

#### **b. Launch awareness campaign**

Public awareness campaigns launched by governments such as in Afghanistan<sup>51</sup> and by local initiatives such as the Faisalabad Hub in Pakistan<sup>52</sup> have largely helped in dispelling misinformation about the coronavirus while promoting precautionary measures like frequent hand washing and wearing masks. The South Korean government also resorted to public information campaigns to promote personal sanitization and social distancing through various channels, including conventional posts and placards, mass media, and new media. Initial research conducted shows that the massive social distancing campaign and the transparent policy stance adopted by the South Korean government has been successful in garnering public cooperation and voluntary quarantine initiatives<sup>53</sup>. It is thus recommended to:

- Enhance public knowledge and information of the protection levels provided by different face masks in the markets including those that follow global technical standards and those that do not as well as between the different types including the cloth masks. This can be done through creating an awareness campaign on the types of effective masks, and the specs which consumers need to be mindful of. Such a campaign would lead to:
  - Pressure on mal-practice producers to follow the guidelines
  - Producers that cannot comply to the standards will gradually go out of business
  - Eradicating the saturation currently achieved

#### **c. Strengthen audit and regulatory bodies**

With news of hundreds of types of face masks being withdrawn in many countries amid safety fears, and with the British government announcing that it would not be using 50

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<sup>51</sup> World Bank, “Awareness Campaigns Help Prevent Against COVID-19 in Afghanistan”, June 2020, <https://www.worldbank.org/en/news/feature/2020/06/28/awareness-campaigns-help-prevent-against-covid-19-in-afghanistan>

<sup>52</sup> World Economic Forum, “COVID-19: Customized and Targeted Awareness Campaign”, 2020, <https://www.weforum.org/projects/covid-19-customised-and-targeted-awareness-campaign>

<sup>53</sup> Wiley Online Library, “Fighting COVID-19 with Agility, Transparency, and Participation: Wicked Policy Problems and New Governance Challenges, April 2020

million masks it has ordered for its National Health Service due to safety concerns<sup>54</sup>, it has become imperative to call for strengthening quality regulatory bodies. It is thus necessary to:

- Improve quality inspection of PPE products by ensuring the regulatory bodies' understanding of global manufacturing specs for PPE manufacturing, in addition to imposing penalty clauses for those who do not comply with the global guidelines.
- Work with regulatory bodies (MOH) to adopt the global standards and reject non-complying products

#### **d. Support business development of PPE sector**

Covid-19 has transformed the PPE industry into a competitive landscape. It is expected that by 2030 the PPE industry will be driven by innovation, disruptive business models and smart wearable PPE to enhance workplace safety and productivity<sup>55</sup>. In this regard it is recommended to:

- Facilitate exposure for local PPE manufacturers to new PPE products, including sizes and innovations in implementation. Through attending local and international exhibitions, manufacturers can get exposed to innovations and implementations for PPE products as well as new trends and networking with potential clients. Examples of renowned global exhibitions include the A+A Safety and Security show in Germany and the CIOOSH exhibition in Shanghai.
- Facilitate and expedite registration procedures of new medical devices particularly for PPE-related products

#### **e. Increase the supply by introducing Public-Private partnerships to produce PPE**

During the pandemic, private-public partnerships for procuring necessary medical and protective equipment between government agencies and the private sector have proven to be crucial in helping to fill some supply chain gaps. For example, in the US, three government agencies, the National Institute of Health (NIH), Veterans Affairs Department (VA), and the Food and Drug Administration (FDA), have signed a

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<sup>54</sup> Euronews, "Coronavirus: UK spends estimated €190m on 50 million face masks it won't use over safety concerns", August 2020, <https://www.euronews.com/2020/08/06/coronavirus-uk-spends-estimated-190m-on-50-million-face-masks-it-won-t-use-over-safety-con>

<sup>55</sup> Frost & Sullivan, "Future of Personal Protective Equipment (PPE)", 2020, <https://ww2.frost.com/research/industry/chemicals-materials-and-nutrition/future-personal-protective-equipment-ppe/>

Memorandum of Understanding with an American non-profit called “American Makes” where they will seek designs, produce, and test 3D-printed PPE and other medical supplies in urgent need in the fight to mitigate COVID-19. “America Makes” will act as a “matchmaker” between health care facilities in need of agency-approved PPE and the manufacturers in the industry with the ability to produce them<sup>56</sup>. Drawing on this, we conclude that:

- Governments can play a significant role in encouraging companies that have the potential to shift their production or add new production lines to produce PPE
- State partnerships with private companies will mean a larger availability of resources and lessening of regulatory requirements.

**f. Investigate the potential to repurpose manufacturing facilities as a temporary measure to produce PPE**

As has been mentioned in a previous section of this paper, there has been notable country experiences in the repurposing of manufacturing facilities to produce PPE. Such examples include the US, which has already issued ventilator contracts to automotive firms<sup>57</sup>, and China which has repurposed state-owned enterprises to manufacture Covid-19 critical supplies, in addition to providing loans to firms producing critical supplies such as masks, medical clothing, disinfection machines, disinfectant solutions and infrared thermometers<sup>58</sup>. Japan was also mentioned as a case in providing financial and fiscal support to help manufacturers repurpose production lines to produce masks<sup>59</sup>. Building on this, we can recommend the following:

- Identify the priority PPE items to be produced.
- Identify manufacturing facilities that could be repurposed to temporarily produce PPE.
- Offer financial and technical support to help manufacturers repurpose production lines to produce PPE.
- Clearly define the product safety specifications and standards and have them validated by health experts.

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<sup>56</sup> Harvard Kennedy School, “How Private-Public Partnerships are Aiding the Response to COVID-19”, 2020, <https://datasmart.ash.harvard.edu/news/article/how-private-public-partnerships-p3s-are-aiding-response-covid-19>

<sup>57</sup> University of Cambridge, “Covid-19: International Manufacturing Policy Responses”, March 2020, <https://www.ciip.group.cam.ac.uk/reports-and-articles/covid-19-international-manufacturing-policy-respon/download/2020-04-07-COVID19A.pdf>

<sup>58</sup> *ibid*

<sup>59</sup> *ibid*



- Support regulatory agencies to be equipped to test and certify new designs and products.



### III. Field Notes

## Assessing PPE supply chain in Egypt

### PPE situation amidst covid-19

Demand over PPE amidst covid-19 witnessed an unprecedented increase. What used to be a commodity produced for health workers became in huge demand for citizens globally. Whatever regulations governing the PPE industry fell to pieces with covid-19. PPE manufacturers were on one hand striving to cope with the new production demand, while other medical non-PPE manufacturers began planning on adding new PPE production lines or on building new PPE factories so as to reserve a share in the market. Moreover, new market players outside the medical field all together wanted as well to get in the game, and so began adding new production lines to manufacture cloth masks, which generally do not comply with the manufacturing guidelines for covid-19. Hospitals or demand agents who were severely affected by the challenges of procuring PPE from new manufacturers, with lower manufacturing specifications than they commonly adhere to. PPE pricing was the other issue, were drastic price increases led some hospital managers to delay purchase orders which ultimately placed a higher financial burden on them since manufacturers only continued to increase their prices.

### Potential to add PPE production lines for Egyptian manufacturers

When asked about potential of manufacturers to begin producing PPE, only one manufacturer (large) from the pharmaceutical sector said to have begun manufacturing surgical masks. When asked about his incentive to add this production line, he said that the Egyptian Armed Forces had been urging large companies to produce PPE to meet the growing demand. The referred to manufacturer supplies all his PPE production to the armed forces, not to the market, thus profit-making was not his main incentive, but rather it was his feeling of national duty to assist in a time of crisis. Nonetheless, this manufacturer said that he plans on growing his PPE production to export in the future, where he believes that PPE and particularly masks have become a “consumer lifestyle”.

Another plastic manufacture added a production line to produce face-shields because it was in high market demand, and more importantly because his factory was equipped for such a production line, and he had the ability to produce the required technical specs. Some of respondents said that PPE production was either in the pipeline or is planned to be part of the company’s longer-term plan, and one respondent said they were planning on building a new factory entirely for PPE production. Other respondents said to have



increased their production of sanitizers and antiseptics to make for their losses in other products. Two of the respondents, however, had not considered investing in adding a PPE production line because they considered it “unreasonable to plan a business that is based on an economy of crisis”, and that they would incur losses once the pandemic is over.

It would seem that only large compliant manufactures have considered adding PPE production lines (mainly to produce surgical masks) due to the high investment cost it requires, and due to the need to import the medical processed material for PPE production (using spun-melt technology). Both manufactures who have added/in the process of adding PPE production lines are planning on producing for both the local and global market. Only one manufacturer seems to have done the necessary research to understand the potential for Egypt to engage in the PPE industry, and the strategic opportunity that could be present by investing in the technology and equipment needed to locally produce the medical PPE processed material using spun-melt technology.