

THE ROLE OF INDUSTRY AND INNOVATION IN COUNTERING COVID-19: THE CASE OF VENTILATOR SHORTAGE IN PAKISTAN

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The time of keeping the Corona Virus out and debate around the right or wrong policy for that is now over. Corona virus is now here and all signs now confirm that Pakistan is or will be in the midst of a major epidemic that could last for well over a year and test our resolve and commitment as never before. This will require a warlike mobilisation and commitment from the entire nation - the government, law enforcement, and health responders, first and foremost, but also business leaders, philanthropists, and ordinary people like many of us. We have never fought a major war that lasted for 12-18 months so we've never experienced the kind war effort that many advanced countries had to put together during the 1st and 2nd World Wars. For the next 6-18 months, we will have to change our production and consumption patterns as a society.

This will require mobilisation and leadership from business and industry leaders. I want to address 3 important pillars of mobilisation that will be expected of them, namely: Industry, philanthropy, and lobbying with the Government.

First, Industrial Mobilisation. Currently we're bracing for a couple of orders of magnitude increase in COVID-19 caseload every month (perhaps 10,000+ by mid-April and as many as 100,000+ by mid-May) and that too if we're able to contain the disease. If not, we're looking at outcomes much worse than Italy or even probably Iran where hundreds are dying on a daily basis. God forbid, should the latter happen, it could lead to the collapse of our healthcare system and the society as a whole.

Which is why need to do everything in our power contain and suppress the epidemic but doing so will require following items on a war-footing basis and we need to produce them in as much quantities as possible at home.

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- a) Masks and Personal Protection Equipment (PPE) for Healthcare Workers (most critical)
- b) Sanitizers and Hospital Disinfectants (most critical)
- c) Ventilators (very critical)
- d) Low Cost Rapid Use COVID-19 Detection Kits (critical)

The Government will not be able to mobilise rapidly to produce these in large enough quantities and we may need a group of private sector leaders to come forward in an effort to mobilise private sector enterprise on a war-like footing.

Textile and Garment Plants can be quickly converted to produce masks, hospital gowns, and personal protection equipment (this is the most critical need) as unprotected doctors and hospitals would very rapidly lead to the collapse of the healthcare system.

Pharmaceutical and Cosmetics Plants can be quickly converted, atleast partially, to making sanitizers and hospital disinfectants (this is very important). We need these things in millions of liters a day and provide them to people so that we can arrest the spread of the disease. It is a simple retrofit of existing plant and machinery and doesn't require any rocket science - just vision and commitment, and perhaps a bit of profit motivation to top it all. Government needs to enable this by opening up licenses to produce these chemicals and hand sanitizers (particularly use of alcohol in doing so) by the industry in bulk.

Automotive Parts Manufactures and Light Engineering Industry can be repurposed to create ventilators that are very critical in the medium to long-run. These are a bit trickier to set up and will require some new investment and retrofit of in the auto and parts industry in Lahore and Karachi as well as Light Engineering Industry in Sialkot and Gujrat. The country currently has less than 2500 (+/-) Ventilators and there is some talk of China donating or giving us a few thousand more but the estimated need could be 25,000-50,000 units in 3-4 months. I have also heard demand numbers as high as 150,000-200,000 Ventilators over the span of 12-18 months. When efforts to contain the disease fail, we'll be putting as much as 5-10% of our total caseload on Ventilators to save lives. We will also need to train doctors and technicians to run these Ventilators.

Low Cost Detection COVID-19 Kits are critical but we may be able to procure in significantly large numbers through international donors and partners such as WHO and China. News is that we're expecting 100,000 kits (good for a million tests) from China very

soon and that should be able to meet the immediate needs and more could follow. Again, some industrial capacity in the medium run will be good to have here.

In addition to industrial mobilization, we also need business leadership for important action on two other fronts that require our immediate attention:

Second, Philanthropy needs to be channeled towards these strategic uses, initially, so we arrest the spread of the virus and enable the health system to respond rather than meeting the more day to day need of food and rations. I am not saying the latter is not important, but no amount of philanthropy will be able to meet the basic needs of 200 million people - 80% of whom live in significant poverty.

Third, Government policy requires serious business input and lobbying. Apart from Healthcare provision, the most important Government policy would have to be law and order and economic regime, most notably, income redistribution and poverty alleviation. Addressing poverty and hunger at the scale that we're looking at is the Government's job. No amount of philanthropy will be able to make a dent in this. If we need to lock down the country for a couple of months to get a handle on this epidemic, the government would have to take over the job of providing food and rations, at the doorstep, for at least 20-25 million households who won't be able to work or will lose their jobs.

If there was a time for the BISP or Ehsas Programmes to rise to the challenge of keeping the society from collapse, this is it. Government may be able to do this by transferring money to philanthropic organizations or use Ehsas' network but this will require efficiently channeling Rs 60-80 billion a month into this activity alone.

Fourth, Supporting Bottom-up Innovators to produce open source ventilators, masks and PPE gear

Over the last couple of weeks, COVID-19 has inspired, energized, and produced a groundswell of creativity and innovation in a manner that has never been experienced by this country before. Keeping this going will require making sure that a level playing field is created and maintained for these citizen innovators and will determine where it goes from here and what will ultimately be able to achieve.

Alongside traditional efforts, there has also been a tremendous flowering of *Do It Yourself* (DIY) and Open Source (OS) innovation in the ventilator realm in Pakistan. The open source movement is particularly of relevance to developing countries since these largely focus on low-cost 'no-frills'

alternatives of high cost and high specs versions in the west. Once published, these designs are available for all and sundry DIY enthusiasts to produce, test, and use under somewhat limited conditions.

Efforts to replicate well-established designs such as MIT or OpenLung design sprang up across the country in Makerspaces, University Labs, and common rooms. However, right from the beginning, these efforts faced significant challenges including a lockdown started from Sindh and then gradually included other provinces including Punjab. This made movement of individuals challenging. Another major challenge right from the beginning has been the procurement of sensors and important components such as Ambubags, etc.

Many quick fixes had to be made to overcome these initial challenges. For communications purposes, many teams began working through Facebook groups and WhatsApp chatrooms as well as using other tools such as Zoom and Teams for online meetings, etc. A number of WhatsApp groups focusing on Ventilator designs and prototyping suddenly sprung up with tens of members from across the country. Online repositories of data and knowledge sharing protocols have been developed almost overnight. The effort has since been joined by 3D printing enthusiasts, medical professionals, medical technicians, and others to further the development of an indigenously designed low cost ventilator.

An informal coalition calling itself [Pakistan Against COVID19-Volunteers \(PAC-V\)](#)² has come into being with its own informal structure of multiple technical teams, sourcing of components, public relations and media, and investor communications. The effort of the PAC-V has been to focus on a broader range of medical supplies required to meet the COVID-19 challenge including face masks, face shields, and PPE equipment for frontline medical professionals as well as ventilators.

There is an important, though often controversial, role of the Government in all of this.

The most challenging task, before any of the above, is the regulatory approval and a formal mechanism for procurement of these systems. The Drug Regulatory Authority of Pakistan (DRAP) did not have any independent standards (or tests) to approve the use of ventilators in the country. The usual practice has been to grant approvals to those devices already approved by well-established regulatory agencies like the FDA, EU, or UK MDRC. This is where government support and oversight can play a significant role. A Committee has been set up under Pakistan Engineering

² <https://tribune.com.pk/story/2181993/1-pakistani-volunteers-3d-print-ventilators-join-war-covid-19/>

Council (PEC) and authorized by the Ministry of Science and Technology to help support, vet, and approve ventilator designs for DRAP's scrutiny and approval.

Preparations are also being made to develop test benches and carry out clinical trials on at least four ventilator designs that have been approved by the PEC Committee for the next stage of review by DRAP and a multi-sectoral technical committee comprising medical doctors, emergency room technicians, engineers, and DRAP representatives. This has never happened in the history of this country before yet extraordinary times require extraordinary efforts. There is still a long way to go before the local ventilator design effort could bear fruit but steps are being taken at COVID-19 speed!

While the vast majority of the efforts at creating a local ventilator may not lead anywhere. But it has created an inspiring and constructive dynamic for the future. At least one design, OpenVentPK is breaking new grounds in developing and adapting already existing open source models to local conditions and seeks to create Pakistan's own Open Source local ventilator that uses easily sourced components and spares. Other designs including those using different approaches are also in the works.

This approach of citizen-led bottom up innovation has been successful in other domains of the COVID-19 response as well. One respiratory technologist has developed a 3D printed splitter valve to enable one ventilator to be used by multiple patients. Since then a whole movement has sprung up to use spare capacity of 3d printers across the country – which are legally banned from being imported – to develop these 1 into 2 or 1 into 4 1 splitter valves. These designs need to be tested before they could be used on live patients in critical care scenarios but if successful these could have a significant impact on life and death calculus of COVID-19 through the expansion of ventilator capacity.

Other efforts have included building of low cost DIY face shields to protect frontline healthcare professionals from exposure. These are now being produced, rather costlessly, in significant numbers (thousands) at makerspaces and small industrial set up across the country. A similar dynamic is beginning to take hold among fabric producers and designers for the production of masks, PPE suits, and hospital gowns, sheets, and others. Here too, like ventilators, the lack of standardization, local testing, and quality assurance has thus far been a hindrance.

In order for the bottom up innovation activity to be successful, the circle must complete from idea to invention to innovation which includes the most critical step of production and commercialization. This is where the industry comes in. Most of these rapidly put together innovations will require production at scale for a considerable period of time. This is where a major disconnect of skills happen. Those who can invent do not necessarily produce. It is, therefore, critical that business and industry leaders come together to support and nurture this bottom up innovation across the country.

What an inventor can visualize, prototype, and validate, a manufacturing engineer and a shop floor machinist can produce in no amount of time. Once prototyped, it will definitely require very precise production planning, sourcing of the supply chain, and the actual act of producing itself. This is where our idea to market continuum is at its weakest and requires much support and handholding. The Association of automotive parts manufactures (PAPAM) has offered to manufacture ventilators to meet the projected national demand and this partnership of knowledge and manufacturing must succeed if this effort is to deliver.

A Steering Group of Business and Industry Leaders can help lobby for the right government policy AND coordinate industrial mobilization. Indeed many of our business leaders and captains of industry are personally in a position to make decisions that can save hundreds and thousands of lives and but working together they could create an impact that is 100x more.