

The Impact of COVID-19 on the Future of Advanced Manufacturing and Production

Insights from the World Economic Forum's Global Network of Advanced Manufacturing Hubs



June 2020

While powerful mega trends like global trade tensions, climate change, new technology innovations and the current COVID-19 crisis impact all parts of the globe, the reality of those impacts – and therefore the necessary responses to them – are inherently driven by unique regional characteristics and the regional enabling environments. The Global Network of Advanced Manufacturing Hubs (AMHUBs) was established by the World Economic Forum in 2018 with the purpose of understanding and leveraging that regional diversity to help rapidly transform manufacturing to keep pace with the global megatrends that might otherwise create disruptions for manufacturers around the globe. No one country, entity or industry alone can ensure that our globally connected manufacturing industry survives and thrives. But, together, we can address the unique combination of common global trends captured through the eyes of local and regional representatives. With the arrival of the coronavirus pandemic, we see a need to move faster than ever as this international health crisis affects manufacturers and their respective supply chain networks around the globe. The magnitude of this unprecedented crisis has yet to be fully realized or manifested. And yet, we must struggle through it and think beyond it.

From rapidly redeploying underutilized factories to learning new ways to secure and build local, regional, national and global supply chains, manufacturing must help today while planning for tomorrow. Many companies are looking at new technologies as each region's experience with COVID-19 causes fractures in supply chains to roil across the globe.

How is the manufacturing sector pivoting to support immediate healthcare needs? How are governments allocating resources, creating structures to support citizens, and ensuring shared knowledge? As manufacturers support their medical community, how does their shift affect the supply chain and their role within it?

This paper reflects an aggregate of voices from the Global Network of AMHUBs and focuses on COVID-19's **impact** in each region; **response** efforts from manufacturing and governments; and **best practices** to achieve rapid results and mitigate repercussions to subsequent regions by learning from those affected earlier. The AMHUB authors contributing to this paper each have a unique supply chain perspective and the ability to positively impact colleagues around the globe by sharing lessons learned and best practices for getting economies and citizens back to health as wisely and rapidly as possible. The World Economic Forum is committed to enabling and amplifying cross-AMHUB collaborations that accelerate industry's ability to adapt to the current crisis, while ensuring future resilience through advanced manufacturing technologies and processes.

Global impact

The COVID-19 pandemic has had an unprecedented and disruptive impact on the global economy and societies since the first cases were reported in China in December 2019. In the months that followed, many of the hardest-hit areas of the world

were major industrial hubs that saw immediate supply chain disruptions and halts to production.

These regions – many of them designated Advanced Manufacturing Hubs by the World Economic Forum – include Detroit, Michigan, and the New England region of the United States; the Lombardy region of Italy; Istanbul, Turkey; the Basque region of Spain; Copenhagen, Denmark; and Ulsan, South Korea.

As a result of this fast-spreading pandemic, manufacturing and overall industrial production in the United States have seen the sharpest declines since the country demobilized after World War Two, reflecting worries about supply chain disruptions and reviving financial market fears of a recession.

Similarly, in Turkey, Italy, Denmark and Spain, the effects of COVID-19 are hitting the economy hard, with manufacturing sectors being especially affected by the economic fallout of the pandemic. This comes at a time when many manufacturers were already facing other economic challenges, including volatile exchange rates, high interest rates and negative bank loan quality.

Daily reports of increasing infections and deaths across these countries raise the anxiety of the population and are forcing manufacturing sectors to take the necessary actions to help prevent the disease. In addition to the immediate concern about the impact on human lives, there is fear about a severe economic downturn. Small and medium-sized enterprises (SMEs) have been hit particularly hard globally.

Unlike China, Italy and the US, there was no lockdown in South Korea. By learning from a MERS outbreak in 2015, the nation was prepared and acted swiftly to ramp up testing. Combined with the mass use of face masks by the population and strict social isolation measures, South Korea was able to improve its outlook and prevent the continued spread of COVID-19.

Despite a spike in infections, South Korea has been containing the outbreak without suppressing economic activity. But the country's manufacturing sector is still taking a hard hit due to decreased demand.

Manufacturing response

Insights from the Michigan and New England AMHUBs

In the US, many factories that have remained open are pivoting to help fight COVID-19, but challenges abound. In Michigan, Automation Alley, a non-profit Industry 4.0 knowledge centre serving 1,100 technology and manufacturing businesses across the state, is observing companies of all sizes shifting to help where they can.

Led by auto giants General Motors and Ford Motor Company, Detroit plants that typically churn out cars are being repurposed to make much-needed ventilators, masks, face shields and other personal protective equipment (PPE). Distilleries intended for whiskey and rum are now turning out hand sanitizer and disinfectant.

But reconfiguring factories to make completely different products is a huge undertaking that takes time, while the demand for these products grows amid a sharp rise in the number of cases nationally and new federal mandates that masks be worn by all citizens, not just healthcare workers.

Other industries are getting involved as well. Michigan-based office furniture company Steelcase, for example, is exploring ways to use its factories to make partitions for hospitals; and 3D printers at DreamLab Industries are running around the clock as the Traverse City, Michigan, start-up churns out face masks.

In the New England region, Tulip, a cross-industry consortium aimed at collaboration within New England's manufacturing community, has observed that technology is helping manufacturers respond to COVID-19 by enabling agility in the scaling and shifting of production.

Technology is also helping manufacturers train employees on new production processes on the job, for faster new product introduction. For example, Rich Brilliant Willing, a manufacturer of high-end lighting in Brooklyn, New York, used manufacturing apps to help their workers assemble protective gear for health professionals from home. Similarly, Tulip is seeing technology being used by companies racing to develop a vaccine. Thanks to Pharma 4.0 technologies, these firms are navigating the validation and production process much faster than ever.

Amid the global attempt to increase production of essential equipment to fight COVID-19, the AMHUB network is also seeing increased collaboration between firms and organizations. In New England, for example, a team from the Massachusetts Institute of Technology (MIT) created a ventilator and open-sourced its design to let others manufacture it themselves. Similarly, a number of private companies are sharing designs for components and even portable ventilators for others to make.

Collaboration is happening downstream as well. Maskson.org, for example, is using additive manufacturing to produce PPE. They are also leveraging manufacturing apps to execute production, ensure quality and traceability of masks, and facilitate distributed delivery logistics to healthcare providers.

Insights from the Istanbul AMHUB

In Turkey, the Turkish Employers Association of Metal Industries (MESS), representing 241 manufacturing companies in the country, has been watching the COVID-19 situation and is in close contact with its member community, of which 40% are SMEs. The organization represents a wide range of metal and related industries, including automotive, moulding, machinery, durable goods, iron and steel and cabling with more than 180,000 employees.

The follow-up conversations with the MESS network about the resumption of production, as well the different challenges companies face, show that the firms are looking for immediate temporary solutions for generating cash flow, public support, increased online support of daily activities, IT infrastructure to enable the remote working of their employees and, of course, medical equipment supplies such as masks and gloves.

Insights from the Copenhagen AMHUB

In Denmark, companies have also converted their businesses to produce protective equipment that is in high demand. Plastic production companies are producing visors and alcohol production has been converted to produce disinfectant, for example.

In addition, the Copenhagen AMHUB gathered an emergency response team consisting of manufacturers, design companies,

universities, regulators and health organizations to support hospitals by 3D printing critical components, including face shields, that were delivered to Danish hospitals. In this case, additive manufacturing technology was especially useful where flexibility was extremely relevant in this special situation.

Furthermore, the Danish Industry Organization has taken the role of coordinating a broad range of production of protective equipment for the health sector. This initiative has gathered gloves, isolation suits, disinfectant and face shields.

Insights from the Lombardy AMHUB

In Italy, regional companies and innovation stakeholders began to immediately design and convert manufacturing processes. For example, several companies in the textiles and fashion supply chain, which is a sector of regional specialization in Lombardy, reconfigured production to make medical textiles, also using materials commonly adopted for automotive, agriculture and building applications.

The regional 3D printing community was very active as well. Within a few hours, companies, fab-labs and universities made available 3D printed valves and parts to fulfil the unmet need caused by broken value chains. Creative solutions were developed, such as the design of 3D-printed adapters to turn snorkelling masks into a non-invasive ventilator for COVID-19 patients in order to address the possible shortage of hospital C-PAP masks for sub-intensive oxygen therapy.

The response in Italy was immediately characterized by a high level of innovation, a mix of multidisciplinary competences and creativity – all made possible thanks to the well-established research and innovation capabilities of the region, coupled with a strong entrepreneurial vocation and flexible companies, including many SMEs.

Government response

In the US, the federal government has stepped in to limit the economic destruction of COVID-19. The \$1 trillion plan includes \$500 billion in direct cash payments to individual taxpayers, \$300 billion for a small business loan programme, \$50 billion for airlines and \$150 billion for other “severely distressed sectors”.

In addition, the government has turned to the Defense Production Act to deal with a shortage of critical medical supplies created by the pandemic. It includes a broad set of authorities to influence domestic industry to protect national interests.

In Michigan, Automation Alley has observed the economic development sector stepping up to the challenge to provide much-needed resources for businesses looking to help during the COVID-19 pandemic. With so much information available, companies that Automation Alley encountered initially wanted to help but didn't know where to turn.

State and local governments in the region put resources in place to address business needs. Some examples of these efforts include: Pure Michigan Business Connect offering grants to manufacturers looking to retool and produce critical health and human service supplies; the Small Business Association of Michigan offering information on loan opportunities, unemployment resources and more; and the Michigan Small Business Relief Program providing up to \$10 million in grant

funding and \$10 million in low-interest loans to provide emergency relief to businesses directly impacted.

In addition, several banks have set up contact lines to work with those affected by COVID-19, and organizations like Automation Alley and the Michigan Small Business Development Center are providing weekly resources and webinars to keep the business community informed as the crisis progresses.

In Turkey, MESS developed a massive support plan for its members and the greater business community to help combat the effects of COVID-19 on the Turkish economy.

This plan included detailed guidance and support for its members in the following ways: announcing closures and new regulations; offering 1 million masks and other supplies; hosting virtual meetings in which members could ask questions directly to the Turkish Employment Agency; early payment of financial support fees and deferrals of dues; early payment of scholarships; deployment of online training platforms; remote working tools and services; and guidance on corporate and internal communication, including all best and worst practices in such circumstances from global corporations.

As soon as COVID-19 began spreading in Lombardy, Italy, at the end of February 2020, the regional government, in cooperation with the national Italian government, put measures in place to face the outbreak from both a short-term and strategic long-term perspective. The first wave of measures aimed at addressing the emergency lack of sanitary equipment and materials. An international call for sanitary equipment was opened by the Lombardy region and, at a national level, the government issued a call for immediately extending or reconverting industrial activities to produce medical devices and PPE.

In parallel, regional and national governments activated fiscal and financial measures in favour of industrial continuity, reconversion and fast development of innovative products and solutions in response to the emergency and to the post-crisis; for example, the Lombardy region established immediate fiscal and financial facilitation measures, in cooperation with the Lombardy financial agency.

The regional government also issued a call for public-private funded collaborative projects for the identification of therapies and diagnostic systems, protection and analysis to defeat COVID-19 and any other future viral emergencies. The Ministry for Technological Innovation and Digitalization launched a call targeting innovative consortia developing technologies for the prevention, diagnosis and monitoring for the containment and spread of COVID-19 across Italy.

In addition, Italy's Ministry of Economic Development called for financing industrial research and development projects offering Industry 4.0 solutions in response to COVID-19. Italy has also paid special attention at a national level to workers' safety to preserve the health of the personnel needed to guarantee the continuous operation of critical value chains like food and agriculture, medical devices, banking, insurance and public services.

Besides public institutions, the Italian Banks Association is contributing to support companies with actions and instruments to finance liquidity, suspend loan payments, consolidate debts and finance investments for operational continuity. The national government has implemented €400 billion to guarantee bank loans in favour of enterprises of all size and across sectors.

Next steps

The coronavirus pandemic should be a wake-up call to the international manufacturing sector, highlighting that Industry 4.0 technologies are necessary for survival in a global marketplace that will require more agile and flexible production systems and supply chains. With Industry 4.0 technologies – like 3D printing, the internet of things (IoT), advanced robotics, artificial intelligence and big data – manufacturers will see the benefits of applying a digital-first mindset to a physical business.

In addition, the growing need for remote interaction and asset management during the pandemic has highlighted the necessity of advanced manufacturing technologies that include cloud-based services and future 5G solutions. The agility enabled by such technologies has allowed early adopters to see the benefits of their investments as they have pivoted more quickly and smoothly during the disruptions created by COVID-19. Such examples of resilience and adaptability are likely to lead to an acceleration of the adoption of advanced manufacturing technologies and processes as companies look to adjust to the emerging “new normal”.

While the Forum’s Global Network of Advanced Manufacturing Hubs (AMHUBs) represents a regionally and industrially diverse group of stakeholders, four key best practices emerged that span this regional diversity and highlight the criticality of coordinated action from multistakeholder communities like the AMHUBs. The below recommendations may serve as a roadmap for manufacturing regions across the globe as they look to navigate the crisis resulting from COVID-19, and prepare their respective manufacturing ecosystems for the increased agility and resilience that will be essential as we turn to a “new normal” in global manufacturing. The Global Network of AMHUBs will continue to share its learning and communicate critical examples of how industry can address the challenges inherent to the COVID-19 era.

- **Ensure worker safety:** Technology plays a key role in keeping manufacturing workers safe. Identifying carriers of the virus early is key to containing the spread, and manufacturers are leveraging technology to achieve that by setting up self-testing kiosks for their workforce using temperature sensors to screen for fever and manufacturing apps to guide employees through health self-assessment questionnaires. Furthermore, companies are using apps to control access to facilities and restrict non-essential personnel, thus minimizing the chance of infection.
- **Scale up and shift production to support the COVID-19 fight:** Companies are responding in different ways to ensure business stability and improve the resilience of their supply chains as they pivot to innovative ways to generate revenue. One measure that

can be observed across industries and regions is that technology is helping manufacturers respond more quickly by enabling agility in the scaling up and shifting of production to manufacture ventilators, hand sanitizers and PPE.

- **Facilitate supply chain collaboration:** In this regard, organizations are mobilizing industrial and innovation stakeholders to identify future solutions and roadmaps for the after-COVID phase with a more strategic, medium/long-term perspective. In Italy, for example, a regional advanced manufacturing cluster promoted a set of “virtual innovation labs” to collaboratively discuss how to accelerate the adoption of new technologies and adapt them to the new future scenario. They are connecting regional manufacturing with other international ecosystems to establish international synergies in the fight against the disease. Through such a multidisciplinary cooperation, they are working to shorten the communication between research and manufacturing and to facilitate the path for the immediate industrialization of critical innovations to fight COVID-19.
- **Minimize remote work disruptions:** The crisis has forced manufacturers to shut down non-essential production and keep non-essential production personnel remote. Technology is facilitating this transition in several ways. Automation is helping some operate with fewer people on the shop floor, especially when technologies like IoT and machine monitoring solutions are used by the remote workforce to keep track of production from home. Worker augmentation is helping manufacturers achieve more with fewer people on the shop floor. Furthermore, companies are leveraging apps to facilitate communication and collaboration between in-person shop-floor personnel and their remote supervisors. Finally, technologies like online learning are letting those staying at home use the downtime to gain the skills their companies need in order to come back for a stronger rebound after the crisis.

Although perhaps a once-in-a-lifetime event, COVID-19 is rewarding forward-looking manufacturers who invested in advanced manufacturing technologies by making them more resilient to the crisis. Technology vendors around the world are doing their part to support companies fighting COVID-19, offering free advice and consultation. This provides a great opportunity for all companies to reassess their technological gaps and put in place a digital transformation plan to come out of the crisis stronger and better prepared to face future disruptions.

The World Economic Forum’s Global Network of Advanced Manufacturing Hubs will continue to connect with new regions and drive cross-region collaborations to support manufacturers around the world.

Contributors

Diego Andreis,

President, Associazione Fabbrica Intelligente Lombardia

Baris Arikan,

Head of Digital Ecosystem and Partner Development, MESS Technology Platform, Turkish Employers Association of Metal Industries (MESS)

Cynthia Hutchison,

Vice-President, Automation Alley

Nicole Kampe,

Manager, Communications & Media, Automation Alley

Dong Sub Kim,

Head, Institute for Future Industry Strategy; Chair Professor, Ulsan National Institute of Science and Technology (UNIST)

Vibeke Kristiansen,

Communications Manager, The Danish National Additive & Digital Manufacturing Hub

Saul Lustgarten,

Head, Product Management, Tulip Interfaces Inc.

Project team

World Economic Forum

Ian Cronin,

Project Lead, Shaping the Future of Advanced Manufacturing and Production

Global Network of Advanced Manufacturing Hubs

Basque Region AMHUB

Host: Innovalia Association

Copenhagen AMHUB

Host: Dansk AM Hub

Istanbul AMHUB

Host: Turkish Employers Association of Metal Industries (MESS)

Lombardy AMHUB

Host: Associazione Fabbrica Intelligente Lombardia (AFIL)

Michigan AMHUB

Host: Automation Alley

New England AMHUB

Host: Tulip Interfaces

Queensland AMHUB

Host: Queensland Department of Development, Manufacturing, Infrastructure and Planning

Ulsan AMHUB

Host: Ulsan National Institute of Science and Technology (UNIST)

