

# Industry 4.0 technologies and their applications in fighting covid-19 pandemic

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**Abstract:** COVID-19 (Coronavirus) pandemic has created a surging demand for essential healthcare equipment, and medicines along with the requirement for advanced information technologies applications. Industry 4.0 is known as the fourth industrial revolution, which has the potential to fulfill customized requirements during the COVID-19 crisis. This revolution started with the applications of advanced manufacturing and digital information technologies.

A detailed review of the literature is done on the technologies of Industry 4.0 and their applications in the COVID-19 pandemic, using appropriate search words on the databases of PubMed, SCOPUS, Google Scholar, and Research Gate.

We found several useful technologies of Industry 4.0 which help for proper control and management of the COVID-19 pandemic and these have been discussed in this paper. The available technologies of Industry 4.0 could also help the detection and diagnosis of COVID-19 and other related problems and symptoms.

Industry 4.0 can fulfill the requirements of customized face masks, and gloves, and collect information for healthcare systems for proper controlling and treating of COVID-19 patients. We have discussed ten major technologies of Industry 4.0 which help to solve the problems of this virus. It is useful to provide a day-to-day update of an infected patient, area-wise, age-wise, and state-wise with proper surveillance systems. We also believe that the proper implementation of these technologies would help to enhance education and communication regarding public health. These Industry 4.0 technologies could provide a lot of innovative ideas and solutions for fighting local and global medical emergencies.

The introduction of information technology into all aspects of our lives has brought forth qualitative and quantitative changes on such a large scale that this process has come to be known as the Fourth Industrial Revolution, or Industry 4.0. This paper aims to fill in the gaps and provide an overview of studies dealing with Industry 4.0 from the business and economic perspectives. A scoping review is performed regarding business, microeconomic, and macroeconomic economic problems. Four investigators performed a literature search of the Web of Science, Scopus, and Science Direct.

**Key Words:** COVID-19, pandemic, industry, applications, micro economic, macro economic

## 1. INTRODUCTION:

Originally initiated in Germany, “the Fourth Industrial Revolution”, known as Industry 4.0, has attracted much attention in recent literature. Industry 4.0 is defined as “the integration of complex physical machinery and devices with networked sensors and software, used to predict, control and plan for better business and societal outcomes” (Industrial Internet Consortium 2017) or “a new level of value chain organization and management across the lifecycle of products” (Kagermann 2014) or “a collective term for technologies and concepts of value chain organization” (Hermann et al. 2016).

The global industrial landscape has changed radically in the last few years due to rapid technological developments and innovations in manufacturing processes (Pereira and Romero 2017).

The first three industrial revolutions have brought mechanization, electricity, and information technology (IT) to human manufacturing. The development and change that have taken place in the industry recently entered a new phase in parallel with the developments in computer technology (Last et al. 2014).

It is too early to predict how global and local economies will deal with the consequences of Industry 4.0. No more than 7% of studies concerned with Industry 4.0 focus on the issue of sustainability. The concept of Industry 4.0 entails necessary changes in the operational processes of companies. However, the macro- and microeconomic points of view of Industry 4.0 remain a relatively little explored area. There

exist studies focusing on innovation processes in companies, on the replacement of labor by capital, and the consequences of the increasing unemployment rates and globalization (Antony 2009; Saam 2008; Sala and Trivín 2018; Hedvicakova 2018). Overall companies, households, and the public sector are facing a big challenge in the next generation with important economic consequences. There is, however, a lack of studies concerned with economic growth and process change.

COVID-19 (Coronavirus) pandemic has affected almost all countries and has made a Significant effect on the available healthcare facilities and treatment systems. There is a requirement for the introduction of various advanced technologies to tackle various problems related to this viral pandemic. Industry 4.0 is also known as the fourth industrial revolution, which consists of advanced manufacturing and information technologies, to fulfil the customized requirement of different areas of the human being in lesser time. These technologies provide wireless connectivity in the manufacturing and service sector to enhance automation. In the fully implemented scenario of Industry 4.0, we see all these technologies are connected, and medical stakeholders communicate with each other for manufacturing and use of the vaccine, health-care equipment & logistics, checkup, surveillance, detection, and decoding necessary actions with lesser human physical involvement. The proper updates on the gathering of people are provided by the data captured by the advanced technologies [1,2]

Industry 4.0 factories have machines that are supported by wireless connectivity and sensors. These sensors are connected to a system that can visualize and monitor the entire production line and can also make its own decisions. Industry 4.0 uses smart manufacturing processes for the manufacturing of essential disposable items to fulfil the shortage of the COVID-19 pandemic. It provides a smart supply chain of medical disposables and equipment during this crisis by which the patients can receive the required essential medical items, in time [3,4].

Industry 4.0 is a smart system, used as a flexible production line for almost entire production processes with real-time information provided by Artificial intelligence (AI), Internet of Things (IoT), and other digital technologies. Designing and development of any medical part are done rapidly using advanced designing software and further used digital manufacturing technologies like 3D printing to print the required parts [5,6].

The aim of this paper is, therefore, to fill in the gap and provide an overview of studies dealing with applications of Industry 4.0 technologies for the management of the COVID-19 pandemic from the economic perspective defined by keywords such as COVID-19, pandemic, economics, economic development, production economics, the financial sector.

## **2. THEORETICAL BACKGROUND:**

Currently, industrial value creation is shaped by the development towards the fourth stage of industrialization, so-called Industry 4.0. Industry 4.0, referred to as the “Fourth Industrial Revolution”, also known as “smart manufacturing”, “industrial internet” or “integrated industry”, is currently a much-discussed topic. It is assumed that Industry 4.0 supposedly has the potential to affect entire industries by transforming the way goods are designed, manufactured, delivered, and paid for (Stock and Seliger 2016; Hofmann and Rüsçh 2017).

Industry 4.0 is the next step in a long process of development, a revolution based on the use of cyber-physical systems (Grieco et al. 2017). The consequence of developing the Internet of Things and Big Data is the conception of Industry 4.0 as a consequence of their continuous development (Witkowski 2017). Opportunities for further development and direction and visions related to Industry 4 are introduced by (Pfeiffer 2017). The main ideas of Industry 4.0 were originally published by Kagermann based on cyber-physical system-enabled manufacturing and service innovation during the Hannover Fair event in 2011 that resulted from an initiative regarding high-tech strategy for 2020 (Lee et al. 2014; European Commission 2018; Zhou et al. 2015) and informed the Industry Manifesto 4.0 released in 2013 by the Acatech Academy of National Science and Technology (Druckversion 2018).

## **3. SIGNIFICANT BENEFITS OF INDUSTRY 4.0 TECHNOLOGIES FOR COVID- 19**

Industry 4.0 technologies have the capability of providing better digital solutions for our daily lives during this crisis [7e9]. Various benefits of Industry 4.0 technologies, as being envisaged by us for mitigating the effects of the COVID-19 pandemic are as under:

### **Planning of activities regarding COVID-19**

- Providing a better experience without imposing risks to healthcare and other workers.

- Manufacturing of precautionary items related to this virus Provides medical parts in time using a smart supply chain.
- Used robotic-based treatment of the infected patient to reduce doctor's risk.
- Used virtual reality for training purposes.
- Promote a flexible working environment of treatment These digital technologies help people to perform daily life work during the lockdown.
- Provides several innovations with the help of advanced manufacturing and digital technologies Researchers can employ these technologies for social and media platforms to identify unusual information
- Used for better risk assessment and global public health emergency of this virus [10,11].

#### **4. INDUSTRY 4.0 TECHNOLOGIES FOR REMOTE AREAS**

Advanced digital technologies provide telemedicine services for proper prevention and control of this virus. These technologies detect any abnormality regarding the patient and immediately contact medical staff during an emergency. The remote health monitoring system is done quickly by these technologies [12,13]. Sensors are used to sense physiological data and provide useful information to patients and doctors. The applications of Advanced digital technologies are applied to create better exposure and innovative solution for the treatment of COVID-19 patients.

Digital technologies are helpful for distance education, and remote and online learning during the emergence of the COVID-19 pandemic. These provide available relevant information to share guidance and documentation. During the lockdown, these technologies are helpful for the teaching and learning process in remote areas [14,15]. These provide digital and multiple sources for open educational resources.

#### **5. SIGNIFICANT TECHNOLOGIES OF INDUSTRY 4.0 WHICH MAY HELP IN COVID-19 OUTBREAKS**

Industry 4.0 technologies detect the symptoms of COVID-19, which helps to avoid any confusion regarding this disease and can also predict the chances of acquiring the disease. It helps track potential health problems and expected chances of recovery. Table 1 discusses the Significant technologies of Industry 4.0, which may help in COVID-19 outbreaks [16e24].

AI-based video surveillance has a high capability to reduce the workload of doctors and hospital managers during this crisis. This is useful to observe the activities of the patient affected by this virus. Industry 4.0 technologies improve the working efficiency of a healthcare professional and provide a better solution. The applications of these technologies are used to learn about COVID-19 [25e31]. A lot of misinformation on COVID-19 is fed to the masses through various technological platforms, so there is a requirement to identify misinformation & misinformants and then provide exact information. Digital technologies of industry 4.0 show superior capabilities to detect misinformation [32e35].

We have analyzed, pooled, and suggested the capabilities of various Industry 4.0 technologies applications in the management of the COVID-19 pandemic. Such consolidated information was not yet available in the literature. This comprehensive review would help healthcare administrators and researchers to combat such pandemics and epidemics using these technologies effectively, presently and in the future also.

#### **6. FUTURE SCOPE**

In the future, Industry 4.0 technologies will be applicable to store sensitive data of our healthcare system that can be used for another similar pandemic like COVID-19. This revolution could rapidly be adopted by professionals, doctors, and staff which can influence the treatment line of COVID-19 and other similar pandemics or epidemics. It can be used to centralize all medical tools, devices, and treatment processes. In the future, the medical industry would grow and has to adapt to digital technologies to create smart healthcare systems hence there is a need to change the software platform software devices to the latest ones. This revolution provides disruptive innovation to minimize the effect of the COVID-19 virus.

#### **7. CONCLUSION :**

Industry 4.0 provides an automatic solution to various manufacturing industries and other related areas. This consists of various manufacturing and digital information technologies to collect, transfer, store, analyze, and properly monitor information systems. Digital technologies provide an innovative method for

the proper isolation of the infected patient to reduce the high risk of mortality, speeding up the drug manufacturing, treatment process, and care. Through the application of these technologies, people are working from home; they are discovering a new office culture, work timings, virtual offices, virtual meetings, and extensive written communications. Industry 4.0 has the capability of remote operation using smart technologies which is helpful for COVID- 19 outbreak. This revolution speeds up the digital transformation with better crowd management, transportation management, and safety of the public. These digital technologies create virtual clinics through the application of telemedicine consultations. So, there will be a reduction in the physical crowding of patients in hospitals and clinics. These technologies track the record of the patient and prevent the patient from unnecessary hospital consultations.

## REFERENCES :

1. Javaid M, Haleem A. Industry 4.0 applications in medical field: a brief review. *Curr. Med. Res. Pract.* 2019;9(3):102e9.
2. Inca M, Vayena E. On the responsible use of digital data to tackle the COVID- 19 pandemic. *Nat Med* 2020 Mar 27:1e2.
3. Zeng J, Huang J, Pan L. How to balance acute myocardial infarction and COVID- 19:the protocols from Sichuan Provincial People's Hospital. *Intensive Care Med* 2020 Mar 11:1e3.
4. Manogaran G, Thota C, Lopez D, Sundarasekar R. Big data security intelligence for healthcare industry 4.0. *Cyber security for Industry, 4.0.* Cham: Springer; 2017. p. 103e26.
5. Ruan Q, Yang K, Wang W, Jiang L, Song J. Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. *Intensive Care Med* 2020 Mar 3:1e3.
6. Haleem A, Javaid M, Vaishya R. Industry 4.0 and its applications in ortho- predicts. *J Clin Orthop Trauma* 2019;10(3):615e6.
7. Cheng GJ, Liu LT, Qiang XJ, Liu Y. Industry 4.0 development and application of intelligent manufacturing. In 2016 international conference on information system and artificial intelligence (ISAI) 2016 Jun 24 (pp. 407-410). IEEE.
8. Grasselli G, Pesenti A, Cecconi M. Critical care utilization for the COVID-19 outbreak in Lombardy, Italy: early experience and forecast during an emergency response. *Jama* 2020 Mar 13.
9. Ahmed SF, Qadeer AA, McKay MR. Preliminary identification of potential vaccine targets for the COVID-19 coronavirus (SARS-CoV-2) based on SARS- CoV immunological studies. *Viruses* 2020 Mar;12(3):254.
10. Haleem A, Javaid M. Additive manufacturing applications in industry 4.0: a review. *J. Ind. Integat. Manag.* 2019. <https://doi.org/10.1142/S2424862219300011>.
11. Microscopy E, Fields M, Micro- E, Beams E, Boone PM. *NDT Techniques: laser-based electron holography in phase space.* 2001. 1995.
12. Irvine C. New holographic virtual events will reach millions amid coronavirus (COVID-19) crisis [Internet]. *DVEholographics.* Available from: <https://www.pnewswire.com/news-releases/new-holographic-virtual-events-will-reach-millions-amid-coronavirus-covid-19-crisis-301025496.html>.
13. What is cloud computing? [Internet]. Available from: <https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/>.
14. Lawrence C. Is cloud computing the superhero of covid-19? *Dev Hub* [Internet]. 2020 Mar; Available from: <https://www.codemotion.com/magazine/dev-hub/cloud-manager/cloud-computing-covid-19/>.
15. Moeslund TB, Granum E. A survey of computer vision-based human motion capture. *Comput Vis Image Understand* 2001;81(3):231e68.
16. Wand M, Adams B, Ovsjanikov M, Berner A, Bokeloh M, Jenke P, et al. Efficient reconstruction of nonrigid shape and motion from real-time 3D scanner data. *ACM Trans Graph* 2009;28(2).
17. Sample C. Covid-19: developing high-tech protective masks [Internet]. *Medical Expo e-mag.* 2020. Available from: <http://emag.medicaexpo.com/covid-19-development-of-high-tech-protective-masks/>.
18. Kim P, Chen J, Cho YK. SLAM-driven robotic mapping and registration of 3D point clouds. *Autom ConStruct* 2018;89(May):38e48.
19. Pejčić B, De Marco R, Parkinson G. The role of biosensors in the detection of emerging infectious diseases. *Analyst* [Internet] 2006;131(10):1079e90. <https://doi.org/10.1039/B603402K>. Available from.
20. Patch for detection and monitoring of COVID-19 symptoms fast-tracked [Internet]. *Med-Tech Innovation/News;* 2020. Available from: <https://www.med-technews.com/news/patch-for-detection-and-monitoring-of-covid-19-testing-fast-/>.

21. Ren JL, Zhang AH, Wang XJ. Traditional Chinese medicine for COVID-19 treatment. *Pharmacol Res* 2020 Mar 4:104743.
22. Baldwin R, Tomiura E. Thinking ahead about the trade impact of COVID-19. *Economics in the time of COVID-19*. 2020. p. 59.
23. Haleem A, Javaid M, Vaishya R, Deshmukh SG. Areas of academic research with the impact of COVID-19. *AJEM (Am J Emerg Med)* 2020. [https://doi.org/ 10.1016/j.ajem.2020.04.022](https://doi.org/10.1016/j.ajem.2020.04.022).
24. Gupta R, Misra A. Contentious issues and evolving concepts in the clinical presentation and management of patients with COVID-19 infection concerning the use of therapeutic and other drugs used in Co-morbid diseases (hypertension, diabetes, etc.). *Diabetes & metabolic syndrome. Clin Res Rev* 2020;14(3):251e4.
25. Gupta R, Ghosh A, Singh AK, Misra A. Clinical considerations for patients with diabetes in times of COVID-19 epidemic. *Diabetes & Metabolic Syndrome. Clin Res Rev* 2020;14(3):211e2.