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CHAPTER 9

The economic impact of covid-19 and the role of AI

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1 Introduction

As the pandemic unleashed by SERS-COVID-19 tramples down lives and livelihood, economists worldwide ask a very crucial question, i.e. how the business will be in a post-COVID world (Rohatgi, 2020). May be with industries shutting down with the widespread loss of jobs, we are looking down the barrel (Javaid et al., 2020). No doubt there is going to be a wide chasm between the haves and the have-nots. GDPs across the world are cascading down like a house of cards. This can very well be understood if we study the scenario in the world's most powerful country i.e. the United States. Analysts say that it may take years to recover the status quo. More than 25% of the working-age population of the United States have already lost their regular jobs and are applying for government subsistence. The scenario in Europe, Asia, and Pacific and Africa is no better. With no potential cure available shortly, sociologists apprehend that we may have to live with the pandemic (Garnier, Sandvik, & Cellini, 2020; Harari, 2020; Mason, 2020; Taskinsoy, 2020). Though lockdowns and social distancing have made a dent in the spread of the virus, yet we see that we are moving towards community transmission. In India, we have a huge population and an ever-widening gap between the few rich people and the majority of the population living on the brink (Nguyen et al., 2020). Artificial Intelligence has numerous packages in today's society. It is vital for today's time because it can clear up complicated issues in a green manner in a couple of industries, including healthcare, entertainment, finance, education, etc. AI is making our each day existence greater cushy and fast (Figs. 1 and 2). Artificial intelligence can rework job tasks and occupations. This column uses US online job postings throughout 2010–19 to indicate how absolute and the relative demand for AI-related skills has matured across all business sectors and

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Fig. 1 Migrant labors during pandemic. *(Source: Original.)*

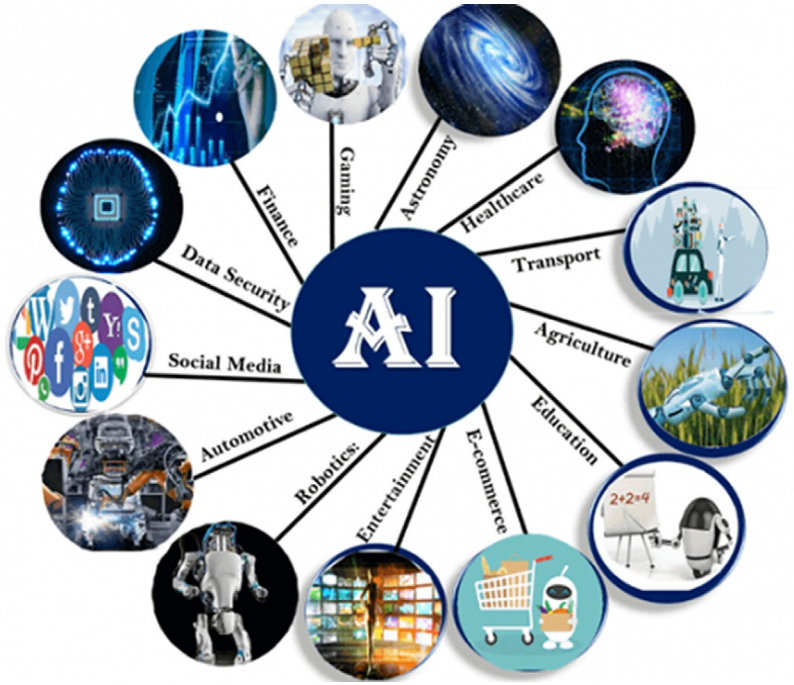

Fig. 2 AI utility. *(Source: https://www.javatpoint.com/application-of-ai.)*

occupation groups. According to this record, with the aid of using Canadian-primarily based start-up totally, 400 international human beings have appeared as pinnacle AI skills. Among those AI experts, 50% belonged to the United States, with some of 10.295, observed using China, which had 2525 AI experts. The record, in addition, said that rank three and four are for the United Kingdom, Germany and Canada with some of 1457, 935, and 815 respectively. According to the record, India stands at quantity nine in those AI experts standing, with the quantity of AI experts being 555 (Fig. 3). This pandemic is converting a pre-existing economic slowdown into a full-fledged crisis. This may cause lasting damage to the already weakened economy. On the economic front, India was in pretty bad shape as Covid-19 struck. Just before the outbreak of the pandemic, we had seen that economic growth was slumping. The investment was not coming and unemployment, as well as poverty, were rising. A clogged financial sector choked the economy even as battered public finances were of limited help. In the wake of this situation, we have witnessed reverse migration of lakhs of migrant labor who walked home listlessly, some dying on the way as the entire economy came to a screeching halt. As we watched this humanitarian disaster helplessly, it is a sad story that these people have contributed to the spread of the disease. This has created nationwide indignation. Even as the

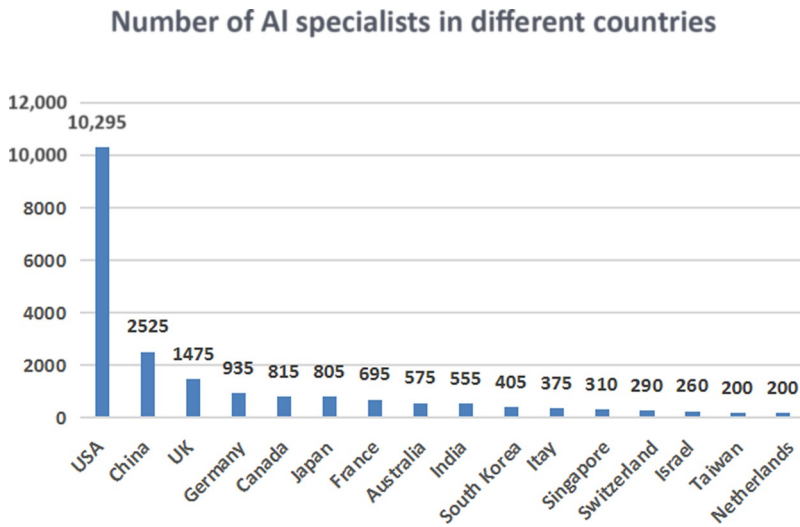

Fig. 3 World ranking of countries with number of AI scholars. *(Source: https://analyticsindiamag.com/india-among-top-9-in-worldwide-rankings-in-terms-of-ai-specialists/.)*

government has started Unlock I and II, to unleash economic activity and save livelihoods, yet it is presumed that it may take years to nurse back the economy to the much-hyped 5 trillion-dollar economy. Each and every sector of the economy around the world has been badly affected, which has triggered a recession-like situation. Traditional organized and unorganized sectors have shredded jobs. Further, there is every likelihood that the middle and lower-middle-class will be pushed into poverty. The pandemic threatens millions of people and has challenged the country's already overburdened health system like never before. Limited state capacity has severely affected the Covid-19 response (Stephany et al., 2020).

If we take a careful look at the banking system, which forms the backbone of the country's economy, we find that the balance sheets have taken a hit. Bad loans or NPAs are rising in the banks. The RBI has reduced the repo rate to push credit into the shagging sectors of the economy (Dev & Sengupta, 2020; Stephany et al., 2020). The government has started multiple schemes like "Atma Nirvar Bharat" or self-reliance to kick start the economy (Singh, Javaid, Haleem, & Suman, 2020). The government wants the resident Indians to boost local products. "Vocal for local" is the call for the day (Ahluwalia, Mahto, & Guerrero, 2020). The national government thinks that giving a boost to the MSME sector will give the necessary impetus to turn around the clock. The world over the pandemic has pushed back the economy by decades. The largest and most powerful economy i.e., the United States, is in the doldrums. Even China, from where the pandemic originated, has suffered. Never before has humanity been put to such a grinding test. World over the rich and the poor, old and the young, sick and healthy is facing the same music. Four out of five workers worldwide have lost their jobs. The global economy has shrunk by 20% and India's by over 30%. Over 80% have lost their livelihood. From New York to New Delhi, people are crying and imploring their governments to provide minimum subsistence levels for the people. ILO has said that workers and businesses are facing a catastrophe of unimaginable magnitude in both developed and developing countries. Things have to move fast in a decisive manner to set things right. The world has come to a stage where we have to choose between survival and collapse (Ozili & Arun, 2020).

Presently the beleaguered economy is trying to limp back to some kind of normalcy. It is good news that the Government of India has introduced Rs 20 lakh crore booster packages to kick start the economy (Singh & Gupta, 2010). The social distortions and hardships imposed by the pandemic continue to cast their pall of gloom. We have realized that the nation cannot

remain in continued lockdown as its economic fallout is quite debilitating. The long-lasting consequences of the pandemic and consequent restrictions present a gloomy future with repeated disruptions, pain and loss. Coronavirus has caused great anguish to daily wage earners, street vendors, and small shop owners, contract employees and debt-ridden farmers. Under this background, we have chosen the topic for research keeping the aim in mind that how artificially intelligent data can play a vital role in addressing these problems (McCall, 2020). The topic for research will be a pioneering work and will provide the impetus for future social scientists to take forward the activity. This is important because our total society is facing the problem and fighting for survival. We understand that there is no past attempt to solve the research problem and answer the research questions. Under these circumstances, the research paper will attempt to provide tangible solutions using artificial intelligence, especially migrant workers. It is a fact that the solution lies in upskilling the workers with artificial intelligence tools like learning techniques, soft computing, expert systems, computational intelligence, data mining, biometrics etc. We propose to adopt a comparative study in analyzing the pre-Covid era and the post-Covid era. We will study in-depth the psychological response of the migrant laborers. Literature study will also be taken up to study similar situations in the past. Over the last many centuries, this world has been affected by so many pandemics. But there is a basic difference between the past and the present. Today because of technological advancement, we have effective tools to fight off any emergencies. Scientists are toiling day and night to prepare an effective vaccine for the elusive virus all over the world. Analysis of past data will lead the way to suggest a road map to recover from this situation. Restoring the livelihood of millions, providing online platforms for continuing education and strengthening health care systems are the issues that need to be addressed (Hyder et al., 2020; Laghi, 2020; Li et al., 2020; Lin & Hou, 2020; Nguyen et al., 2020; Rao & Vazquez, 2020; Singh et al., 2020; Yang, Gentile, Shen, & Cheng, 2020). The study will use methodologies like observation, survey, primary/secondary data analysis and archival data mining to study the topic comprehensively. Sample studies will be carried out to facilitate arriving at the desired objectives.

This chapter is an attempt to answer the research questions as follows;

- Whether the economic system in India was not prepared to handle a grave crisis of this magnitude?
- What is the economic fallout of the pandemic-qualitatively and quantitatively?

- Whether this will trigger a chain reaction for the new world order?
- Whether humankind can use the tools of Artificial Intelligence to predict and visualize this type of pandemic in the future.

AI may "help with the next pandemic." In the meantime, gathering extensive diagnostic data on who is infectious will be essential to save lives and limit economic damages (Baldwin & Tomiura, 2020; Bloom et al., 2020; Dewatripont et al., 2020).

2 Economic impact of Covid-19

The economic impact of Covid-19 is endemic. The global effect can be ascertained from the fact that major banks in the United States have set aside nearly 28 billion dollars this quarter for potential bad loans. Governments across the world have unveiled plans in the form of deferments, direct assistance and unemployment aid. But the fact is that this massive stimulus may not be enough to support society in the long run. There is little likelihood that the economy will bounce back shortly. Table 1 presents the projection of real GDP growth (in percentage, basis: year-on-year) done by the Organization for Economic Cooperation and Development (OECD). Colors in the table indicate the direction of revisions since the December, 2020 Economic Outlook.

Post the first wave of Covid-19, activities in many sectors have picked up and partly adapted to pandemic restraints. Government stimulus coupled with vaccine roll-out, which is gaining momentum, is presumptive to furnish a stellar boost to economic activities in a slow and uneven manner. However, outlooks for sustainable growth differ largely between countries and sectors. Quicker and more efficacious vaccination preparation across the globe is captious. Prospects have been reinforced over recent months, with signs of a movement in merchandize trade and industrial production becoming unsubtle by the end of 2020. Global GDP growth is now projected to be 5.6% this year, i.e., in 2021, an upward revision of more than one percentage point from the December *OECD Economic Outlook*. World output is expected to reach pre-pandemic levels by mid-2021, but much will depend on the race between vaccines and emerging virus variants. The global vaccine roll-out remains uneven, with restrictions remaining in some countries and sectors. The outlook for growth would improve (upside scenario) if the production and distribution of doses accelerate, is better coordinated worldwide, and gets ahead of virus mutations. This would allow containment

Table 1 Projections of real GDP growth (*%, year-on-year, colors indicate the direction of revisions since the December 2020 Economic Outlook*).

	2020	2021	2022
World	−3.4	5.6	4.0
Australia	−2.5	4.5	3.1
Canada	−5.4	4.7	4.0
Euro area	−6.8	3.9	3.8
Germany	−5.3	3.0	3.7
France	−8.2	5.9	3.8
Italy	−8.9	4.1	4.0
Spain	−11.0	5.7	4.8
Japan	−4.8	2.7	1.8
Korea	−1.0	3.3	3.1
United Kingdom	−9.9	5.1	4.7
United States	−3.5	6.5	4.0
G20	−3.2	6.2	4.1
Argentina	−10.5	4.6	2.1
Brazil	−4.4	3.7	2.7
China	2.3	7.8	4.9
India	−7.4	12.6	5.4
Indonesia	−2.1	4.9	5.4
Mexico	−8.5	4.5	3.0
Russia	−3.6	2.7	2.6
Saudi Arabia	−4.0	2.6	3.9
South Africa	−7.2	3.0	2.0
Turkey	1.8	5.9	3.0

Note:

	Downward revision, by 0.3 pp or more
	No change or smaller than 0.3 pp
	Upward revision, by 0.3 pp or more

Source: OECD (2021). OECD Economic Outlook, interim report March 2021.

measures to be relaxed more rapidly and global output to approach pre-pandemic projections for activities. But consumption expenditure and business certainty would be striking (downside scenario) if vaccination programs are not accelerated enough to incise infection rates or if new variants become more far-flung and necessitate alterations to incumbent vaccines. However, considering the intensity of cruelty of the second wave of Covid-19, the projections done may get disturbed.

It needs less to mention that at present, a big cloud of uncertainty surrounds the global outlook. The future will depend on how the nations manage health crisis, including whether the vaccines successfully counter the new COVID-19 strains/ genetic mutations or they prolong the pandemic;

the effectiveness of policy formulations to limit continuous damage to the economy; the emerging market dynamics and fiscal/administrative measures to reign in escalating prices; and the flexibility of the economy to bounce back.

While the pandemic rages without a break, national policies should first focus on minimizing the long-term effect of the crisis, increasing health care spending as a percentage of GDP, providing well-targeted financial support to crucial sectors, and maintaining accommodative monetary policy while monitoring financial stability risks. Then, as the recovery progresses, policymakers will need to limit long-term economic damage by more production (for example, public investment) and increasing incentives for an efficient allocation of productive resources. It is a delicate balance, especially given the prevailing uncertainty as needed). Simultaneously, long-term challenges like boosting productivity, improving policy frameworks, and addressing climate change issues cannot be sidetracked. Widespread mass vaccination covering the frontline workers, vulnerable groups of the population, working-age group citizens hold the key to early recovery.

Strong international cooperation is vital for achieving these objectives and ensuring that emerging market economies and low-income developing countries continue to narrow the gap between their living standards and those of high-income countries.

- On the health care front, this means ensuring adequate worldwide vaccine production and universal distribution at affordable prices—including through sufficient funding for the vaccination facility—so that all countries can quickly and decisively beat back the pandemic.
- Vaccination should be universal and suitable tax incentives can be given.
- Moreover, strong cooperation is needed to resolve economic issues.

Global trade is estimated to have fallen by 5.3% in 2020 but is projected to grow by 8.0% in 2021. Major advanced economies, which comprise 60% of global economic activity, are projected to operate below their potential output level through at least 2024. A resurgence in infectious cases in Europe, the United States, Japan, Brazil, India, and various developing economies renewed calls for lockdowns and curfews and threatened to weaken or delay a potential sustained economic recovery into mid to late 2021.

In India, the situation is no better (The Economics Times, 28 Apr 2021). It is a very precarious situation in India, home to nearly 140 crore human beings i.e., around 20% of the global population. The onset of the second wave has dashed the hope of a V-shaped economic recovery as the pandemic rages around with lives and livelihoods being lost like ninepins.

Presently the Indian economy, the world's fifth-largest, is under the long shadow of long COVID as the aftereffect of the long seize is beginning to have its deleterious effect on the economy. Economists and rating agencies have downgraded India's growth. We can hope for a maximum nine plus % GDP growth against an IMF forecast of 11.5% as of January 2021.

If we look at Budget 2020, it estimated the country's GDP at around Rs 203 lakh crore or $2.8 trillion. The economy was projected to grow by 10% and reach approximately Rs 220 lakh crore. On the other hand, the economy contracted around 8%, downgrading to Rs 195 crore or around $2.6 trillion, pegging at the figures of 2018. This year for 2021–22, as per the budget, the economy was projected to touch Rs 222 lakh crore or $3.00 trillion. But as of now, it seems that the economy may make it to the pre-pandemic level of 2019 by early 2022.

It was expected that the budget of 2021 would achieve its targets because of the ongoing vaccination program, privatization of selected public sectors to fund expenditure and boosting the financial sectors. The assumption was that this would set the cycle rolling for demand creation, jobs, income generation, consumption, investment opportunities and resultant growth.

But as things turn out today, there is little movement on the economic front. The second wave of the muted virus rages across the length and breadth of the country in rural and urban India. As a result of this, the nation as a whole is under lockdown and shut down. Spiraling caseloads in lakhs and increasing mortality rate have put brakes on livelihoods. The retail and MSME sectors are the worst hit. The retail sector contributes 10% to the GDP and creates jobs. Now, most of the employees have lost their jobs or are irregularly paid. In this scenario, the funding roadmap via privatization may not be off-take as this is not the best time disinvesting. Lately, 90% of the economic activity, movement of goods and services are under standstill effect. Epidemiologists and economists are accessing that the Virus curve may flatten by July end and the economic unlock process will begin.

The Indian economy is on the ventilator and struggling to rebound back. The human distress is clearly visible with prices of diesel, petrol almost increasing daily and prices of essential commodities skyrocketing through the roof. Gross mismanagement of the fragile health care system is clearly showing up with an acute shortage of medical oxygen, lifesaving drugs, Poor infrastructure, ICU beds, ventilators etc.

Though the situation looks pretty gloomy, economic pundits hope things may turn better as vaccination speeds up and the curve flattens. The timeline looks hazy as of now.

A whopping 6.2% of the country's GDP, or about Rs 12.5 lakh crore, is required to fight the Covid-19 pandemic in India with intensified measures. In India, the Union health budget is 1.3% of the GDP, and the Union Govt. has allocated Rs 15,000 crore only towards the public health crisis so far. As a result, the cost of COVID-19 care will be 5 times the annual allocation on health and 75 times the fund allocated to fight till now. Presently we are witnessing a recession-like situation around the globe. But it is no ordinary, normal situation. It is estimated that India's economy will contract in 2020–21 from −5% to −15%. The GDP has hit rock bottom in April and May 2020. Businesses are struggling to survive. As an after-the-shoot, we are witnessing firms downsizing employees and reducing salaries to bridge the gap between revenue generation and recurring expenditure. We are gradually likely to see more and more outlets in the retail or FMCG sectors, whether automobile, dress, or eateries, to reduce by 30% due to lack of demand generation. This will result in jobs lost, business space vacated, less power consumption and elimination of other needs. This will, in most likelihood, usher in an era of stagflation, i.e., inflation will rise with a high unemployment rate and subdued demand. In addition to this, we are also witnessing a nonstop rise in fuel prices and their effect on ancillary sectors. Economists fear that there may be a situation where there will be no demand in our country, but prices will grow up continuously. Production units will be unable to cut costs due to the reduced no. of units. Social scientists believe that people will spend less and hold on to their liquidity or cash due to reduced income and uncertainty about the future until normalcy is restored in normal economic activity. Of course, nobody will invest in foreign travel or branded apparel, or consumer goods shortly. With each and every sector of the economy being affected and coupled with the migrant labor crisis and other crises, the middle class, which forms the backbone of the economy, is already pushed into economic stress and poverty. The migrant labor class, which forms the majority of the workforce in factories in distant towns, had left the cities for their native villages at the height of the crisis. Now they are slowly returning to their previous workplaces in the absence of any employment opportunity in their native places. But can all these people get back their jobs? In the absence of any other alternative, the farm or agriculture sector is the only avenue that is expected to do well. Then we may see another flow of reverse migration. The banking sector constitutes an integral part of the financial sector. The RBI revealed in its Financial Stability Report (FSR) that the economic stress induced by Covid-19 could push gross bad loans in banks to their highest in two decades. The loan

moratorium has suppressed the real stress on Indian Banks. The report warns that in this very stressed scenario, the gross NPA of the banking sector would rise to as high as 14.7% of total loans as of March 2021. It predicts a very gloomy picture for the Indian banking sector, at least in the immediate future. The pandemic has also added to the volatility of the financial markets. The economy has already shrunk to abysmal depth. It is a million-dollar question, how soon we can see a recovery.

It is not that the pandemic has taken a toll in India, but it has done so globally. From where the pandemic came from, China is the first major country with economic growth falling by 23%. But significantly, the case counts to be 81 thousand only out of a population of 138 crores. Governments across the world are providing fiscal stimulus packages (Morey, 2004). Globally it is difficult to predict the long-term effects. But sectors like tourism, hospitality, public events are under a lot of stress. On the contrary, sectors like retail, logistics, education, manufacturing, health care, media, telecom, banking, and insurance face radical changes and new opportunities. The financial sector is facing long-term challenges and defaults are rising. Covid-19 has disrupted these industries, but the business models will be more or less dependent on increased digitization.

AI tools like automation, cloud computing, cybersecurity, the Internet of things and data analytics are the need of the hour. Health care industries will have to depend upon data analytics tools to track their business progress and track their investments. In the long term, real-time data will be required to monitor the health conditions. Manufacturing units associated with health care will have to produce personal protective equipment and healthcare technology. Retailers will have to go for large-scale digitalization, considering that consumers will not physically come to the stores. Supply chains and logistics firms will have to be more sensitive to the serious pandemic situation. Online education using new AI technology has already become the order of the day instead of the traditional education systems in schools and colleges (Bragazzi et al., 2020; Luckin, Holmes, Griffiths, & Forcier, 2016; Rodriguez, 2012; Seetharaman, 2020; Woolf, Lane, Chaudhri, & Kolodner, 2013). Telecom companies have to sustain new business volumes as work from home becomes the new norm. Bandwidth demand has increased for residential users. Broadband connectivity helps as more and more people are relying on to work from remote locations. There are far-reaching ramifications of the COVID-19 pandemic. Irrespective of various restrictions like lockdown or social distancing, there is every likelihood this global crisis may well spill over to the next calendar year.

3 Artificial intelligence (AI) as a solace to help mankind out

This pandemic has generated massive amounts of information and data that can help both medical staff and policymakers to better understand the evolving nature of the disease and implement a more informed public health response to achieve early COVID detection, and to develop new diagnostic and planning tools that can support self-testing and public advice.

The following AI facilitated systems can help us fight the pandemic (Allam, Dey, & Jones, 2020; Goodman-Casanova, Dura-Perez, Guzman-Parra, Cuesta-Vargas, & Mayoral-Cleries, 2020; McCall, 2020; Nguyen, Ding, Pathirana, & Seneviratne, 2020; Nguyen, Nguyen, et al., 2020; Pham, Nguyen, Huynh-The, Hwang, & Pathirana, 2020; Soares et al., 2020; Vasu, 2020; https://intellimedianetworks.com/):

- AI-powered early warning systems help to find out epidemiological patterns by generating news, online content and information channels to provide early warnings. (WHO Early Warning System-Blue dot.)
- AI tools like interactive dashboards track the spread of the virus through live news and real-time data on COVID active cases, recoveries and death. They can identify virus transmission chains and monitor the economic impact on society broadly.
- AI-enabled Rapid diagnosis is effective in limiting contagion and understanding the spread of the disease. This can be done by analyzing images and symptom data. Data representing the entire population may be collected with scale and precision.
- AI-enabled population surveillance can monitor COVID-19 cases by studying geolocation data, surveillance camera and credit card records to trace patients. In countries like China, contagion risk level has been assigned (color code-red, yellow or green) to all the citizens with the help of mobile software. Machine learning makes use of travel, payment, and communications data to predict the next outbreak of a disease.
- AI-enabled contact tracing systems identify infection routes of the disease. Geolocation data is used to find out the persons coming into close contact with infected persons and text messages are directed to them advising them immediate isolation.
- Automatic drones and robots are used by healthcare authorities to deliver medicines, equipment, sterilizing premises and helping medical professionals.

Finally, we can say that the COVID-19 crisis is a warning to humanity across all borders that we have a very fragile control over the world around us. New

technology like AI can help us in providing some control to monitor, analyze and automate our systems and procedures. Trans formal changes coupled with new technology will help humanity to sustain itself in the future.

Artificial Intelligence is now being applied in our lives in a variety of ways. Nowadays, AI is playing an important role in our battle against the Coronavirus pandemic. These are medical image processing, data analytics, natural language processing, text mining, the Internet of things, computational biology and medicines. Artificial Intelligence facilitated deep learning adds value, especially in the fields of computer vision, Natural language processing, and video games. AI has a significant contribution to data management. Sectors like electronics, automotive, security, retail, agriculture, health care and medical research give better results with the aid of AI. This, in turn, affects the economy. Development in science and technology has helped the world in this unprecedented and chaotic time. Nowadays, robots are used in hospitals to deliver food and medicine to COVID patients and drones are used to identify infected people and disinfect streets as well as public utilities. Computer science experts manage to attend to the needs of virus-affected patients by processing and understanding medical imaging data like X-ray images and CT scans. These are all part of Artificial Intelligence which has been applied in numerous fields.

Artificial intelligence constitutes various aspects. They can be summarized as under.

- Symbolic rule-based methods—which include Bayesian network, hidden Markov model and Kalman filter.
- Probabilistic methods.
- Evolutionary computation-which includes evolutionary algorithm met heuristics, swarm intelligence.
- Machine learning, deep learning, reinforcement learning-which include auto encodes, deep belief network and computational net.
- CNN Architecture-Le net, Alex net, Google net, VGG Net and Res net.

The COVID-19 pandemic has seriously affected the lives of people around the globe. Simultaneously AI technologies support our lives in a multifaceted manner. AI can be used to help people remotely communicate and provide consultations to patients about the coronavirus. AI can be used to fight false news on social media platforms to ensure clear, responsible and reliable information about the pandemic, such as scientific evidence relevant to the crisis. This research article is presented with a detailed analysis of the impact

on the economy by the crisis. The article also discusses the AI applications to restore and improve the economy and control strategies. Literature relevant to the COVID-19 crisis is also discussed. But though studies have been published, it is being observed there are still relatively limited applications and contributions of AI in this battle. Probably this is due to the availability of limited data on AI methods. Artificial Intelligence requires a large amount of data for computational models to learn and update knowledge. This will accelerate discoveries to tackle such emergencies like COVID-19 related issues. This will allow researchers and scientists across the world to contribute to research purposes. In comparison to the 1918 Spanish flu pandemic, now we have a technologically advanced platform. Today almost all stakeholders like different organizations and the government can fight this kind of crisis in an effective manner. Artificial Intelligence technology can be used to plan and execute strategies to fight the pandemic. Robots, various tools for creating systems to understand and address the crisis, can be pressed to intervene to ameliorate the condition of the public at large. The economic growth of the nation is dependent on the physical and psychological health of the people. A country and the globe can grow if the people live a deceased-free life to make a meaningful contribution to society.

In a recent study by MarketsandMarkets, it is predicted that global AI has mammoth potential with the projection of reaching $200 billion market place. Similarly, as per the PWC predictions, AI technologies will have a $15 trillion impact on global GDP. Thus, the impact of AI is going to be monumental in the next decade. The leading drivers behind the growth of the AI market include big data, the adoption of cloud-based applications, and an increase in the demand for intelligent virtual assistants such as chatbots. On a macroeconomic level, AI technology provides greater capacity to predict future outcomes and greater certainty. Over the course of the last few months, the three key impact areas that AI has had on global economic growth include:

- Agile data science has increased the speed of decision-making for national governments.
- Multi-agent simulations and scenario planning drive greater certainty about the future beyond COVID-19 for leaders.
- A lack of historical data has led to an upsurge of model-based AI improving inadequacies of global systems, processes, governance and behaviors.

Even prior to COVID-19, AI has already been acknowledged as a leading force in improving and bringing off global value chains. In the same manner, the technology has been used to address the problems relating to the virus,

AI is used to foretell future trends, like alterations to consumer demand, as well as efficaciously pull off risk at every stage throughout a supply chain. Thus, there was massive potential for AI to contribute to the global economy. It is estimated that by 2030, about 70% of the organizations would have adopted at least one of the AI technologies.

4 Future scope of AI

Artificial Intelligence has a great future. It will have multifaceted use in the days to come. Let us discuss some of the use as under. Manufacturers are applying Artificial Intelligence (AI)-powered analytics to data to improve efficiency, product quality, the safety of employees, ongoing maintenance of production line machinery and equipment, having a crucial impact on the bottom line (Fig. 4). Transformational technology will digitize business processes. AI will interpret the massive amounts of data that Internet of Things (IoT) devices provide, allowing more accurate forecasting to take place and better predictive maintenance routines. Solutions are also already

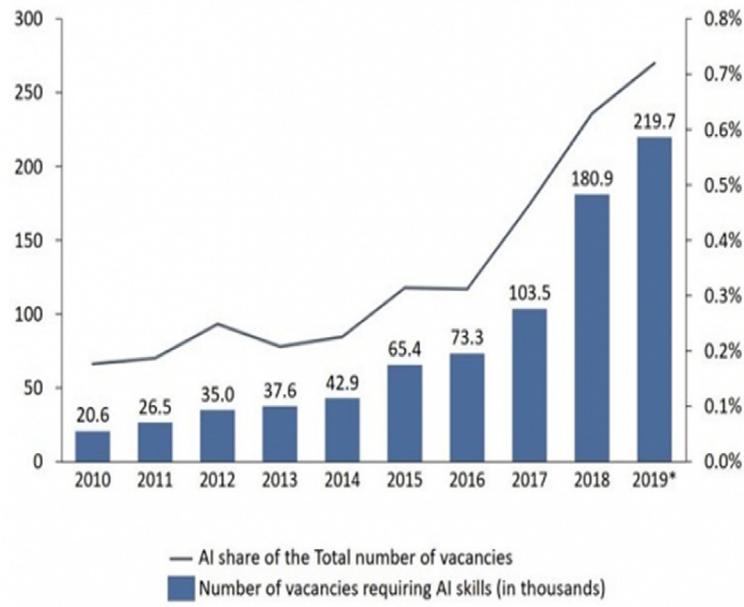

Fig. 4 Job vacancies requiring AI skill. *(Source: https://voxeu.org/article/demand-ai-skills-labour-market.)*

being used on the production side of the automotive sector. Consistency, increasing their savings on repairs and material transportation costs reduce the impact. AI is finding its niche in manufacturing as the technology matures and costs fall and as manufacturers discover applications for which AI algorithms can make complex decisions. However, we believe that advanced technologies like AI can only achieve their full benefit when AI-based solutions are integrated into day-to-day operations and the way of working across the business.

- Intelli Media is trying to add value to India's education sector by providing technological solutions for professionals and students using Artificial Intelligence (AI), Augmented Reality and Virtual Reality technologies (https://www.biopharmatrend.com/m/company/fetch-biosciences/).
- The use of AI for Drug Discovery is a lengthy process of Research and Development. Multiple layers of the process are undertaken to conclude the effectiveness of the drug. It could be a long and costly effort. The potential of AI here is noteworthy. This is in particular useful to treat cancers and neurodegenerative conditions.
- Artificial intelligence can ingest and reason over information from the scientific literature and databases as well as patient-level data to identify potential approaches to treat diseases by proposing a drug target, designing a molecule and defining patients in which to test that molecule to drive greater clinical success. This will provide a holistic understanding of a molecule's activity through integrated systems biology and structural pharmacogenomics.
- Fetch Biosciences is applying machine learning to improve traditional protein engineering techniques dramatically. Fetch is a protein engineering platform that can be used to engineer a variety of protein structures with improved or entirely new features in very little time. Fetch enables scientists to routinely engineer proteins not only faster but ultimately into more active compounds. By optimizing the design and engineering process and working in tandem with existing engineering workflows, Fetch enables proteins to be created that are not attainable through traditional means alone. Companies are using AI to share their data from drug discovery as part of the Machine Learning Ledger Orchestration for Drug Discovery (Melody project) indicates that it will be used more frequently in the future. The project is the first of its kind and allows pharmaceutical companies to learn from the shared data and improve through AI (https://www.crunchbase.com/organization/bluesemi).
- The COVID-19 pandemic has ushered in many artificial intelligence-based health care systems in India and the world. A start-up named Blues

Semi R and D Pvt. Ltd. has developed a contactless and wireless thermal scanning device called "NEEM" which measures the body temperature exactly from a distance of 15 cm and speedily detects, records and transmits the data of multiple no. of individuals without any manual intervention (https://qure.ai/).

- Qure.ai, a start-up, has redesigned the existing chest X-ray AI tool to support medical professionals to predict COVID-19 (https://sense.bio/).
- Sense.bio, an IoT—backed health and fitness app, provides fitness, wellness, and nutrition on a single platform. It helps to check heart rate, oxygen levels and blood pressure through a Smartphone coupled with a sensor device (https://t-hub.co/blog/startups-fight-corona-ai-based-computer-vision-solution-byteforce/).
- Bite forces a start-up has developed a computer vision solution with the aid of AI (Pownall, 2019). This is called Safe vision, which can be fixed to CCTV or drone cameras to keep a watch on crowd behavior in public places. This application analyses video footage on a real-time basis and issues alerts about safety violations. 5C Network, a health care start-up, has utilized AI and Machine learning to scan radiology reports. The technology platform combines all radiologists, hospitals and diagnostic centers. After scanning, the image is circulated through this platform to all available radiologists to analyze and provide the results within a short period. The AI is reshaping the healthcare system considerably and enables physicians to understand the cases even in remote areas by using even mobile phones and other apps. This has resulted in providing health care at cheaper rates with much more efficiency. Covid-19 spread is controlled by the adoption of teleconsultation as a major tool for patient care (Baudier, Kondrateva, Ammi, Chang, & Schiavone, 2021). A novel approach for effective determination of Covid-19 from few CT scans of lungs by few-shot segmentation (FSS)are reported (Abdel-Basset, Chang, Hawash, Chakrabortty, & Ryan, 2021).
- Emotion AI, Artificial Intelligence technology, caters to emotions by decoding live facial expressions, analyzing speech differentiations, monitoring eye movements to detect moods, assess heart rate. This can facilitate business houses to detect customers' emotions and understand them better in a digitalized world. Salespeople accordingly can help the targeted customers to make decisions. SBI utilizes an AI-based solution developed by Chapdex that captures the facial expressions of customers and immediately reports whether the customer is satisfied or not, through cameras installed in the branches.

- Facing Emotions, an AI app developed by Huawei translates emotion into short and simple sounds (BW Online Bureau, 16 Jul 2020). The app assesses the emotion it sees on a person's face to help visually impaired people understand the emotion of the person they are talking with. Another emotion AI-driven technology for mental health is a wearable device developed at the MIT Media Lab that monitors a person's heartbeat to tell whether they are experiencing something like stress, pain, or frustration.
- Two major requirements to be secured from Covid-19 are social distancing and wearing a face mask. These two requirements are properly managed by deep neural networks, fog computing and cloud computing (Singh, Jindal, Sandhu, & Chang, 2021).
- AI-based technology is expected to be the most adopted component and is expected to surge the industry over the next few years. Industry players holding major shares include Amazon, Appear Networks, Apple, Autodesk, Facebook, Microsoft, Nokia and Google. Numerous industry players such as Apple, Intel and Nokia are focusing on creating context-aware APIs (Application Programming Interfaces) for the development of new-age commercial applications. This will augment productivity and collaboration is likely to propel context-aware computing market share over the next 7 years. Context-enriched services are predicted to use situational and environmental information about the user's presence, social attributes, location etc., to predict the consumer's immediate requirements. The AI-enabled firms can proactively offer situation awareness with more sophisticated and better utility functions.

Studying the impact of COVID-19 on the financial sector has thrown open many innovative efforts. If we study the banking sector, we find many instances. IndusInd Bank, a new age private bank, has Completed Integration with CRMNEXT across all Its Customer bases (https://voxeu.org/article/demand-ai-skills-labour-market). This integration will enable the Bank to simplify the process of customer onboarding, introduce new products and meet customer demands by automating and customizing processes to fit modern-day financial requirements. The CRMNEXT platform will facilitate IndusInd Bank with an intelligence-driven "Customer Action Centre," which will provide complete information on customers acquired from multiple sources and make it available on a single screen. As the pandemic spreads, ATMs get Covid-ready, with contactless debit cards and credit cards will come. Banks' Digital lending platforms, which are disbursing COVID Emergency loans, focus on existing customers instead of

acquiring new ones amidst business uncertainties. In an increasingly connected universe, banking linked with IoT is linked to multiple devices like mobile phones, payment terminals, and ATMs. Firms like VISA and FICO have devised products to help banks using smartphones to detect geolocation data to verify a client's identity. IoT can improve a customer's experience with a bank. In the future, banks can track raw materials and inventory stocks by using sensors installed at the borrower's go downs. This tracking enables banks to deduce the account balance and ensure that a loan is paid when stocks are sold. This helps banks reduce overhead costs of tracking and stops borrowers from defrauding the banks.

As a developing nation and its more than 85% workforce, India is engaged in the unorganized sector. There is no tracking system for tracing individual income and nature of work demand and available resources. As many as 50% of laborers go out of state for work and 25% for an unspecified reason (Fig. 5). The average income that they gain in the range of Rs 5000–12,000. There are labor contractors who actually do the counseling of village-level laborers and migrate them to urban. There is no minimum wage act applicable for them. Although there is MGNREGA scheme to create jobs at the village level, the complexity of the nature of engagement limits the interest of rural households to opt for work in the

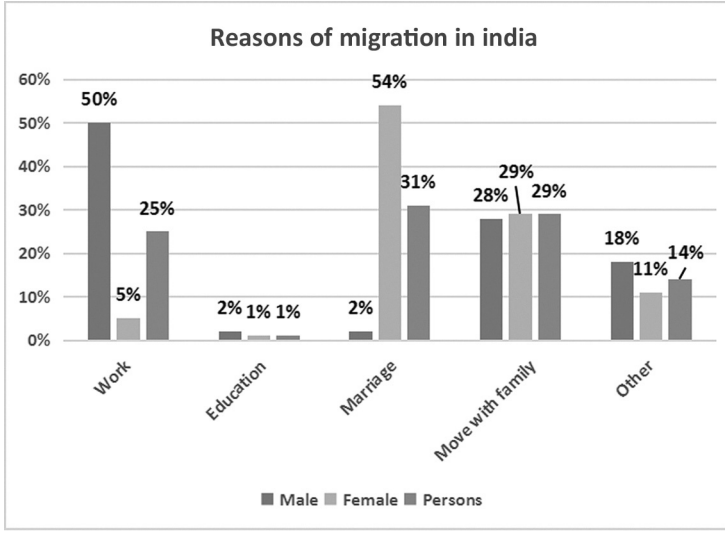

Fig. 5 Reasons of migration in India. *(Source: www.prsindia.org/theprsblog/migration-india-and-impact-lockdown-migrants.)*

scheme. The need of the hour is to recognize the job opportunity in the unorganized sector, recognizing the labor force and artificially intelligent integrated work engagement system to be developed. It will balance the job demand over manpower available, assure recognition, wages and social security (National Strategy for Artificial Intelligence, Niti Aayog, June 2018; the inter-state migrant workmen (regulation of employment and conditions of service) act, 1979; https://www.javatpoint.com/application-of-ai).

5 Conclusion

The Covid-19 pandemic has played havoc with many aspects of our lives, including our offices and workplaces. As the world gears up for re-opening the economy after various phases of Lockdowns, global organizations such as the Centre for Disease Control (CDC) in the United States and the World Health Organization (WHO) provide recommendations for workplace safety. These recommendations include allowing office workers to remotely work wherever possible, staggering shifts to reduce the number of workers physically present at a location, increasing social distance between employees in the workplace and even reducing operations if necessary. As an employee arrives at a workplace, he should be on the screen to eliminate any symptomatic or asymptomatic cases. AI-based technology solutions can prepare a health certificate to this effect. This should be a reliable document. Swiss security technology firm SICPA is researching to develop a QR code-based solution. Once the employee arrives at the office entry, Facial Recognition Technology can allow touching less entry followed by thermal screening. PID has created a solution that uses a wall-installed thermal imaging camera with facial recognition. Once inside the office, employees can be monitored using intelligent video cameras to ensure social distancing within the workplace. Such technology can significantly reduce the spread of the virus.

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