Chapter 16
Analyzing the Economic Depression Post-COVID-19 Using Big Data Analytics

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Abstract Various industries like technology, food, agriculture, and education are predicted to suffer major financial and production depreciation. The economic crisis suffered by the major large-scale industry on the other hand is predicted to effect the other economic enterprises effecting the world on a major scale. The lockdown incurred upon the general public is implemented all over the world in order to control the widespread of this pandemic. Coronavirus has hit the worldwide economy tremendously all over the world. Various countries have suffered life loss, temporary stop gap in various industries, economic growth, loss in revenues collected, etc. Though after a span the lockdown was made open, certain extra policies and rules were implemented such as social distancing and no gathering of people more than two or three in a close proximity. Restriction over number of people who can board at the same time over any public places like shops malls have effected the cash inflow to a huge extent. This chapter aims at analyzing the depression suffered by various sectors post-COVID-19 as a result of the lockdown along with various recent policies implemented. It also covers visualizing these issues with big data analytics perspective and how the concept of AI and other technologies is working across in order to solve these issues. It covers in brief how these upcoming technologies have been able to contribute in the healthcare sector while fighting against COVID-19 or uplifting the economy by helping the industry to build and design new models or plans to regain the cash inflow.

Keywords Economic deflation · Production crisis · Big data analytics · Post-COVID crisis · AI-based analysis for economic deflation · Market movement due to COVID-19
16.1 Introduction

Deflation is the decline in the price of goods or services due to falling aggregated demand and lower costs of production.

The world has changed recently in the last few months with the inception of COVID-19 pandemic disease [1, 2]. As all counties have mandate a proper quarantine and lockdown, therefore the day-to-day, essential activities have got stacked. This pandemic situation has shown a huge impact over small and big sector like automobile, marketing, education, financial, agriculture, healthcare, etc. The situation has made every country suffer from economical deflation. Regular activities are suffering a huge collapse, where the current crises surpass every crises seen in the past many decades giving rise to apprehensions regarding its impact over people’s lives and livelihoods [3].

Multiple countries are currently facing various kinds of crises with respect to health, financial, economic, and social and a severe collapse in commodity prices, which interacts in a complex manner [4]. Policymakers are formulating various methods of providing support to households, firms, and financial markets, which is currently vital for a robust recovery, but it is quite an apprehension about what the economic landscape will appear post lockdown [5, 6].

The estimates have indicated that the virus could trim global economic growth by 3.0–6.0% in 2020, with a partial recovery in 2021, assuming there is not a second wave of infections as depicted in Fig. 16.1.

The economic fallout from the pandemic raises the risks of a global economic recession with levels of unemployment. The human costs in terms of lives lost have permanently affect global economic process. In addition to the cost of rising levels of poverty, lives upended, careers derailed, and increased social unrest have also

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Fig. 16.1 Economic growth rate post-COVID-19 [7]
impacted the humans socially, economically, and physiologically. Global trade could also fall by 13–32%, counting on the depth and extent of the global economic downturn, exacting an especially heavy economic toll on trade-dependent developing and emerging economies [7].

Considering the fact that both the pandemic and needed containment are at its peak during the second quarter for almost many countries, and it recedes within the last half of this year, during April the World Economic Outlook projected a global growth fall up to −3% and a downgrade of 6.3 percentage points. This makes the good lockdown the worst recession since the good Depression and much worse than the worldwide financial crisis. Considering the spread of the virus within almost all countries during the end of March 2020, the global growth forecast has assumed that all countries undergo disruptions with respect to economic activity [7, 8] The world has shown a drastic change within a span of 3 months since the inception of coronavirus as updated by the *World Economic Outlook* in January [7]. A highly rare disease named as COVID-19, a coronavirus pandemic, resulted in tragic death of large number of human lives. As countries implement procedures of quarantines and social distancing practice and policies in order to control the spread of infection, the world has undergone a great lockdown which was the first experience of its own accord faced by various industries. The magnitude and speed of decline in activity that has followed is unlike anything experienced in lifetimes [8, 9].

This has been tagged as an unmatched crisis that has substantial uncertainty regarding its overall impact on human life and livelihood.

The epidemiology of the virus has a major role to play where the impact of measures undertaken to cure via development of therapeutics, vaccines, etc. is hard to predict. Multiple countries are currently facing crises with respect to health, finance, major fall in commodity prices, and interaction in complex ways [10].

Nevertheless, policymakers are currently offering support to various households, firms, and financial markets. Though it is important for a strong recovery, it has been observed that it does involves quite an uncertainty about what the economic landscape would appear as once lockdown is over. This chapter aims at projecting the impact of COVID-19 on various industry sectors and its effect over the economics of the country. The paper comprises of global crises caused due to the COVID-19 pandemic situation in Sect. 16.2, Sect. 16.3 is about the issues faced by the country due to the lockdown, and Sect. 16.4 is regarding how AI and big data analytics can be used to overcome this crisis situation as discussed in details in Sect. 16.6.

### 16.2 Global Crisis Due to COVID-19

The COVID-19 situation has shown a drastic effect over both emerging and advanced economies resulting in a market undergoing huge recession. It is predicted that post-COVID-19, the world economy will experience the worst recession since the great depression. Figure 16.1 shows the GDP growth post-COVID-19 of the international monetary fund [10, 11].
Hoping the pandemic to suppress within the second half of 2020, various policy actions have been undertaken in order to save the major countries in the world from suffering bankruptcy, with an extension to unemployment, as well as system-wide financial strains. A recent study undertaken by economic times has projected a global growth in 2021 to rebound to 5.8% [12].

The assumed recovery claimed in the article for year 2021 is partially portrayed since the level of economic activity stays below the extent that has been projected for 2021, before the virus hit the economy. The cumulative loss to global GDP over 2020 and 2021 due to the pandemic crisis is assumed to be approximately around 9 trillion dollars. Figure 16.2 shows the cumulative output loss over 2020 and 2021 [13, 14].

As shown in Fig. 16.3, we can consider the current economy indicating to undergo a real global crisis where no country will be spared from being affected. The various countries whose economy relies over tourism, travels, hospitality, and entertainment for their economic growth and upliftmen will suffer major disruption. The countries having various emerging markets and developing economy would suffer various challenges due to the unprecedented reversal of cash flows due to issues such as global risk appetite wanes, currency pressures, coping with weaker health systems, and more limited fiscal space to provide support. Several countries have currently entered the crisis state suffering a sluggish growth and huge debts [13, 14].

It was commented globally by major economists of the world that “for the first time since the Great Depression both advanced economies and emerging market and developing economies are in recession.” The current economy has projected a growth of −6.1%. Various emerging market and developing economies having normal growth levels were also projected as showing a negative growth rate of −1.0% in 2020, as well as −2.2% excluding China. It was further shown that the income per

![Cumulative output loss](image)
Fig. 16.3  (a) Real GDP growth of advanced companies and developing companies for year 2020 vs. 2009 (source: https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-down-turn-since-the-great-depression/). (b) Depicts the detailed GDP growth of various countries. (c) World economy since great depression
capita was supposed to shrink over 170 countries and advanced economies, emerging market, and developing economies are expected to overcome the depreciation partially by year 2021. Figure 16.3a shows the degradation of world major economies [15].

Figure 16.3a–c shows the GDP growth effecting the world economy post-COVID-19 situation [15].

16.3 Problem Faced by Country Locked Down Due to COVID-19

Considering the various structural changes caused due to the coronavirus in our lives, we have faced immense loss in various means, e.g., loss of life due to increase in mortality, prolonged social distance due to lockdown as well as government implemented policies, etc.; however, the pandemic has even highlighted the vulnerabilities existing in our current technological infrastructure [16, 17]. Few of the technical issues raised during the course of pandemic situation are outdated business systems, existing analog mode of communication, and existing nondigital payment infrastructure followed by small town laborers and farmers. The challenges thrown up at us to face were something never heard or can be stated as beyond imagination and the requirement of a privacy preserving system for the purpose of contact tracing. Figure 16.4 shows the impact of the pandemic over the world economy as a whole [18–20].

Such numerous major technical lacunas have triggered us with the thought to think about measures that can be undertaken to bridge them and undergo digital transformation in the coming years [9].
The healthcare sector can be considered as one of the most affected areas that has faced the brunt of this COVID-19 pandemic in terms of life loss as well as health deterioration. The senior government officials are currently working on planning various strategies so as to cope up with the economic deflation caused by post-COVID-19. As a result, it becomes all the more important for us to navigate through the post-peak environment scenario [10, 11]. The general public health tools include at-scale testing, sophisticated real-time surveillance, rigorous contact tracing, and targeted quarantine in order to isolate cases and contacts. Likewise, insurance companies have a major role to play at crucial times of economic stress so as to help companies and households into managing risks and prepare cushion against losses (Fig. 16.5) [14].

The heavy trends in economic have been heavily augmented by the shocking wave of COVID-19. The impact of COVID-19 has reduced the global interest rates extremely low in the current economic cycle. As a result, the banks have extended the loans for the hard hit borrowers as well as renegotiating the credit terms. In the meantime, members of congress are calling over digital dollar in order to reignite COVID-19 stimulus [14].

16.3.1.1 Problem #1: Supply Chain Disruptions

The COVID-19 lockdown has completely disrupted multiple manufacturing units and supply chains across the globe. Many strategic planners of companies are still working over policies to be implemented that can deal with this pandemic situation, which includes overcoming fear or apprehensions around shortage or gauging overall impact of COVID-19 over the trends of supply chain or logistics monitoring. This has triggered the companies to adopt immediate measures in order to meet...
supply and the customers need. This indicates the need of analyzing current plans for future disruptions which is quite a challenging task to undertake.

Artificial intelligence and various other emerging technologies have had an intense contribution into maintaining business continuity and uncertainty. Organizations can see through the huge amount of data storage and extract useful insights that can help predict disruptions and vulnerabilities and provide long-term visibility.

For example, IBM developed a cognitive control capability model in order to maintain its own supply chain, which can point out early warnings derived out of external data or social media. It helps the supply chain experts to have relevant as well as actionable information at their disposal. These information help them into quickly responding and focusing attention over higher activities, like communication with customers, suppliers, as well as other impacted stakeholders.

Though we live in the world of uncertainty where future is unpredictable, Ai and such technologies can make us smart and enhance the strength of global supply chain which helps these business sectors in various ways.

As quoted in IBM Institute for Business Value report, “COVID-19 and Shattered Supply Chains,” supply chains is expected to be dynamic, responsive, and interconnected to an organization’s ecosystem and processes which requires end-to-end visibility, real-time insights, and decisive actions, particularly in escalating situations [15, 16].
16.3.1.2 Problem #2: Manufacturing in a Safe Environment

As we know huge amount of product assembling operation is done by humans with their hands who are working at a gap of 0.6 m interval. As predicted by the WHO, increasing the space among the individual by 1 or 2 m raises both the assembly line length as well as manufacturing cost of the given product. The outfitting factory workers may also generate additional cost that can drastically reduce the finger dexterity that is needed in order to assemble small components.

16.3.1.3 Problem #3: Limited Movement of People

With restrictions imposed over the movement of people like laborer and workers the can be achieved by keeping the electronic products at a distance of around 1000 miles away from each other. This makes traveling a mandate component while undergoing production of new products.

The restrictions regarding maintaining social distance imposed over movement of people all over the globe are expected to continue for roughly about 18–24 months. It is therefore well quoted as “necessitating a new way to develop products remotely.”

16.3.1.4 Problem #4: Limited Remote Oversight

In order to attain the mature products and process quickly, various multinational companies delegate mechanical manufacturing engineers to factory site during the period of development building. These engineers work in process in order to fix various issues as possible while going through a series of building which gradually improves the product maturity. For example, running experiments and highlighting specifications regarding applications like glue or grease, measuring improvements during real-time with respect to the factory partners.

Though the factory-related data and reports provide useful insights by providing context, misaligned incentive along with human error existing in the spreadsheet depicting data may end up in error.

Since early production of data trend was the dominating factor, hence the spreadsheet lacked hugely in portraying the critical elements existing in the data that are present in the physical world. This lacunae forced the companies to search multiple methods into extract factory data. The task is possible only with the support of the appropriate technology. Under the current COVID-19 situation, it is well commented that, “without trustworthy real-time, aggregated data,” companies are undergoing product development process being built in the dark [14, 16].
16.3.1.5 Prioritization Pitfalls

Keeping in account a long list of problems to be addressed such as limited team resources and completely diverse condition of working enjoinment like complete sanitization and social distancing, multiple companies have followed the path of Maslow’s pyramid of needs which ended in making the production process all the more slow and challenging to attain desired goals. This problem was solved by empowering the manufacturing teams and individuals the skillset of acting immediately during urgency of removing the bureaucracy factor. Clear mission alignments help to enable the teams to take over the ownership while acting urgently to address during emergency situation, e.g., ventilator refurbishment efforts undertaken by bloom energy [17].

The speed of putting the solutions in place, the lesser is the disruption caused to overall business. Various leaders looking up to reduction of bottlenecks for adopting it in their organizations must look to expedite overall decision-making process as well as streamline procurement, legal, and security review processes.

The issue surfaced during the pandemic COVID-19 is expected to witness fast adoption of innovative technologies at huge scale. The rate at which progress in innovation is taking place currently would be apt to state, “necessity is truly the mother of invention.”

16.3.2 Education Industry

The education industry since pandemic lockdown is seen to undergo huge struggle to meet out the academic schedules and the predefined dates for the commencement of academic activity. Though majority of the classes have moved into online mode of delivering education, the universities are still unable to deliver certain specific skillset in terms of practical classes with respect to highly technical field. Moreover, there are multiple areas existing in the world which are yet to attain a good Internet connectivity and bandwidth.

16.4 Understanding the COVID-19 Pandemic as a Big Data Analytics Issue

The current global trade can be stated as undergoing a sudden shock due to the ways companies have been transacting cash in the last few months. Various industry related problems such as supply chain disruptions, enforcement of refocus round track, and tracing solution so as to gain popularity and visibility. In the meantime, certain financial intuitions such as bank or trade finance are looking forward toward implementation of paperless transaction in order to avoid contacts. Coming down to
many large popular industries such as Teleco, acute disruptions are quite visible as a result of threats imposed due to human physical contact. For example, COVID-19 has currently stalled the rollout of 5G networks further to add on the network capacity is resilient to providing huge consumer demand of growing video conferencing or cloud and data service [12, 15].

The current new erupting era of digitalization has enormous growth and advantages due to which majority of top economic performers are shifting their business models to digital mode. The Software vendors here play a key role into modernizing the technology stacks of companies that range from almost every industry or geographical location. Due to the sudden booming of prevalence and accessibility data during this pandemic situation, software vendors may harness upon this opportunity toward implementing a new platform-based business models extracted from collaboration among customers providing a control over various ways, and methods data can be shared and transactions are implemented (Fig. 16.6).

Apart from the vendors, various other emerging technologies such as blockchain and Corda can also have a part to play where blockchain provides foundational technology to enable certain characteristics such as multiparty transparency, and Corda can accelerate the process of digital transformation with more promising and collaborative solutions. While addressing the requirements of an enterprise IT environments, such as privacy, scalability, and settlement finality. Such software firms that leverage latest technologies or other digital solutions have an extra opportunity to come up with wave of solutions that are not only during this COVID-19 pandemic crisis but also as a critical step undertaken in order to connect as well as future-proof industries for years to come.

**Fig. 16.6** COVID-19 causes unprecedented response as analyzed by Big Data analytics [12]
While manufacturing sectors are typically slow, COVID-19 has imposed a sequence of challenges for them to overcome, for example, disruptions in supply chain management, social distance being practiced at high touch assemble line, limited ability to travel, or restricted movement permitted. For electronics manufacturing industry, the urgency of handling the situation is even more demanded where such challenges could pose further issues of delayed launch schedules effecting the entire cash flow, lower financial returns, and quality issues that can damage the brand reputation [10, 14].

The current researchers and developers have started to use AI machine learning, and natural language processing vigorously is now increasingly used in order to keep track of coronavirus and gaining a more clear understanding of the overall disease.

In the last couple of months, researchers are trying hard at work in order to uncover and comprehend the nature, features, as well as traits of the virus. There are multiple related questions to be addressed such as why it has effected humans much more than any other virus giving birth to worldwide pandemic situation. What measures are supposed to be undertaken that can help reduce the spread and where the disease likely would go next [17, 18]?

Putting these factual aside, the bottom line of all these efforts is the information it generates which is currently the essence of a big data problem. Recently, professor James Hendler stated that they are currently working over tracking the spread of COVID-19 disease around the world. He further stated that he is currently collaborated with various organizations over modeling and dealing with the corona via supercomputer. He has further created websites in order to contribute into various organizations for conducting research over COVID-19 by providing the open data and documents.

The researchers in RPI use big data and analytics to improve the understanding and study the novel coronavirus with the perspective of various facets. Various organizations have recently broadcasted the news regarding supports provided by government entities, research organizations, and industry access for various innovative AI tools, in collaboration with various experts in data related to public health sector to fight against COVID-19 [19, 20].

These projects conduct a study over analyzing various signs and symptoms, tracking virus, monitoring the availability of hospital resources, etc. Researchers are currently dealing with huge amounts of information that are extensively impossible for any humans to comprehend and analyze on their own. There are currently multiple big data components that have incorporated AI to play a big role.

AI technology can also work over developing vaccines or drugs that can fight against COVID-19.

These projects typically require molecular modeling, where currently many of them use AI and machine learning in order to map things ranging from what we know about the virus into things in pharmacological databases and genomic databases” [21, 22].
Many huge companies have launched major projects such as “Amazon Web Services” and “Google Cloud”. Multiple other companies have offered free access to open datasets and analytic tools in order to support the building of COVID-19 solution faster. The concept of AI has the capacity to eliminate false tracts while enabling the inclusion of identification of various potential targets.

- Various researchers also are observed to exploit various attributes of AI so as to identify and test the effects of COVID-19 interventions over the human kind across various countries.
- Another major component is natural language processing and social media where various text is processed from various sources and analyzed to extract important information.
- AI is currently being considered as a promising tool since it is contributed at various kinds of multifactor learning. Recently, the UT Health team has developed an AI tool which can highlight the need for stricter, immediate interventions at Greater Houston area. Likely, researchers at Stanford University have launched a data-driven model which can predict possible outcomes of various intervention strategies.
- Another area where AI can make an impact is in mining scientific literature.

### 16.5 Contribution of AI and Data Analytics in Healthcare to Fight COVID-19

Since the inception of COVID-19, the world’s radar seems to undergo huge global health crisis, where the virus has proved itself to be both challenging and deadly.

The field of AI and data analytics recent emerged immensely in various fields of healthcare industries as line of defense against COVID-19. Few researchers have gripped over the various tools in order to do everything ranging from “tracking hospital capacity” to identifying high-risk patients [23].

Concepts like “machine learning and data analytics have a major role to play in understanding the reason and traits for spread of disease, as well as understanding the effectiveness of our various responses to disease, as stated by Joe Corkery, MD, director of product management at Google Cloud, told Health IT Analytics.

Currently, the concept of AI and machine learning is playing a major role over drug discovery at scale, along with studying the effect of data analytics in real time. This kind of research highlights the fact that there are quite new things that can be done in order to make data analytics more easily repeatable as well as specific to “healthcare use cases” [22, 23].

While COVID-19 has disrupted the settled and finalized state of affairs, it has contributed in giving a background for the industry players into coming together and upskilling data analytics capabilities (Fig. 16.7).
The requirement of a good quality, up-to-date data has always been foremost important in various sectors to achieve accuracy in data analysis. Moreover, it is even treated with high importance in various significant sectors such as healthcare. Moreover, the volatile nature of coronavirus has made data accuracy all the more necessary [22].

The researchers are cautiously working over identification of various aspects of COVID-19, but any analysis undertaken and conclusion drawn is at a very nascent stage where the future is still unexplored. Corkery has stated in their article about new data being added and quite lot of information being evolved. These factors have triggered the great deal of research which is being undertaken in order to understand how accurately the disease can be addressed [23].

To ensure the good quality and updated information, researchers aim at collecting real-world data during the pandemic. The data collected from various primary and secondary sources may help stakeholders to extract patterns in order to make critical decisions [21].

As now most of the healthcare systems are encouraging individuals to stay home in order to protect themselves from being exposed to the deadly coronavirus leaves the government with the only option of conducting a survey over the population in order to identify the people who have symptoms. This motivated Dixon to carry out project that can allow individuals to report on their symptoms from their mobile or web browsers, giving insight to the researchers with a comprehensive picture of disease trends and hotspots.

Similarly, the Regenstrief and his team are conducting a survey that seeks to find new, viable ways of collecting data that can be used in the future [23, 25].

In addition to real-world data, researchers have shown inclination toward opening publicly available datasets in order to ensure reaching out to accessing quality
COVID-19 information. Using these datasets, teams can develop artificial intelligence and data analytics algorithms in order to have a clear understanding over the virus and its impact. It has been wisely commented that, “algorithms are the algorithms, but having that quality underlying data is what makes them work.” Lack of refined content supporting the algorithm has successfully proved the importance of data collection.

16.5.2 Recent Collaborations Undertaken by Various Research Organization to Contribute During COVID-19

As the healthcare industry is working toward building its defense against coronavirus, various organizations from different sectors and individuals belonging to various geographical regions of the world have started to work together to find solutions to various problems surfacing related to multiple issues.

The unanticipated nature of the breakthrough of corona infection coupled with various other problems arising due to the preventive measures adopted has united all segments under a common goal to defeat and wipe out corona as well as its side effects [26, 27].

Assistant professor at Harvard Medical School and Dana Farber Cancer Institute have commented that, “the situation has opened up doors that we would have never thought to knock on.” Not only in the field of medicine and healthcare but also technology has also come with collaborative efforts such as Harvard Medical School and Dana Farber Cancer Institute recently joint hands with Google Cloud to leverage advanced cloud and analytics technologies to accelerate the discovery of potential therapies.

The concept of open-source virtual drug discovery platform has enabled the researchers to able to reach out to billions of drug compounds against COVID-19, drastically reducing the time it would naturally take to analyze possible treatments [28].

The researchers have further commented that the partnership has helped them in order to reach the finish line in a time much lower than that it would have naturally taken.

16.5.3 Envisioning the Healthcare Industry in a Post-COVID-19 World

Considering with all positive hopes that the dust would be settled and the pandemic will be over, no matter when, there is a clear indication that the status quo of the world post-pandemic will be quite different from what we once knew. These changes can be of various measures ranging from huge to subtle based on the industry. For
example, the effect in the healthcare, technology will be drastic and more evident with new ways of collecting, sharing, and evaluating data that will hopefully extend into life after COVID-19, leading to new technological advancements that have previously eluded the industry [29, 30].

With better data, increased collaboration, and faster analysis, researchers are looking forward to revolutionize the entire healthcare system providing a robust patient care facilities while preparing for any future emergencies.

As commented recently by researchers [30], “we did not know how to face this crisis, but the tools that we’re developing could be very helpful for future drug discoveries, future pandemics, or other diseases that don’t generate much pharmaceutical interest because they don’t impact people in developed countries,” which makes it quite evident that the combined efforts from stakeholders across the healthcare industry will facilitate more opportunities for researchers in all areas [31, 32].

16.6 Conclusion

This chapter has discussed various aspects of economic deflation post-COVID-19 across different industry sectors in the world. It covers the economic changes faced in the market across the world, then it moves into analyzing these problems using the current big data technology for analysis and various contributions of AI and big data analysis in areas pertaining to healthcare for fighting against COVID-19. The chapter also explained the importance of data collection for undergoing various analysis and how it can impact the results. Further, it throws light on various collaborative research work undertaken by various sectors, institutes, and organization, both technical and healthcare in order to fight COVID-19 pandemic situation which has given rise to various developments under all sectors that have come into existence for all time to come.

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