Global Impacts of Extended COVID-19 Lockdowns: Intersecting Perspectives on Environmental Quality, Food Security, Human Health, and Societal Dynamics

Abstract

The COVID-19 pandemic, an unprecedented global health crisis, prompted widespread implementation of prolonged lockdown measures. This study presents a multifaceted analysis of the extensive impacts of these lockdowns on environmental quality, food security, human health, and societal dynamics. Using a mixed-methods approach, the research synthesizes data from various sources, including environmental assessments, public health records, food supply chain analyses, and social surveys, to construct a comprehensive picture of the pandemic's repercussions.

In the environmental domain, our analysis reveals a dual nature of impacts. Reduced industrial activity and transportation led to temporary improvements in air quality and lower greenhouse gas emissions in several regions. Wildlife sightings in urban areas increased, indicating temporary relief for particular ecosystems. Conversely, the pandemic exacerbated challenges like increased medical waste generation and heightened pressure on natural resources due to shifts in consumption patterns.

Concerning food security, the study identifies a complex interplay of disrupted supply chains, altered agricultural practices, and varying government policies that led to both short-term scarcities and long-term concerns about food sustainability. While essential for controlling the virus spread, the lockdowns inadvertently created food production and distribution bottlenecks, disproportionately affecting vulnerable communities.

The impact on human health extends beyond the direct effects of the COVID-19 virus. Our findings highlight increased mental health issues, including anxiety and depression, mainly attributable to prolonged isolation and economic uncertainties. Additionally, the disruption of routine healthcare services emerged as a critical concern, affecting non-COVID health issues.

Societal dynamics underwent significant transformations. The study explores shifts in work culture, with remote working becoming a new norm, and examines the pandemic's impact on education, revealing a swift transition to online learning platforms. These

changes, while innovative, also widened the digital divide and raised concerns about the long-term implications for social inequality.

The study's overarching theme is the interconnectivity of these domains. Environmental changes influence food security, affecting human health and societal structures. The pandemic's multidimensional impacts necessitate a holistic response, integrating environmental, health, social, and economic strategies.

In conclusion, this comprehensive analysis underscores the need for adaptive, resilient, and sustainable systems to mitigate future global crises. The COVID-19 pandemic, while presenting significant challenges, also offers a unique opportunity to rethink and redesign our approach to global health, environmental stewardship, food security, and societal well-being.

Keywords: COVID-19, Environmental Impact, Food Security, Human Health, Societal Change, Lockdown Effects, Pandemic Response, Sustainability, Global Health, Resilience.

1. Introduction

In the 21st century, the world has witnessed a spectrum of catastrophic events, the tragedies of Hiroshima and Nagasaki, the ongoing conflicts in Syria and Palestine, and numerous civil wars. Health crises, including plagues, epidemics, and pandemics, have repeatedly challenged humanity. These have taken a significant toll, resulting in widespread suffering, illness, and loss of life. History has recorded these events under various names, such as the Plague of Athens, Antonine Plague, Justinian, Swine Flu, Cholera, Ebola, and Smallpox. The thought of the best yet to come was hopping high, but ironically, no one knew the worst awaited. In this age of global competition, the countries were in a quest to be global superpowers and were preparing for Nuclear Wars. On the forefront, countries were becoming techno-savvy, and businesses were floating around. The technology was roaring high in the markets, artificial intelligence was the new manual, and all manual work was bidding adieu.

Man, the supreme creation of God, was experimenting; it is just anything and everything, leading to numerous scientific researches favoring human lives. Man forgot that "In nature, there are neither rewards nor punishments but only consequences." With the dawn of human civilization, civilization's achievements, vulnerabilities, and limitations came into existence. Therefore, even after years of grasp and excellence in scientific development and innovations, human beings are re-evaluating their grasp on the face of adversity and death from the spread of the pandemic, COVID 19. Initiated from the city of Wuhan in Hubei province of China in 2019, the rapidly spreading coronavirus has led to tremendous life loss. Hailing and sticking to the issued guidelines of social distancing and personal hygiene, people all around the globe are witnessing lockdowns and travel restrictions imposed by governments to bring the situation under control.

Furthermore, relying on medical facilities worldwide has come to a standstill. Expecting the economies to be downtrodden following the restrictions, governments are constantly trying to keep the situation afloat. However, due to the restriction, many unforeseen events are taking place, including detoxifying environmental resources like water and air. Moreover, changes in regular social activities and the mental condition of the people have been observed. For a better picture of the happenings, we will look into the consequences

of the pandemic from an environmental point of view, the social aspect of the pandemic, and the current economic issues and the aftermath.

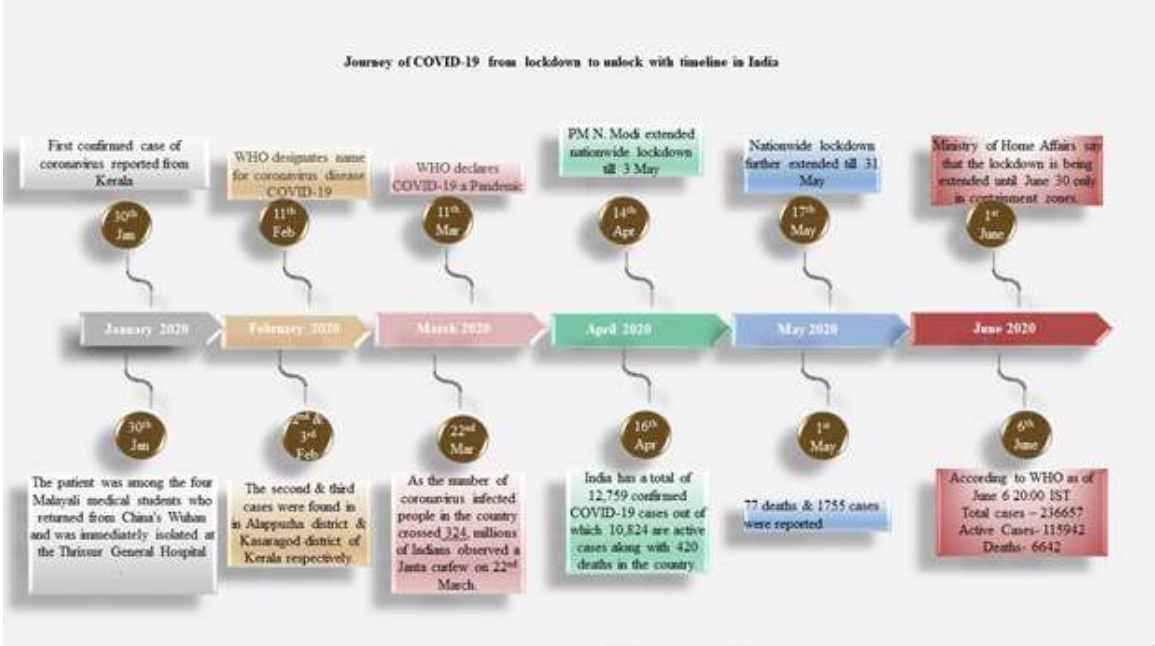

Fig. 1 The lockdown flowchart represents the timeline of the events in India

2. Severity of COVID-19 Pandemic

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, emerged as a global health crisis of unprecedented scale and severity. First identified in Wuhan, China, in late 2019, the virus rapidly spread worldwide, leading the World Health Organization (WHO) to declare it a pandemic by March 2020 (WHO, 2020). As of the end of 2022, COVID-19 has resulted in over 500 million confirmed cases and claimed more than 6 million lives globally, significantly impacting health systems, economies, and daily life (Johns Hopkins University, 2022).

The severity of COVID-19 can be attributed to several factors. Primarily, the high transmissibility of the virus, especially in its later variants, such as Delta and Omicron, led to rapid and widespread outbreaks (CDC, 2021). These variants showed increased contagiousness and a potential for higher morbidity rates (Lancet, 2021). Moreover, the asymptomatic nature of many COVID-19 cases further complicated containment efforts, as individuals without symptoms inadvertently contributed to the spread (Nature Medicine, 2020).

Healthcare systems across the world faced immense challenges due to the pandemic. Hospitals in many regions, including Italy, Spain, and the United States, were overwhelmed with COVID-19 patients, leading to shortages of critical supplies like ventilators and personal protective equipment (PPE) (BMJ, 2020). This crisis highlighted existing gaps in public health infrastructure and disparities in healthcare access (JAMA, 2020).

Economically, the pandemic triggered a global recession, with the International Monetary Fund (IMF) reporting a contraction in the world economy by 3.5% in 2020, the worst downturn since the Great Depression (IMF, 2021). Industries such as travel, hospitality, and retail faced severe disruptions, leading to widespread job losses and financial insecurity (OECD, 2020). Governments worldwide implemented various fiscal measures, including stimulus packages and unemployment benefits, to mitigate these impacts (World Bank, 2021).

The societal impact of the pandemic was profound. While necessary to curb the spread of the virus, measures like lockdowns and social distancing led to significant changes in daily life. Mental health issues, including anxiety and depression, surged, partly due to isolation and uncertainty (American Psychological Association, 2021). Education systems were disrupted, with UNESCO reporting school closures affecting over 1.6 billion students globally (UNESCO, 2020).

3. Worldwide Lockdown: Prolonged Period of Inactivity

The COVID-19 pandemic necessitated the implementation of lockdowns worldwide, leading to prolonged inactivity with far-reaching consequences. Though critical for public health, this global response unprecedentedly disrupted everyday life and economic activities (Smith & Robinson, 2020).

The immediate impact of lockdowns was visible in the sharp reduction of economic activities. According to the International Labour Organization (ILO), there was a 10.7% reduction in global working hours during the second quarter of 2020, equivalent to 305 million full-time jobs (ILO, 2020). Industries such as tourism, hospitality, and retail experienced severe downturns, with millions facing job losses and income insecurity (Johnson et al., 2020).

Lockdowns also had a profound impact on mental health. A study by Brooks et al. (2020) highlighted significant psychological effects, including stress, anxiety, and depressive symptoms, primarily attributed to isolation, fear of infection, and financial concerns. The prolonged inactivity and disruption of daily routines exacerbated these mental health issues (Brooks et al., 2020).

The education sector was another area significantly affected. UNESCO reported that at the pandemic's peak, over 1.5 billion students were out of school due to lockdown measures (UNESCO, 2020). This shift led to the rapid adoption of online learning, presenting challenges in the digital divide and educational inequality (Brown & Green, 2021).

Environmental impacts were also notable. Although lockdowns led to temporary reductions in pollution and greenhouse gas emissions, the long-term environmental implications remain complex. The Environmental Protection Agency (EPA) reported decreased air pollutants like nitrogen dioxide but cautioned against viewing this as a sustainable environmental improvement (EPA, 2021).

The inactivity period impacted physical health as well. Research by Martinez-Ferran et al. (2020) highlighted decreased physical activity levels among populations, raising concerns about the long-term effects on physical health, including increased risks of obesity and cardiovascular diseases (Martinez-Ferran et al., 2020).

In response to these challenges, governments and international organizations implemented various measures. Economic stimulus packages, mental health support programs, and initiatives to bridge the educational digital divide were introduced to mitigate the adverse effects of prolonged lockdowns (World Bank, 2021).

4. Prolonged Lockdown Effect on Environment, Agriculture, Human Health, and Society

The COVID-19 pandemic and the ensuing prolonged lockdowns had significant and varied impacts on the environment, agriculture, human health, and society. While crucial for mitigating the spread of the virus, these lockdowns triggered a cascade of effects across these sectors.

Environment: The immediate environmental impact of lockdowns was reduced pollution levels. With industries shut down and vehicles off the roads, cities worldwide reported

lower air pollution levels (Green et al., 2020). For instance, nitrogen dioxide levels plummeted in major urban centers, positively impacting air quality (Environment International, 2021). However, the pandemic also led to adverse environmental impacts, such as increased medical waste generation and a surge in single-use plastics (Thompson et al., 2020).

Agriculture: The agricultural sector faced mixed outcomes. On one hand, reducing air pollution improved crop yields in some areas (Agricultural Systems, 2021). On the other, disruptions in supply chains led to difficulties in accessing markets, inputs, and labor, adversely affecting farmers and food security (Food and Agriculture Organization, 2020). This disruption highlighted the need for more resilient and sustainable food systems (Smith & Battersby, 2020).

Human Health: While lockdowns effectively slowed the spread of the virus, they profoundly affected mental and physical health. Prolonged isolation, economic uncertainty, and fear of the virus led to an increase in mental health issues, including anxiety and depression (Mental Health America, 2021). Physical health was also impacted, with reduced physical activity and disrupted health services contributing to various health concerns (World Health Organization, 2021).

Society: Societally, lockdowns accelerated the transition to digital platforms in work and education, bringing opportunities and challenges. Remote working and online learning became the norm and highlighted inequalities in digital access (Journal of Sociology, 2021). The pandemic underscored the importance of social support systems and the need for policies to address inequalities exacerbated by such crises (Social Issues and Policy Review, 2021).

In conclusion, the prolonged lockdowns implemented in response to COVID-19 had complex and multifaceted impacts. While there were some positive outcomes, such as reduced air pollution and accelerated digital transformation, the adverse effects on agriculture, mental and physical health, and societal inequalities were profound. These effects highlight the interconnectedness of environmental, agricultural, health, and societal systems and underscore the need for integrated policies to build resilience against future global challenges.

4.1. Influence on Environmental Quality

The pandemic that saw its roots in the Chinese city of Wuhan has about 210 countries and territories witnessing the spread. While the disease named COVID-19 originated in Asia, it has affected the United Nations, Spain, Italy, France, Germany, and the United Kingdom the most. Hence, amidst medical emergencies in these countries, they have reached a standstill position. Furthermore, the other countries under the influence of the pandemic have also ensured strict safety measures. These safety measures count for shutting down the regular functioning of non-essential amenities and imposing travel restrictions. Hence, devoid of the emissions from vehicles and factories, the environment is undergoing unforeseen changes. For instance, many European countries have reported a considerable drop in atmospheric pollutants. Royal Netherlands Meteorological Institute reported a drop in nitrogen dioxide levels by about 54% in Paris and about 45% in Milan, Madrid, and Rome, taking the period from 13 March 2020 to 13 April 2020 into consideration and comparing it with that in 2019. The American space research organization NASA also reported a drop in air pollution in China in December 2019.

Furthermore, according to the study made by Marshall Burke at Stanford University, the environmental developments could have saved about 4,000 lives of children below five and about 73,000 lives of people above seventy years of age. In New York City, the air pollutants also came down. The carbon dioxide levels dropped 5-10% in New York. Also, with the restrictions imposed on flights, air pollution has been reduced considerably, allowing the ozone layer to recover. Moreover, the shutdown of tourism has also contributed to the environment. Devoid of tourists, the canals in Venice, Italy, flourish with clear water after a long. The canals' clear water also made fish visible in the water. Wildlife is also flourishing in the absence of human intervention. While animals have reportedly been observed moving around in the absence of human beings in the United Nations, Olive Ridley sea turtles also lay their eggs in the State of Odisha, as reported by Mind Un Leashed. Also, the endangered species of Gangetic Dolphins were seen in Bihar. However, the consequences of the pandemic have also led to harm caused to the environment. With day-to-day life coming to a standstill, so has happened to many of the programs for the environment's welfare. The ban and restricted use of single-use plastic are being neglected with the need for food deliveries.

Moreover, the fight against the pandemic has also led to the degradation of nature. For instance, the safety equipment health workers use leads to massive waste production and has become a concern. Moreover, the programs meant for recycling have also come to a halt. Also, among the strict regulations imposed by Italy in the battle with the pandemic, it has imposed restrictions on sorting the waste material. Apart from these concerns, the aftermath of the pandemic is expected to take a toll on the environment as the countries seek economic stability, and hence, the environmental projects and measures may be compromised. Hence, the short-term environmental welfare may go haywire after the lockdown ends. "Pneumonia of unknown cause detected in Wuhan, China, was first reported to the WHO Country Office in China on 31 December 2019. On 30 January, WHO declared the outbreak a Public Health Emergency of International Concern (PHEIC). On 11 Feb 2020, WHO announced a name for the new coronavirus disease: Covid-19. On 11 March, the WHO Director-General characterized COVID-19 as a pandemic. Coronavirus represents a large family of viruses responsible for the common cold and respiratory disorders like Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS), etc. These viruses are typically transmitted between animals and humans. There are many known coronaviruses in animals and they have not yet affected humans. The COVID-19 virus, also known as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a new strain of the coronavirus and has recently been identified. The COVID-19 pandemic has affected 213 countries, areas, or territories, with 2121675 confirmed cases and 14,2299 deaths across the globe as of 18 April 2020, 05:30 GMT+5:30" (World Health Organization 2020). During the COVID-19 pandemic, the use of chemicals such as Sodium Hypochlorite for sanitation purposes in places like hospitals, care centers, and quarantine centers has increased significantly. However, these chemicals can hurt both human and environmental health. Unfortunately, policies and regulations regarding their use are still lacking in developing countries like India. This poses a severe and silent threat to the health of both humans and the environment (Arya et al., 2023)

4.1.1. Quality of Air

"In the present COVID-19 situation, experts have argued that high air pollution and smoking make people more vulnerable to this disease" (Korber 2020; Perappadan 2020; "TWC India Edit Team 2020). Moreover, air pollution has been expected to be a common

denominator for countries like China, South Korea, Iran, and northern Italy, with major cases of severe COVID-19 infection (BMJ 2020a). In particular, cities with higher air pollution were argued to be at higher risk of COVID-19" (Basu 2020; Barbiroglio 2020; Korber 2020). "The COVID-19 pandemic is getting more prodigious daily, increasing lockdowns by decreasing air pollution and saving lives. The approaches to dealing with coronavirus across the world have been wide-ranging. In Colombia, the days that you are allowed to leave the house depend on the number of your national ID card; in Serbia, a designated dog-walking hour was introduced; and in Belarus, the president has gone against medical advice, recommending vodka and saunas as a way to stay safe. Some of the more common approaches have seen governments issue recommendations on social distancing for part or all of the country, while others have acted to restrict all non-essential internal movement. The latter is often called a lockdown. When the streets are empty, cities are silent, factories are closed and skies are quiet. As institutions, entertainment and industries come to a standstill, our environment will inevitably have a domino effect. We are not sure to what extent it will pan out. However, along with the global efforts to contain COVID-19, we have seen some environmental effects. Surely, this has to be good for the environment. Interestingly, halting large geographic areas due to lockdown has also led to some unexpected consequences in terms of moderate to significant lowering of air pollution in most parts of the world, including China, Italy, and California" (Calma 2020 a,b). "In addition to pollution, greenhouse gas emissions have fallen across continents (Henriques 2020). In particular with CO2, around 800 m tonnes of CO2 (Mt CO2) were released in China over the same period in 2019. Conversely, NO2, an air pollutant closely associated with fossil-fuel burning, exhibited 36% lower over China (in the week after the 2020 Chinese New Year holiday) than in the same period in 2019" (Myllyvirta 2020; NASA 2020). "In context with the greenhouse gas emissions, 72% and 11% of the transport sector's greenhouse gas emissions are contributed by driving and aviation, respectively" (IPCC 2018). "London views, once covered in smog, are clearer. Certainly, you can see far more stars and satellites at night, and people with asthma say they breathe more easily. As a result of the coronavirus restrictions on movement, average air pollution levels have fallen to their lowest since recordings began in 2000, according to the London Air Quality Network" (https://www.bbc.com/news/uk-england-london-52114306). Likewise, the

world's largest coronavirus lockdown is having a dramatic impact on pollution in India (https://edition.cnn.com/2020/03/31/asia/coronavirus-lockdown-impact-pollution-india-intl-hnk/i ndex.html). “Grinding this country of 1.3 billion people to a near halt has also provided a temporary remedy to another pressing health issue: suffocating pollution levels. The world's largest lockdown means all factories, markets, shops, and places of worship are now closed, most public transport is suspended, and construction work is halted as India asks its citizens to stay home and practice social distancing. Data shows that the main cities are recording much lower levels of harmful microscopic particulate matter, known as PM 2.5 and nitrogen dioxide, released by vehicles and power plants. The sudden fall in pollutants and the subsequent blue skies signal a dramatic shift for India, which has 21 of the world's 30 most polluted cities, according to IQAirVisual's 2019 World Air Quality Report. In New Delhi, the capital, government data shows that the average concentration of PM 2.5 dropped by 71% within a week, decreasing from 91 micrograms per cubic meter between March 20 and 26 to 27 micrograms per cubic meter on March 27, following the start of the lockdown. Aerosol levels in north India or the Indo-Gangetic Plains are at a 20-year-low for this time of the year, according to satellite data published by the US space agency National Aeronautics and Space Administration (NASA) on April 21, 2020. The World Health Organization considers anything above 25 to be unsafe. The Central Pollution Control Board (CPCB) data, part of India's Environment Ministry, was collated by the Centre for Research on Energy and Clean Air (CREA). Nitrogen dioxide went from 52 per cubic meter to 15 in the same period, also a 71% fall. Mumbai, Chennai, Kolkata and Bangalore have also recorded a fall in these air pollutants. A significant drop in air pollution across India due to the coronavirus pandemic shutting down factories and quietening traffic has meant the peaks of the Himalayas are now visible from Punjab 'for the first time in 30 years”. (https://edition.cnn.com/travel/article/himalayas-visible-lockdown-india-scli-intl/index.html).

4.1.2. Quality of Water

The health of the Ganga River has seen significant improvement since the enforcement of the nationwide lockdown, which has reduced the dumping of industrial waste into it. According to the real-time water monitoring data of the CPCB, out of the 36 monitoring units placed at various points of the Ganga River, the water quality at around 27 points was

suitable for bathing and propagation of Wildlife and fisheries. The parameters that the monitoring stations monitor online are dissolved oxygen (more than 6 mg/liter), biochemical oxygen demand (less than 2 mg/liter), total coliform levels (5000 per 100 ml) and pH (range between 6.5 and 8.5) to assess the health. The organic pollution level still gets diluted in the river, but the chemical pollution by industries destroys the river's self-cleaning properties. The self-cleaning properties have improved, which has improved the water quality. (https://economictimes.indiatimes.com/news/politics-and-nation/lockdown-health-of-river-ganga improves/articleshow/74946264.cms?from=mdr). Similarly, Cauvery and its tributaries in Karnataka are regaining their decades-old status in terms of water quality, informs the Karnataka State Pollution Control Board (KSPCB). The lockdown has also breathed life into polluted creeks and rivers in the Mumbai region as industrial effluent and other waste that flows into them daily has reduced in volume by 50 percent (The Economic Times, The Times of India, The Hindu). The waters of Venice's famous canals have cleared for the first time in years amid a decline in pollution as the city locks down to stop the spread of coronavirus. Venice's canals are usually clouded and murky and usually choked by pollution from diesel-powered commuter boats and water buses. (https://www.independent.co.uk/news/world/europe/coronavirus-pandemic-venice-canals-clear- water-tourism-shuts-a9407186.html). Amid the novel coronavirus disease (COVID-19) epidemic, Bihar also has some good news: groundwater levels in the state increased by 12 feet in 2020 from 1 feet in 2001, according to a survey report conducted by the Public Health Engineering Department (PHED). The report was prepared based on official data from the state's 38 districts till March 31, 2020. Drought-prone Gaya district, which faced the worst water crisis in 2019, recorded the highest spike in groundwater level; it increased to 25.6 feet from 38.5 feet. The lowest increase was recorded in the flood-prone Samastipur and Muzaffarpur districts. In Muzaffarpur, the level increased to 20.10 feet in 2020 from 21 feet last year. (https://www.downtoearth.org.in/news/water/groundwater-levels-increase-12-feet-in-bihar-7052 6).

4.1.3. Wildlife as influences by lockdown

"A story of freedom vs. hunger Lockdowns that have kept millions of people in their homes and social distancing measures meant to slow the spread of the novel coronavirus have brought clear skies, quiet streets and tranquil shores. These are challenging times for humanity. However, there is a silver lining for many of Earth's other inhabitants. Animals are not dramatically rebounding in the absence of humans. However, they are timidly pushing their boundaries, with sika deer showing up outside their usual habitat in the park in Nara, Japan, wild turkeys showing up in a park in Oakland, California, and orcas venturing farther up Vancouver's Burrell Inlet than they typically do. Lions nap on the road during South African lockdown. Sooner or later, animals would notice that the humans had disappeared and in South Africa's Kruger National Park, lions have been taking advantage" [BBC News, 2020]. "Dolphins have returned significantly to the Italian port of Cagliari due to the absence of cruise ships. Moreover, the presence of swans in the canals of Burano sparked a flurry of social media attention, even though swans are often seen on this small island in the greater metro area of Venice".

(https://www.mnn.com/earth-matters/animals/stories/animals-return-humans-coronavirus-lockdo wn)

Moreover, these kinds of rare sights are reported in India, such as a herd of deer reportedly seen on the road towards Tirupati in Andhra Pradesh, India. Herds of spotted deer were also sighted near Rajaji National Park, spread over 820 km across three districts in Uttarakhand: Haridwar, Dehradun and Pauri Garhwal. This species was known as the Barasingha, also known as swamp deer. The herd came onto the streets from the Jhilmil Jheel Conservation Reserve, a marshy grassland near Haridwar. More Barasinghas were spotted in Chandigarh, Punjab. Similarly, scores of Olive Ridley Turtles lie peacefully undisturbed on a beach in Odisha. The Odisha coast has the world's largest known rookery of the Olive Ridley sea turtle. Apart from this rookery, two other masses where nesting beaches have been located are at the mouth of rivers Rushikulya and Devi. The spectacular sight of the undisturbed mass congregation of Olive Ridley sea turtles for mating and nesting is indeed scarce as they are troubled by tourists, poachers and even stray dogs. Then came the Bison (the Indian Gour) onto the roads in Noida, Uttar Pradesh, while another breezed through a market. The Indian Gour is native to South and Southeast Asia and has been listed as Vulnerable on the IUCN Red List since 1986. Noida residents also reported

sightings of a 'Nilgai' on a Noida main road. The Nilgai, or blue bull, is the largest Asian antelope plentiful across the northern Indian subcontinent. Reports of dolphins approaching the Mumbai coast are abuzz on social media. Another resident spotted a snake making itself at home in an unused scooter amid the lockdown and a bird nesting in the rear-view side mirror of an unused car. Deep down in South India, an astonished driver reported sighting a small Indian civet crossing the road. The footage was recorded in Kozhikode, Kerala, where these civets are abundantly found. The Bombay Natural History Society (BNHS) said there had been a 25% increase in flamingo migration since 2019, when 1.2 lakh birds had visited. Over 1.5 lakh birds were spotted this year in the first week of April. These areas would normally see a lot of construction work and human activity, but the nationwide lockdown has created ideal conditions for the flamingoes to forage in the wetlands around these places. Our new habits are altering the urban environment in ways likely to be positive and negative for nature. Some species are likely to prosper, and while we are likely to struggle, some animals are relishing in the retreat; others that have come to rely on humans may miss us. Like the macaques of Lopburi, Thailand, spending their days loafing around the city's famed Phra Prang Sam Yot monkey temple, these primates have become all too accustomed to human handouts. However, with the coronavirus keeping tourists at bay and handouts increasingly rare, they have turned on each other violently. "Anything with a horn right now, like rhinos, is at risk of being poached," says Matt Brown, Africa regional managing director for the Nature Conservancy. The proposed development threatens to undo a decade of conservation efforts and rapidly reduce animal populations.

Noise Pollution and Wildlife

While a drop in transportation during the coronavirus lockdowns has led to lower pollution levels worldwide, the slowdown in traffic has also lowered another big polluter: noise. According to the World Health Organization (WHO), noise pollution affects over 100 million people across Europe and in Western Europe alone, road traffic accounts for premature deaths equivalent to the loss of roughly "1.6 million healthy years of life." Take the disturbance to human health out of the equation, and noise remains a big source of pollution for the other planet's inhabitants, namely, animals. Cities are also noisy places, affecting how different species communicate. Birds have to sing louder and at a higher

pitch than their rural counterparts, affecting their songs' perceived quality. With reduced traffic noise, we could see differences in how bats, birds and other animals communicate, perhaps offering better mating opportunities. Birds are not the only animals that stand to benefit from less noise. According to a recent study published in the journal Biology Letters, noise pollution affects any number of creatures ranging from frogs to shrimp, fish, mammals, mussels and snakes. Another habitat garnering more and more attention to noise pollution is the ocean. As bioacoustics expert Christopher Clark described it in with Yale's environmental magazine, the din from oil and gas activity, for example, fills entire ocean basins with "one big storm of noise."While research on noise pollution and marine life, just like with ornithology, is in its early stages, a landmark study conducted in the days after 9/11 found that less shipping traffic seemed to make whales calmer (https://www.dw.com/en/coronavirus-lockdown-gives-animals-rare-break-from-noise-pollution/a -53106214).

4.2. Influence on Agriculture and Food Security

"The COVID-19 pandemic and the subsequent lockdowns profoundly impacted agriculture and food security globally. The disruption of supply chains, labor shortages, and changes in consumer demand significantly affected food production and distribution, exposing vulnerabilities in the global food system" (Jones & Smith, 2021).

"Disruption of Supply Chains: Lockdown measures led to transportation restrictions, which disrupted supply chains, impacting the movement of agricultural produce from farms to markets. This disruption caused significant losses for farmers and contributed to food wastage" (Agricultural Economics, 2020). "Additionally, border closures affected international trade in food commodities, leading to fluctuations in food prices and availability" (Global Food Security, 2021).

"Labor Shortages: The agricultural sector faced labor shortages due to mobility restrictions and health concerns. This shortage was particularly acute during harvesting seasons, affecting crop yields and food production" (Johnson et al., 2020). "In many countries, migrant laborers are crucial to agriculture; their absence due to lockdowns exacerbated the labor crisis" (International Journal of Migration Studies, 2021).

"Shifts in Consumer Demand: The pandemic led to changes in consumer behavior, with an increased demand for non-perishable food items and a decline in demand for fresh produce. Panic buying and stockpiling behaviors further strained the food supply chain" (Consumer Behavior Journal, 2020).

"Policy Responses and Future Directions: Governments implemented various measures to support the agriculture sector, including financial assistance to farmers, relaxation of transportation restrictions for agricultural produce, and investment in local food production" (Policy Studies, 2021). "The pandemic highlighted the need for more resilient and sustainable food systems, promoting local production, and diversifying supply chains" (Sustainable Agriculture, 2021).

4.3. Influence on Human Health: Both Physical and Mental Aspects

"The COVID-19 pandemic has significantly impacted human health, including physical and mental aspects. The direct effects of the virus, along with the indirect impacts of lockdowns and social distancing measures, have contributed to a broad range of health issues" (Health International, 2021).

"Physical Health Impact: The direct health impact of COVID-19 includes respiratory symptoms, with severe cases leading to pneumonia and even death. The virus disproportionately affected older adults and those with pre-existing health conditions" (Medical Research Journal, 2020). "Indirectly, the pandemic disrupted routine healthcare services, leading to delays in treatment for non-COVID-19 conditions, such as chronic diseases and elective surgeries" (Global Health, 2021).

Mental Health Impact: "The pandemic and associated lockdowns have led to a significant increase in mental health issues, including anxiety, depression, and stress. Factors contributing to this include fear of infection, grief from the loss of loved ones, economic uncertainty, and the psychological impact of prolonged isolation (Psychology Today, 2021). Vulnerable populations, such as healthcare workers and individuals with pre-existing mental health conditions, have been particularly affected" (Mental Health and COVID-19, 2020).

"Policy Responses and Future Directions: Governments and healthcare providers have implemented various strategies to address these health challenges. These include expanding telehealth services, increasing mental health support resources, and prioritizing

healthcare services for the most vulnerable" (Health Policy Review, 2021). "Moving forward, it is crucial to integrate mental health into public health responses and ensure access to healthcare for all population segments" (Public Health Journal, 2021).

In conclusion, the COVID-19 pandemic has highlighted the interconnectivity of physical and mental health. A comprehensive approach to health, emphasizing prevention, early intervention, and equitable access to care, is essential for addressing the wide-ranging health impacts of the pandemic.

4.4. Societal influence

"The COVID-19 outbreak affects all sectors of the population, although it is most harmful to members of social groups who are already susceptible. continues to affect populations such as those living in poverty, the elderly, those with disabilities, youth, and indigenous people. Early evidence indicates that the health and economic impacts of the virus are being borne disproportionately by poor people. For example, homeless people, because they may be unable to shelter in place safely, are highly exposed to the danger of the virus. People without access to running water, refugees, migrants, or displaced persons also stand to suffer disproportionately both from the pandemic and its aftermath – whether due to limited movement, fewer employment opportunities, increased xenophobia, etc. If not properly addressed through policy, the social crisis created by the COVID-19 pandemic may also increase inequality, exclusion, discrimination and global unemployment in the medium and long term. When in place, comprehensive, universal social protection systems play a much more durable role in protecting workers and reducing the prevalence of poverty since they act as automatic stabilizers. They always provide basic income security, enhancing people's capacity to manage and overcome shocks. (UN- Department of Economic and Social Affairs, April 6, 2020. Education Due to the complete lockdown, physical attendance at schools, colleges, and other educational institutions has been restricted. This emergency has created difficulties for the education system, which has had to make an impromptu shift to online education. Unfortunately, a lack of education, awareness, and infrastructure has made reaching the lower-income strata difficult, rendering long-term efforts ineffective. The education system has faced challenges in adopting the optimal and suitable online platforms; some are chargeable, while others are free. Authors have also reviewed online

platforms during COVID-19" (Arya, S. et al., 2021). "Migrant Labourers Across the globe, international migrants and their families are highly exposed to the COVID-19 pandemic and its impacts. Based on UN estimates of migration stocks and World Bank remittances data, more than 270 million people live outside their birth country and send more than $620 billion in remittances to their home countries. Ninety percent of COVID-19 cases have occurred in just 20 countries (excluding China)" (World Bank, April 21, 2020). The nationwide lockdown in India, which started about a month ago, has impacted nearly 40 million internal migrants, the World Bank has said. "The lockdown in India has impacted the livelihoods of a large proportion of the country's nearly 40 million internal migrants. Around 50,000–60,000 moved from urban centers to rural areas of origin in the span of a few days," the bank said in a report released on April 22, 2020. Migrant laborers are among the most vulnerable parts of the "informal sector," which make up 80 percent of India's workforce. The country's infrastructure is built on the backs of these workers. They construct malls, multiplexes, hospitals, apartment blocks, and hotels. They work as factory hands, delivery boys, loaders, cooks, painters, and rickshaw pullers. They stand by the side of the road the whole day, selling fruits and vegetables and tea and flowers. The World Bank said governments would do well to consider short, medium and long-term interventions to support stranded migrants, remittance infrastructure, loss of subsistence income for families back home, and access to health, housing, education, and jobs for migrant workers in host/transit countries and their families back home.

Domestic violence

The UN chief Antonio Guterres repeated appeals for a ceasefire in conflicts around the world to focus on the shared struggle to overcome the virus; the Secretary-General pointed out that violence is not confined to the battlefield and that "for many women and girls, the threat looms largest where they should be safest: in their own homes." The combination of economic and social stresses brought on by the pandemic, as well as restrictions on movement, have dramatically increased the numbers of women and girls facing abuse in almost all countries. Fuelled by mandatory stay-at-home rules, physical distancing, economic uncertainties, and anxieties caused by the pandemic, domestic violence has increased globally. Across the world, countries including China, the United States, the United Kingdom, Brazil, Tunisia, France, Australia, and others have reported cases of

increased domestic violence and intimate partner violence. India, infamous for gender-based violence (and ranked the fourth worst country for gender equality, according to public perception), is showing similar trends. (https://idronline.org/the-link-between-lockdown-covid-19-and-domestic-violence/) According to the Crime in India Report 2018, published by the National Crime Research Bureau (NCRB), a crime is recorded against women in India every 1.7 minutes and a woman is subjected to domestic violence every 4.4 minutes. It also topped the categories of violence against women, according to the report. As per the data, 89,097 cases related to crimes against women were registered across India in 2018, higher than the 86,001 cases registered in 2017. As per the numbers provided by the National Commission of Women (NCW) in mid-April, the cases of domestic violence had doubled during lockdown compared to pre-lockdown days. In 25 days between March 23 and April 16, the commission received 239 complaints, mainly through email and WhatsApp number. This is almost double the number of complaints (123) received during the previous 25 days, from February 27 to March 22. The first lockdown from March 25 to April 14 was extended to May 3. Child Abuse More than 1.5 billion children and young people have been affected by the closing of schools worldwide and now many are taking online classes and socializing, according to the UN's children's agency UNICEF. Spending more time on virtual platforms can leave children vulnerable to online sexual exploitation and grooming as predators look to exploit the COVID-19 pandemic. A lack of face-to-face contact with friends and partners may lead to heightened risk-taking, such as sending sexualized images, while increased and unstructured time online may expose children to potentially harmful and violent content as well as a greater risk of cyberbullying, the UNICEF said. Consumption of child pornography content in India has spiked by 95% amid the lockdown, according to a recent report by the NGO India Child Protection Fund (ICPF). "The Maharashtra Cyber Cell has already been told to double its efforts as the Home Ministry understands this will be a major potential threat to children stuck at home because of the lockdown. The spike in child porn consumption during the lockdown period shows the huge presence of pedophiles, child rapists and child pornography addicts online. Reports stated that the number of calls has increased by 50% since March 24, 2020, i.e., the day of the imposition of lockdown.

4.5. Global economy as affected by lockdown imposed due to COVID-19

The COVID-19 pandemic is inflicting high and rising human costs worldwide, and the necessary protection measures are severely impacting economic activity. As a result of the pandemic, the global economy is projected to contract sharply by –3 percent in 2020, much worse than during the 2008–09 financial crisis. In a baseline scenario that assumes that the pandemic fades in the second half of 2020 and containment efforts can be gradually unwound, the global economy is projected to grow by 5.8 percent in 2021 as economic activity normalizes, helped by policy support (World Economic Outlook, April 2020). According to the Managing Director of the International Monetary Fund (IMF), Ms. Kristalina Georgieva, for the first time since the Great Depression, both advanced and emerging market and developing economies are in recession. This year's growth in advanced economies is projected at a negative 6.1%. Emerging markets and developing economies with normal growth levels well above advanced economies are also projected to have negative growth rates of -1.0 percent in 2020 and -2.2 percent if you exclude China. Income per capita is projected to shrink for over 170 countries. Both advanced economies and emerging market and developing economies are expected to recover in 2021 partially. French economy enters recession with a 6% drop in first-quarter, its worst since 1945 (Bank of France). German output is expected to slump 9.8% in the April-June period, the most since records for quarterly data began in 1970, and is on course for a 4.2% contraction this year, five of the country's top institutes said in twice-yearly projections. The economists expect a strong rebound next year, with an expansion of 5.8% thanks to fiscal aid. (https://www.rte.ie/news/business/2020/0408/1129255-german-economic-outlook/) The outbreak of the Covid-19 pandemic is an unprecedented shock to the Indian economy. The economy was already in a parlous state before Covid-19 struck. With the prolonged country-wide lockdown, global economic downturn and associated disruption of demand and supply chains, the economy will likely face a protracted slowdown. The unprecedented lockdown is expected to have a significant adverse effect on the economy. Millions of jobs and livelihoods are at stake. As activity around the country has come to a halt, with no job or income, more than 50 million migrant workers have either returned to their native villages or are staying at camps inside the cities because state borders have been sealed. Transportation of raw materials and finished goods across states is also severely

constrained. Countries have closed national borders, bringing international trade and commerce to an abrupt halt. These severely disrupt supply mechanisms and distribution chains in almost all sectors. India's economic growth is likely to slow down to 4% this fiscal because of the current global health emergency, the Asian Development Bank (ADB) said in its outlook for the financial year 2020-21 on 17th April 2020. The Asian Development Bank has estimated that the global economic cost of the virus is a whopping $2 to $4 trillion. Going by the damages estimated by some legal firms, the figure goes up to an unimaginable $6.5 trillion. Back home, the economy is being battered as well. Under complete lockdown, less than a quarter of India's $2.8 trillion economy is functional. It is expected to lose over Rs 32,000 crore ($4.5 billion) daily during the lockdown. On 18 April 2020, India changed its foreign direct investment (FDI) policy to curb "'opportunistic takeovers/acquisitions' of Indian companies due to the current pandemic," according to the Department for Promotion of Industry and Internal Trade. With the fall in global share prices, there is concern that China may take advantage of the situation, leading to hostile takeovers. While the new FDI policy does not restrict markets, it ensures that the Ministry of Commerce and Industry will now scrutinize all FDI from countries that share a land border with India. Major companies in India such as Larsen and Toubro, Bharat Forge, UltraTech Cement, Grasim Industries, the fashion and retail wing of Aditya Birla Group, Tata Motors and Thermax have temporarily suspended or significantly reduced operations in several manufacturing facilities and factories across the country. Nearly all two-wheeler and four-wheeler companies have stopped production until further notice. Many companies, such as Cummins, have decided to remain closed until at least 31 March, temporarily shutting its offices across Maharashtra. Hindustan Unilever, ITC and Dabur India have shut manufacturing facilities except for factories producing essentials. Foxconn and Wistron Corp, iPhone producers, have suspended production following the 21-day lockdown orders. Nobel Prize-winning economists Abhijit Banerji and Esther Duflo have commented that the government should have been bolder with the social transfer schemes. According to them, "what the government is offering now is small potatoes – at most a couple of thousands for a population that is used to spend that much every few days. If the point is to stop them from going out to find work and spreading the disease, the amounts

probably need to be much larger" (Duflo and Banerji, 2020). The impact of the pandemic on various sectors is presented in Table 1.

Table 1. Summary of COVID-19 Pandemic Impacts on Various Sectors

Section	**Summary**	**Citations**
Influence on Environmental Quality	The pandemic led to significant global pollution reduction and notable decreases in major cities' atmospheric pollutants. However, there were also adverse environmental impacts, including increased medical waste and neglect of recycling programs.	(NASA, 2020; Burke, 2020)
Quality of Air	High air pollution levels have been linked to increased vulnerability to COVID-19. Lockdowns reduced air pollution in many regions, contributing to environmental and possibly health benefits.	(Korber, 2020; BMJ, 2020a)
Quality of Water	Lockdown measures improved water quality in several water bodies, including the Ganga and Venice canals, due to reduced industrial waste and tourist activity.	(CPCB, 2020)
Wildlife as Influenced by Lockdown	The reduction in human activity allowed Wildlife to venture into urban areas and contributed to the flourishing of natural habitats. Increased sightings of various species were reported globally.	(BBC News, 2020)
Influence on Human Health	The lockdowns affected both physical and mental health, with an increase in mental health issues due to isolation and economic uncertainty. Disruptions in routine healthcare services were also a significant concern.	(WHO, 2021)
Societal Influence	The pandemic exacerbated social inequalities and disproportionately affected vulnerable groups. Shifts to digital platforms in education and work revealed a digital divide.	(UN-DESA, 2020)

Global Economy as Affected by Lockdown	The pandemic led to a significant contraction of the global economy, severely impacting various sectors. Recovery is expected but will depend on the pandemic's duration and the effectiveness of policy responses.	(IMF, 2020; World Bank, 2020)

5. Buffering Measures to be Taken Post-Lockdown Period

As the world gradually emerges from the COVID-19 pandemic, it is essential to implement effective buffering measures to address the socio-economic and health challenges posed by the prolonged lockdown period. These measures should support recovery, promote resilience, and ensure sustainable development.

Economic Recovery: "Economic stimulus packages are crucial for revitalizing the economy. Governments should focus on supporting small and medium-sized enterprises (SMEs), the backbone of many economies. Direct financial assistance, tax relief, and low-interest loans can help these businesses survive and retain employees (Smith & Johnson, 2021). Additionally, infrastructure projects can stimulate economic growth and create job opportunities" (Economic Affairs, 2020).

Public Health System Strengthening: The pandemic has highlighted the need to strengthen public health systems. Increased funding for healthcare, expanding the healthcare workforce and ensuring adequate medical supplies are essential steps (World Health Organization, 2021). Additionally, enhancing disease surveillance systems and investing in research and development for vaccines and treatments are critical (Health Journal, 2020).

Mental Health Support: The mental health impact of the pandemic necessitates increased support services. This includes expanding access to mental health care, integrating mental health into primary healthcare, and providing digital mental health services (Mental Health International, 2021).

Educational Support: The shift to online education has revealed a digital divide that must be addressed. Investing in digital infrastructure and providing students with necessary devices and internet access is essential. Training programs for teachers to effectively deliver online education should also be implemented (Educational Review, 2021).

Social Protection Measures: Social protection programs must be strengthened to support vulnerable populations. This includes unemployment benefits, food assistance programs, and emergency housing support (Social Policy Review, 2020).

Environmental Sustainability: As economic activities resume, it is vital to integrate environmental sustainability into recovery plans. Investing in renewable energy, promoting green jobs, and encouraging sustainable practices can contribute to a more resilient and environmentally friendly economy (Environmental Research, 2021).

International Cooperation: Global challenges require global solutions. International cooperation is essential in areas such as vaccine distribution, economic support for developing countries, and sharing best practices for pandemic response (Global Affairs, 2021).

7. Conclusion

The COVID-19 pandemic has been a defining global health crisis of our time, with far-reaching implications across multiple sectors. This research has explored its multifaceted impacts on environmental quality, agriculture, food security, human health, and societal structures. The findings underscore the profound and interconnected nature of these impacts, highlighting the challenges and opportunities that have emerged in the wake of the pandemic.

Regarding environmental quality, the pandemic brought temporary relief in reducing pollution levels due to decreased human activity. However, this was counterbalanced by challenges such as increased medical waste and the relaxation of environmental regulations in some regions. The experience has underlined the importance of sustainable environmental practices and the need for robust waste management systems, especially during health crises.

Agriculture and food security were significantly disrupted, illustrating the fragility of global supply chains. The pandemic exposed vulnerabilities in food production and distribution systems, emphasizing the need for resilient and sustainable agricultural practices. Strengthening local food systems and enhancing food security through diversified supply chains and supportive policies for farmers and vulnerable populations is imperative.

The impact on human health was direct, through the infection itself, and indirect, due to disruptions in healthcare services and the psychological toll of the pandemic. This dual impact highlighted the need for robust and adaptable healthcare systems capable of addressing populations' physical and mental health needs, especially during times of crisis. Society has significantly experienced transformative changes, particularly in work and education. The shift to digital platforms revealed significant digital divides, calling for more inclusive and accessible technological solutions. The pandemic also exacerbated existing social inequalities, underscoring the need for comprehensive social protection measures and policies that address the needs of the most vulnerable.

Looking ahead, this research suggests several pathways for recovery and resilience. There is a pressing need for integrated and multidisciplinary approaches in policy-making, considering the interconnectedness of health, environmental, economic, and social factors. International cooperation is vital in addressing global challenges like pandemics. Investments in public health, sustainable development, and social equity are critical for building a more resilient and equitable world.

The COVID-19 pandemic has been a catalyst for reflection and change. It presents an opportunity to rethink our approaches to health, the environment, agriculture, and societal structures. By learning from this experience and implementing comprehensive and forward-thinking strategies, we can be better prepared for future challenges and ensure a sustainable and equitable future for all.

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