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10. Environment and Human Population

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Abstract:

One of the key issues of the twenty-first century is environmental change. Despite all of their efforts over the previous few decades to repair the ecosystem, humans may only budge a few steps ahead, not up to an admirable extent. The COVID-19 plague is measured as the mortal disease of the century and the utmost dispute that mankind faced ever.

The spread of COVID-19 has enforced the world to stop the progress of all outdoor human actions on the peak phase in the reminiscences of the current population of this globe. This lockdown will perhaps be distinct in history eternally.

Nonetheless, this shutdown is a renewal of the Earth, atmosphere, and human health systems. But throughout the last few months, consequences of the COVID-19 plague have effectively improved the surroundings to a great coverage that ought to undeniably set an optimistic impact on universal atmosphere evolution. It will definitely change the actions of humans and the contiguous environmental system daily.

Keywords: Environment, Pandemic, Greenhouse gas, Economy, Water based epidemiology.

10.1 Introduction:

As the COVID-19 pandemic augmented exponentially across the globe threatening lives and uprooting the economy of cities and nations, it also had a major impact on the environment.

Here this chapter gives you a broad spectrum of views over the indirect effect impacts the COVID-19 pandemic has brought to the ecology system.

The unbidden new coronavirus (SARS-CoV2) has generated an unprecedented impact all over the world. COVID-19 is being viewed as a symptom of bias and a lack of social advancement, in addition to flattering the largest threat to inclusive community health of the century.

The ‘CO' in COVID-19 refers for ‘corona,' as the name implies. 'VI' stands for 'virus,' 'D' stands for 'disease,' and '19' stands for the year of its occurrence.

The World Health Organization called COVID-19, a new infectious respiratory disease that arose in Wuhan, Hubei zone, China, in December 2019. (Coronavirus disease 2019).

COVID-19 is a single-stranded RNA virus that measures 80 to 120 nanometers in diameter. COVID-19 belongs to a large diverse family of viruses.

They are lined up into four genera namely, α-, β-, γ-, and δ. All the coronaviruses responsible for the worldwide spread of the pandemic, namely SARS, MERS-CoV, and SARS-CoV-2 are β- coronaviruses.

The spike protein of the novel coronavirus shares 98% sequence identity with the spike protein of bat coronavirus.

The novel coronavirus has four stages of transmission namely stage-1 (imported cases), stage-2 (local transmission), stage-3 (community transmission), and stage-4 (transmission out of control).

The spread of disease between humans, from one infected person to another uninfected person, both through direct contact and indirect contact such as surface contamination.

The COVID-19 pandemic has had an impact on many aspects of human existence as well as the global economy.

The global response to the COVID-19 pandemic has resulted in erratic drops in economic activity and financial prices.

According to a statement released by the World Health Organization (WHO) on June 24, 2021, there have been 179,686,071 confirmed cases of COVID-19 worldwide, with 3,899,172 deaths.

It has hurriedly multiply around the globe, causing huge health, monetary, ecological, and community challenges to the complete human inhabitants.

Clinically approved antiviral drugs or vaccines that are helpful against COVID-19 are being continuously produced across the countries.

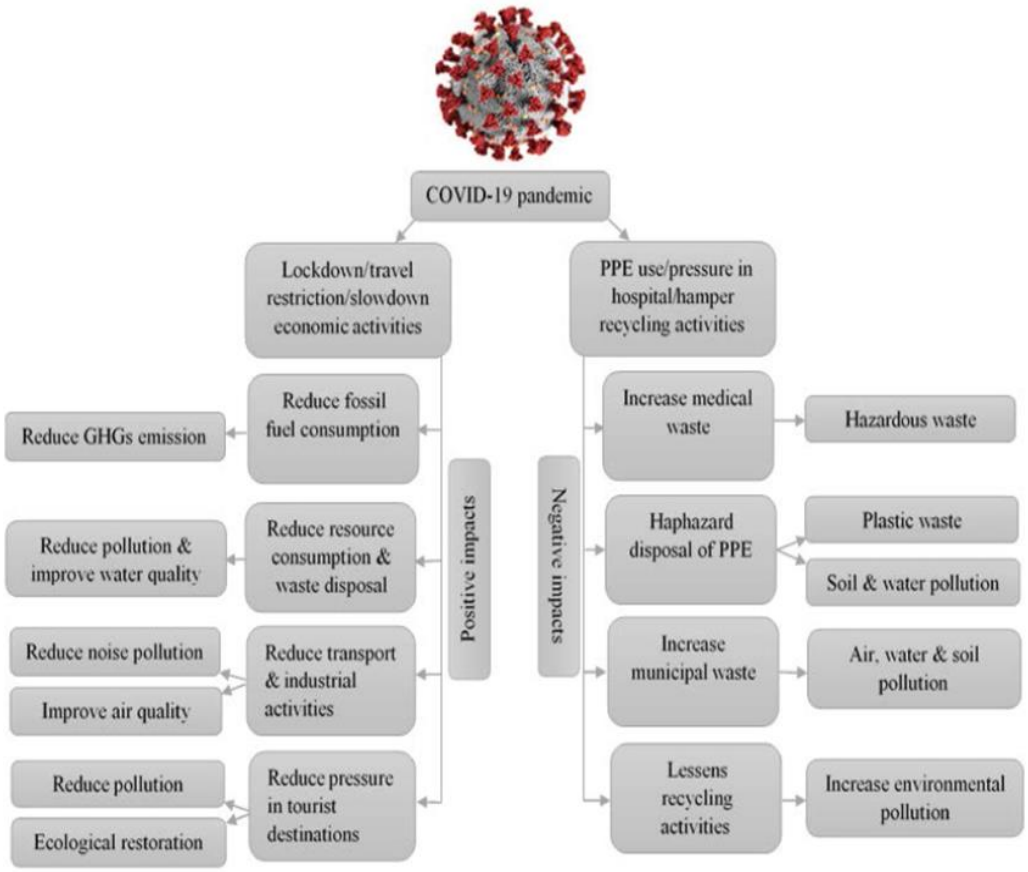

Figure 1.1: The Positive and Negative Indirect Effects on COVID-19 Pandemic

10.2 COVID-1 Impact on Air Quality:

In the case of air quality improvement COVID-19 is a stock of luck for this entire world. Global temperatures have risen considerably above ground level, making it harder to ignore. Temperatures have risen as a result of increased greenhouse gas emissions, indicating global warming (GHGs). GHGs and air pollution are inextricably linked, with severe repercussions for human welfare.

According to the report, air travel fallen by 96% due to COVID-19, truncated in 75 years. Recent coronavirus prevention measures have resulted in a 40% reduction in typical levels of nitric dioxide pollution (NO2), and a 10% reduction in particulate matter pollution has resulted in a reduction of 11.000 deaths due to air pollution. Moreover, not only the transport sector but also the industrial and manufacturing sector is greatly affected by a deadly disease. This boom is the result of a 37% decline in coal production and a 1/3 drop in oil use.

NASA satellites and of the Copernicus Atmosphere Monitoring Service of the European Space Agency (ESA) have predicated considerable fall in air pollution in major cities across the world.

Particulate matter (PM2.5 and PM10) is an additional pointer of air quality and it originates from different emission sources like industries, power plants, refuses burning and road dust re-suspension, etc. As lockdown limited all these activities in the whole country, its direct impact on PM concentration is inexorable.

When people are exposed to PM on a regular basis (especially the elderly), their respiratory systems are more likely to be damaged by the virus. The satellite views evidently show how the concentration of PM2.5 and PM10 has condensed in the span of one month particularly in the Northern and eastern states including the capital New Delhi.

The COVID-19 emergency has resulted in a large reduction in motor vehicle traffic, resulting in lower greenhouse gas emissions and particle pollutants, as well as a significant reduction in traffic clatter and road surface tire wear.

Short- and mid-term airline travels are both on the decline, resulting in lower greenhouse gas emissions, particularly CO2.

Furthermore, the reduction of contrails may result in a wider temperature range on a regular basis. Due to the reduced greenhouse effect, the reduction of contrails will almost certainly result in a drop in air temperature.

Despite the fact that the COVID-19 disaster has caused widespread human suffering around the world, air pollution is decreasing as a result of ongoing virus-fighting efforts, demonstrating what is achievable if we shift to clean energy.

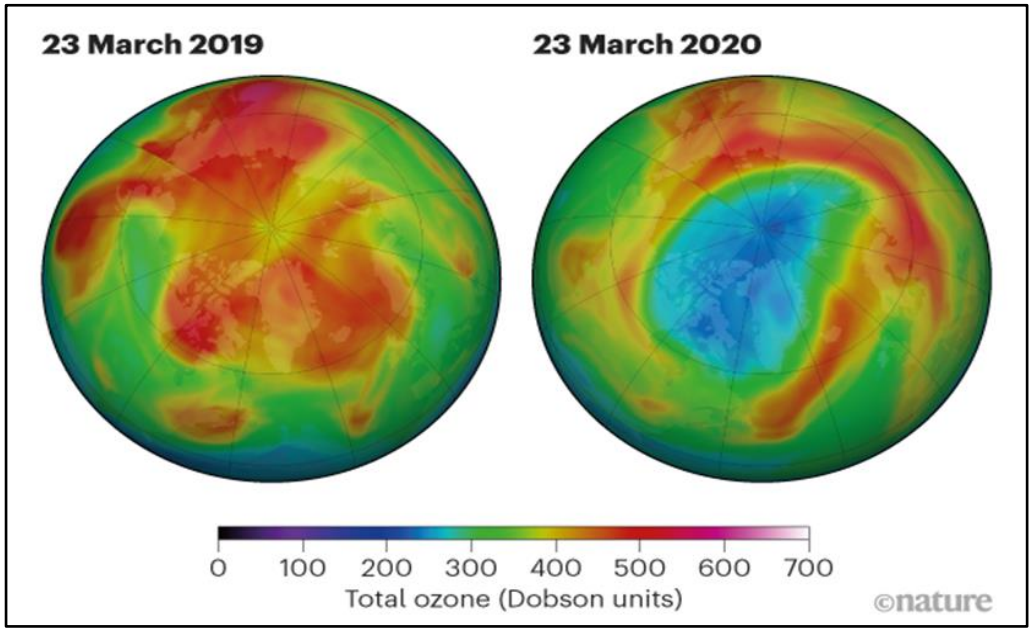

Figure 1.2: ARCTIC OPENING: A rare and record ozone hole has formed over the Arctic. An opening in the ozone layer appears each spring over the Antarctic, but the last time this phenomenon was seen in the north was in 2011

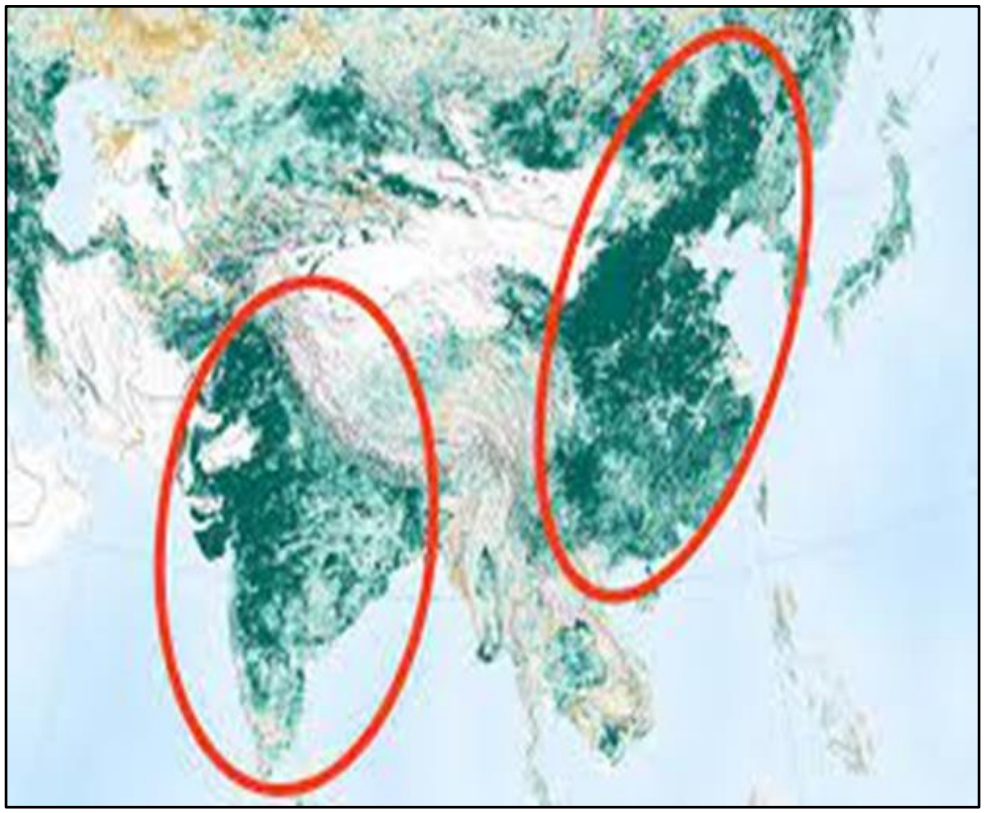

Figure 1.3: NASA Says Earth is Greener Today than 20 Years Ago Thanks to China, India

10.2.1 COVID 19 - Water:

The immediate impact of the COVID-19 pandemic on water resources is minimal, but monthly and annual perspectives may exaggerate water quality and resources. The presence of SARS-CoV-2 in sewage was first discovered, and it was suggested as a sensitive way to track the virus's spread. While viral RNA has been found in wastewater, this does not necessarily mean that the public or the environment is at risk. Corona viruses die swiftly in wastewater and inactivate faster in warm water (i.e., 10 days in 23°C water and >100 days in warm water at 4°C). Until now, sewage or drinking water has not been claimed as a means of infection for this virus. But recently it has been proposed that this virus can live on surfaces for hours or days suggests that it is a potential pathogen competent of being infectious through untreated wastewater, untreated waste, and soil, or its access into other forms of life allowing its circulation into the environment and under its control to change its characteristics.

Wastewater-based epidemiology (WBE) is a well-organized approach with enormous potential for early caution of infectious disease transmission and outbreaks, which aim to draw the source of the virus, recognize the locations of possible carriers, and offer early cautions effectively. Also, if associated to an effective response system, WBE can be helpful for pandemic surveillance.

The WBE trial biochemical signatures in wastewater, such as fragment biomarkers for Corona virus Severe Acute Respiratory Syndrome 2 (SARS-CoV-2), just by applying the type of medical diagnostic test (designed for individuals) to the signature joint of complete communities.

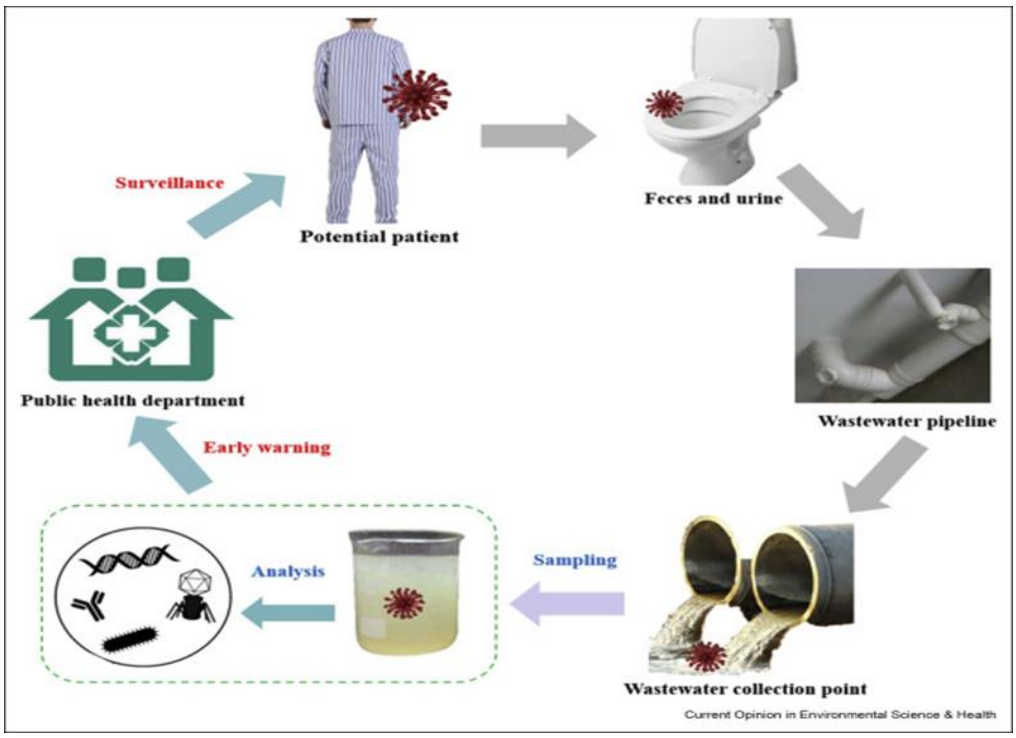

Figure 1.4: The Potential of Waste Water-Based Epidemiology as Surveillance and an Early Warning of Infectious Disease Outbreak

10.2.2 COVID 19 - Aquatic Resources:

Among the changes in the atmosphere due to the occurrence of the SARS-CoV-2 virus in the world, it is experiential that the water of rivers, coasts, and seas are clearer and clean given the fall in the number of tourists, of the use of motorboats and decreased sediment agitation, while the company of water pollutants has also been reduced accordingly.

Many fishing fleets have suspended or decreased activities as a result of the drop in demand, which has resulted in lower prices for fish and fish products in some situations. Due to insufficient demand and a lack of storage for a perishable product, quotas have not been filled in some circumstances.

Export-oriented fleets are more likely to be affected than fleets serving domestic markets. Sanitary measures (physical distance between crew members at sea, faces, masks, etc.) and a lack of appropriate equipment (e.g. masks and gloves) make fishing difficult (and in some circumstances deadly) and may result in the cessation of operations. Input supply constraints (e.g. ice, gear, bait).

The effects on catches have varied around the world, with many nations experiencing dramatic declines in productivity in the early weeks of the crisis, followed by improvements as the sector reacted. Due to the risk of the virus spreading, governments have abandoned their recycling and waste management programmers, potentially causing negative health and environmental consequences.

The quality of a number of Indian rivers, including the Ganga, Cauvery, Sutlej, and Yamuna, has improved, according to articles and reports published in newspapers and on social media. The lack of industrial effluents inflowing into rivers as a result of the epidemic's lockdown is the primary cause. A decline in irrigation water demand, above-average rainfall, and human-made factors such as reduced religious activities such as puja and cremations on the river's banks have all helped to improving the river's quality.

Excess water extraction can be reduced by reusing treated sewage water in non-production operations such as toilet flushing and road cleaning. Both industrial and municipal trash should be recycled and utilized to alleviate the burden of wastes and ecological affluence.

As a result, globular economy or circularity systems should be implemented in the manufacturing process to reduce raw material consumption.

Furthermore, WHO guidelines for the management of hazardous and infectious restorative waste should be followed. It is now clear that the vast majority of people (particularly in poor nations) are unaware of waste segregation and disposal difficulties. As a result, the government should launch a social media campaign to raise awareness about proper waste segregation, recycling, and disposal. Former to COVID-19, the worldwide water sector was impacted by five main trends:

a. Global warming, which has led to an augment in extreme floods and droughts, challenging the resilience of water and sanitation systems.
b. Increasing population facing water stress (currently 2 billion), which increases supply vulnerabilities.
c. Hurried urbanization, which strains existing water resources and ecosystems
d. The emergence of metro cities, which adds the challenge of extending water and sanitation services to about 1 billion people living in casual settlements not served by water grids.
e. Growing infrastructure, which has amplified the pressure to accelerate investments in more highly developed markets. The aquaculture production sector is tremendously diverse, both freshwater and marine, but it however, relies greatly on labor, inputs, financing, and markets, which have been and will continue to be impacted during and after the COVID-19 epidemic.

10.2.3 COVID19 - Education:

The COVID-19 outbreak has wreaked havoc on educational systems around the world, causing schools, colleges, universities, and other educational institutions to close. School closures in reaction to the pandemic have overstated the number of students by nearly 1.268 billion.

According to UNICEF monitoring, 177 nations have implemented nationwide shutdowns and 13 have implemented local halts, affecting roughly 73.5 percent of the world's student population.

Several universities offered online classes and reading material through emails and other media.

In a nutshell, for high school students, the usual classroom education is turned into an e-class room education system.

This is an international turning point for adopting this new 'e-education system and `Work from Home' tradition which is being approved by institutions and individuals.

The e-education will have a bang on research and its procedures one cannot gather practical experience of real laboratory work like handling of instruments etc.

COVID-19 is the greatest challenge that the national education systems have ever faced. Almost every government has ordered institutions to instruct, teach and guide students virtually.

The COVID-19 plague has disrupted the lives of students in unusual ways, depending on their level and course of study. In different ways, the main concern is to reassure students and parents-with embattled communication.

The most significant modification, for those used to teach in real-time, is to take benefit of asynchronous culture. For most, there is no need for simultaneous communication for the learners.

One of the major advantages of Asynchronous learning is teachers' flexibility in preparing materials and enables students to fit in the demands of home and study. Asynchronous education works best in digital formats.

Teachers do not need to distribute the material at a fixed time. Students can access those notes using various e-platform according to their schedules.

One of the opportunities in the crisis is the virtual internships, which are allowing the students to go beyond their prospectus and gain knowledge about the realism of their professions.

A further value-added advantage is that the way universities are approaching students to examine the present situation and value the need to mechanize.

This will upgrade them in their fields shortly and also preparing them to face any kind of situation. This follow will encourage more self-confidence than disarray or dread.

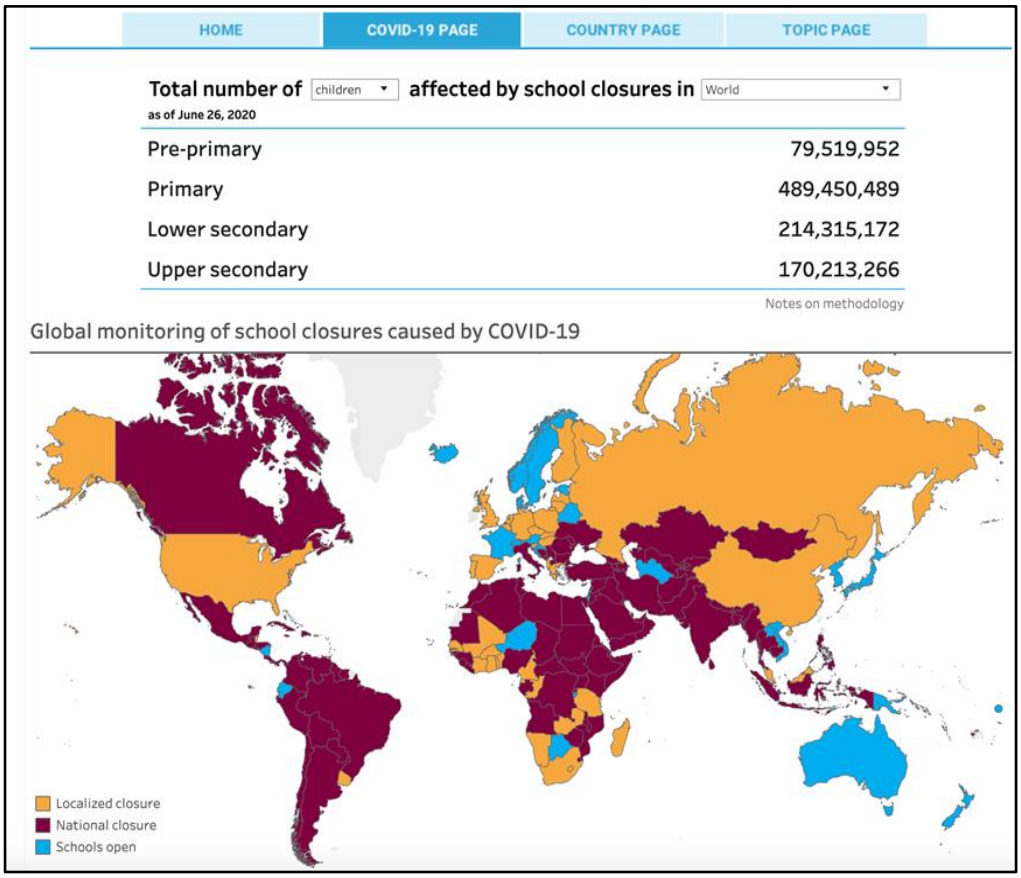

Figure 1.5: UNICEF: Global Monitoring of School Closures Caused by COVID-19

10.2.4 COVID 19 - Employment:

The COVID-19 endemic is having a tragic effect on employment and earnings globally. The International Labor Organization (ILO) the report shows that the COVID-19 catastrophe is probably to wipe out 6.7% of working hours globally comparable to 195 million full-time workers in the 2nd Quarter of 2020.

ILO claimed that about 40 lakh students post-graduated in India every year, but in the current situation, it's not that easy to get a job for each passed out student. Almost 3.3 billion are presently exaggerated by full or partial workplace closures.

Due to the COVID-19 shutdown, there was an of temporary factory closures which has shown its impact on the manufacturing sector. Because they specialized in areas that are more likely to be forcedly closed, the countries that are hardest struck by the epidemic are more likely to face the harshest employment implications of the confinement.

The COVID situation is so severe that it will not only have a significant impact on labor markets in the near and medium term, but it will also have a significant impact on how the government operates.

10.2.5 COVID19 - Global Health:

At the beginning stage of civilization, the human beings started to influence the natural resources for their own benefit. The increasing population needs to satisfy their demand of urbanization and industrialization it become necessary and the axiomatic significance to prove the detrimental on global climatic changes. The humans desire to drive the nature as per their tendency, without the affectionate for sustainable development they started to destroy the nature in many ways by anthropogenic activities.

After the COVID-19 issue it affected a major public health issue and it bring large global outbreak in all over the countries. The scientist report that virus is extremely infectious it transmitted through close contact and droplets. Being a respiratory disease, it damage the lung tissues rather than it affect the other organs of tissue.

Beyond viral shedding in plasma/serum is demotic in respiratory tract infections, through the insertion of labile blood products, there is a possibility of transmission of corona virus .In the world's population, COVID-19 become major public health concern, particularly for old and middle age people leading to cause of hospitalization and death, in the affected countries.

Climate specialists, on the other hand, believe that greenhouse gas (GHG) emissions might be decreased to levels not seen since World War II. The environment become a zero emission of GHG and without the suspended of tiny particles because of vehicles are rarely found on the road sides. Due to closing and minimal activities of factories, industrial sites and construction sectors the waste produced from these sectors had reduced large extent and improving the air quality.

Due to COVID-19 lockdown, in many cities inhabitants are experiencing a clear river water and clear sky for their first time in their lives. Variety of birds are seen in their localities. Ecosystem are being greatly recovered. The main sources of discomfort for the population is due to the environmental noise because of unwanted sound created by industrial or commercial activities, the transit of engine vehicles etc., it cause health problems and the natural condition of ecosystem. Environmental noise had been reduced in this pandemic situation. Protection against health emergencies necessitates urgent modification as well. Despite a greater emphasis on global health security, COVID-19 has revealed a crucial need for multi-sect oral health emergency surge capacity and well-coordinated preparedness at all levels and across all countries. It was necessary to maintain and develop early warning systems in order to move and control public health over the world.

10.2.6 COVID 19 - Social Changes:

According to the reports specify that Covid-19 is not affecting every person the same way in terms of Social and demographic factors. To fully figure out that why contagious pandemics influence different socioeconomic groups differently is pretty difficult. Irrespective of some socioeconomic indicators like education, rural or urban area, population, etc., regrettably, Covid-19 has a significant impact on the impoverished community.

Work from home can bind social relationships with new individuals, but it is more advantageous for better socio-economic jobs, with only a portion of a group benefiting from this circumstance. WHO has published health advisories that people smokers are in danger to a great extent since and Covid-19 both aim at lungs. Inhabitant areas with fewer socioeconomic provision, such as India, Pakistan, and Bangladesh, are at greater danger due to a lack of healthcare services. Patients with COVID-19 (or, for that matter, anyone suffering from a contagious condition that necessitates protective isolation in a healthcare setting) frequently experience feelings of isolation and depression.

Although various patients perceive and cope with physical, social, and psychological confinement in different ways, the isolation is genuine. Modern electronic communication methods have provided much-needed mental respite and may help with physical and social recovery sooner rather than later. COVID-19 sufferers are also subjected to the disease's social stigma, which presents in many ways depending on the patient's or caregiver's position. During the infected stage, this makes the patient hesitant to return to the community. This could be due to genuine anxiety about infecting other family members, or it could be owing to society's indifference to people who have been afflicted.

10.2.7 COVID 19 - Economy:

A supply chain suggests is a system of organizations that work mutually to design, produce, and deliver a product to a market, extending from the extraction of raw materials to the division of finished products or services. It plays an essential role in the automobile, IT sectors but due to the Covid-19 pandemic, all the automobile, manufacturing, and IT sectors had to be shut down which exaggerated the supply chain worldwide.

The negative and large effects of COVID-19 will drag the economy several years back and government needs to take measures for this in a hostile way. The government will have to consider current as well as future policies for handling this situation. It is going to slow down both, business and economy. On the set of a viral outbreak already dampening the oil demand, this oil-price war is predicted to have grave implications for the global economy. In more usual times, low-priced oil may have functioned as an advantage for economies.

Countries around the world have forced several defending actions to hold the exponentially escalating spread. Which includes social distancing, avoiding needless travel, and a ban on congregations. Shutdown limitations drastically condensed the manufacture of goods from factories, while quarantine policies decreased utilization, demand and utilization of products and services. Due to the outbreak of COVID-19, the tourism sector is hardly affected, with great impacts on both travel and supply. The world of travel and tourism has announced that 50 million occupations in the global tourism and travel sector at a risky stage. COVID-19 has created a lot of uncertainty in the real estate business. Individually, social distancing caution lowered house views; it's a big part of the selling process, and it's forcing both buyers and sellers to rethink their plans. Sellers are gradually waiting for assurances about the health of potential purchasers who come to inspect properties. Recently evidence reports that both low-income and high-income countries, economically reduced to proportion, with a limited capacity of the health system, are liable to suffer contagion mortality rates. The evidence that exists reveals majorly on macroeconomic data and the disease spread based on the assumption of forecast potential modeling of future scenarios.

The socioeconomic treaty of this outbreak and the policies implemented by the government slow the spread of the virus at household, adult, and child levels.

The global pandemic situation brings a penetrating challenge to individuals and strikes a balance between the economically to manage the spread of the virus and health benefits.

This situation brings that politically difficult in high-income countries. To summaries, socioeconomic demographics are at the heart of the Covid-19 epidemic, which is why densely populated places have greater infection and mortality rates. Economists are nonetheless worried about a potential economic loss.

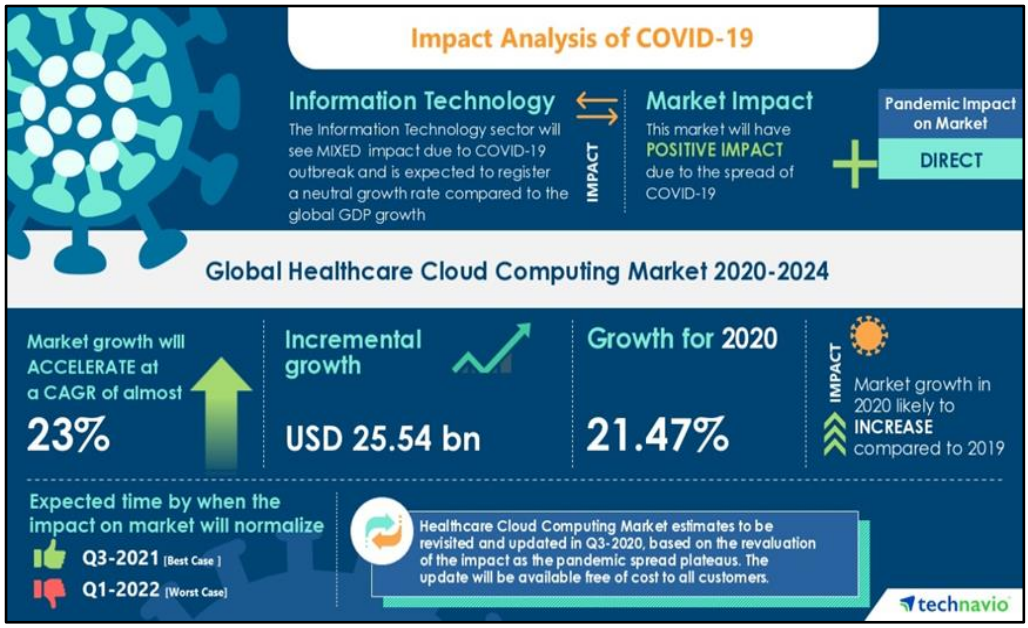

Figure 1.6: COVID-19 Impact and Recovery Analysis- Global Healthcare Cloud Computing Market 2020-2024

10.3 Conclusion:

Finally, COVID-19 will have both positive and negative indirect effects on the environment, but the overall result will be better. Short-term reductions in GHG concentrations are not a long-term solution for environmental sanitation.

Furthermore, if countries ignore the viral threat, it will result in other environmental issues that will continue longer and be more difficult to control. Some countries' reductions in GHG emissions are just temporary. When the pandemic is over, countries' economy will most likely recover, and GHG emissions will resume their upward trajectory.

This positive influence on the environment may be temporary, but governments and individuals should be taught how to reduce pollution on a long-term basis as a result of this lockout.

10.4 References:

1. Abouleish, M. (2021). Indoor air quality and COVID-19. Public Health, 191, 1–2. https://doi.org/10.1016/j.puhe.2020.04.047
2. Aneja, R. (2021, May 1). An assessment of socioeconomic impact of COVIDâ 19 pandemic in India. Wiley Online Library. https://onlinelibrary.wiley.com/doi/full/10.1002/pa.2266
3. Bashir, M. F., MA, B., & Shahzad, L. (2020). A brief review of socio-economic and environmental impact of Covid-19. Air Quality, Atmosphere & Health, 13(12), 1403–1409. https://doi.org/10.1007/s11869-020-00894-8
4. Chakraborty, I., & Maity, P. (2020). COVID-19 outbreak: Migration, effects on society, global environment and prevention. Science of the Total Environment, 728, 138882. https://doi.org/10.1016/j.scitotenv.2020.138882
5. Cheval, S., Mihai Adamescu, C., Georgiadis, T., Herrnegger, M., Piticar, A., & Legates, D. R. (2020). Observed and Potential Impacts of the COVID-19 Pandemic on the Environment. International Journal of Environmental Research and Public Health, 17(11), 4140. https://doi.org/10.3390/ijerph17114140
6. Couch, K. A., Fairlie, R. W., & Xu, H. (2020). Early evidence of the impacts of COVID-19 on minority unemployment. Journal of Public Economics, 192, 104287. https://doi.org/10.1016/j.jpubeco.2020.104287
7. COVID-19 Effect on Mental Health. (2020). Journal of Addiction Research, 4(2). https://doi.org/10.33140/jar.04.02.02
8. COVID-19 Impact and Recovery Analysis- Global Healthcare Cloud]. (n.d.). https://mms.businesswire.com/media/20200703005270/en/803014/5/IRTNTR41148.jpg?download=1
9. Daniel, S. J. (2020). Education and the COVID-19 pandemic. PROSPECTS, 49(1–2), 91–96. https://doi.org/10.1007/s11125-020-09464-3
10. Environmental effects of COVID-19 pandemic and potential strategies of sustainability. (2020, September 1). PubMed Central (PMC). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7498239/
11. Espejo, W., Celis, J. E., Chiang, G., & Bahamonde, P. (2020). Environment and COVID-19: Pollutants, impacts, dissemination, management and recommendations for facing future epidemic threats. Science of the Total Environment, 747, 141314. https://doi.org/10.1016/j.scitotenv.2020.141314
12. Fana, M., Torrejón Pérez, S., & Fernández-Macías, E. (2020). Employment impact of Covid-19 crisis: from short term effects to long terms prospects. Journal of Industrial and Business Economics, 47(3), 391–410. https://doi.org/10.1007/s40812-020-00168-5
13. Impact of COVID-19 on the social, economic, environmental and energy domains: Lessons learnt from a global pandemic. (2021, April 1). PubMed Central (PMC). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7556229/
14. Jackson, G. (2021). COVID-19 and socio-economics. Socio-Economic Review. Published. https://doi.org/10.1093/ser/mwab030
15. Josephson, A., Kilic, T., & Michler, J. D. (2021). Socioeconomic impacts of COVID-19 in low-income countries. Nature Human Behaviour, 5(5), 557–565. https://doi.org/10.1038/s41562-021-01096-7

16. Kalbusch, A., Henning, E., Brikalski, M. P., Luca, F. V. D., & Konrath, A. C. (2020). Impact of coronavirus (COVID-19) spread-prevention actions on urban water consumption. Resources, Conservation and Recycling, 163, 105098. https://doi.org/10.1016/j.resconrec.2020.105098
17. Lokhandwala, S., & Gautam, P. (2020). Indirect impact of COVID-19 on environment: A brief study in Indian context. Environmental Research, 188, 109807. https://doi.org/10.1016/j.envres.2020.109807
18. Lord, P. (2020). Incentivising Employment during the COVID-19 Pandemic. SSRN Electronic Journal. Published. https://doi.org/10.2139/ssrn.3573176
19. Majumder, M. S., & Mandl, K. D. (2020). Early in the epidemic: impact of preprints on global discourse about COVID-19 transmissibility. The Lancet Global Health, 8(5), e627–e630. https://doi.org/10.1016/s2214-09x (20)30113-3
20. Manjula Bai, H. (2020). The Socio-Economic Implications of the Coronavirus Pandemic (COVID-19): A Review. ComFin Research, 8(4), 8–17. https://doi.org/10.34293/commerce.v8i4.3293
21. Mok, K. H., & Montgomery, C. (2021). Remaking higher education for the post-COVID-19 era: Critical reflections on marketization, internationalization and graduate employment. Higher Education Quarterly. Published. https://doi.org/10.1111/hequ.12330
22. Muhammad, S., Long, X., & Salman, M. (2020). COVID-19 pandemic and environmental pollution: A blessing in disguise? Science of the Total Environment, 728, 138820. https://doi.org/10.1016/j.scitotenv.2020.138820
23. Pereira, M. M. O., Silva, M. E., & Hendry, L. C. (2021). Supply chain sustainability learning: the COVID-19 impact on emerging economy suppliers. Supply Chain Management: An International Journal, ahead-of (ahead-of-print). https://doi.org/10.1108/scm-08-2020-0407
24. Riveros, R. (2018). Chemical treatment and reuse applications for latex paint industry wastewater. DESALINATION AND WATER TREATMENT, 103, 290–295. https://doi.org/10.5004/dwt.2018.21932
25. Rolain, J. M., Colson, P., & Raoult, D. (2007). Recycling of chloroquine and its hydroxyl analogue to face bacterial, fungal and viral infections in the 21st century. International Journal of Antimicrobial Agents, 30(4), 297-308. https://doi.org/10.1016/j.ijantimicag.2007.05.015
26. Tortajada, C. (2021). COVID-19 and clean water, sanitation and wastewater management. International Journal of Water Resources Development, 37(2), 179–181. https://doi.org/10.1080/07900627.2021.1877956
27. Wang, Q., & Su, M. (2020). A preliminary assessment of the impact of COVID-19 on environment – A case study of China. Science of the Total Environment, 728, 138915. https://doi.org/10.1016/j.scitotenv.2020.138915
28. Wastewater-based epidemiology: current status and future prospects. (n.d.). [Photograph]. https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.sciencedirect.com%2Fscience%2Farticle%2Fpii%2FS2468584418300965&psig=AOvVaw3Z3KJ14hAPi9XVnV9cmmVM&ust=1625044092588000&source=images&cd=vfe&ved=0CAoQjRxqFwoTCLDVgJO_vPECFQAAAAAdAAAAABAM
29. [Water based epidemiology as surveillance]. (n.d.). https://ars.els-cdn.com/content/image/1-s2.0-S2468584420300337-gr1.jpg

30. Xu, H. (2020). COVID-19 Pandemic and Environmental Pollution. International Journal of Environmental Sciences & Natural Resources, 25(2). https://doi.org/10.19080/ijesnr.2020.25.556160
31. Yunus, A. P., Masago, Y., & Hijioka, Y. (2020). COVID-19 and surface water quality: Improved lake water quality during the lockdown. Science of the Total Environment, 731, 139012. https://doi.org/10.1016/j.scitotenv.2020.139012
32. Zambrano-Monserrate, M. A., Ruano, M. A., & Sanchez-Alcalde, L. (2020). Indirect effects of COVID-19 on the environment. Science of the Total Environment, 728, 138813. https://doi.org/10.1016/j.scitotenv.2020.138813.