

COVID-19 Affect Our Perception of Sustainability

Subjects: Environmental Sciences

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Since the World Health Organization (WHO) declared the outbreak of severe acute respiratory syndrome COVID-19 virus 2 (COVID-19) virus disease 2 (SARS-CoV-2) on 9 January 2020, the entire world has been exceptionally interested in examining the impact of this pandemic on people and the environment. The pandemic led to unprecedented measures to halt air traffic and close factories due to lockdowns, economic closures, and the stopping of transportation of all kinds. The decline in the use of coal by power plants, oil refining, and steel manufacturing had a beneficial effect on air pollution and caused a decrease in carbon dioxide emissions. Moreover, the concept of sustainability has become more prevalent, reflecting the increasing awareness of the responsibility placed on every member of society. Sustainability is the quality and quantity of change that meets our needs without destroying the giving planet, which is the hope for the survival of future generations.

Keywords: pandemic ; COVID-19 ; sustainability ; environmental pollution ; air pollution

1. Introduction

Sustainability is based on equal economic growth that generates wealth and happiness for all, without harming the environment or others. Scientists, activists, researchers, and world leaders are committed to protecting the planet through sustainable consumption and production, managing its natural resources sustainably, and taking urgent action on climate change, not only to secure the current generation but to support the needs of future generations as well. Scientists worldwide are increasingly endorsing programs, initiatives, and actions that aim to conserve resources. Hence, the term sustainability has been widely used in the past two decades to refer to the four human, social, economic, and environmental domains that represent the four pillars of the concept of sustainability ^{[1][2][3]}.

Sustainability creates and maintains conditions under which humans and nature can live in developmental harmony without depleting or polluting the environment. The COVID-19 virus pandemic has had many repercussions for future sustainability opportunities. The COVID-19 virus (COVID-19) pandemic crisis has had many repercussions on future sustainability opportunities. For this reason, the global impact of the COVID-19 virus pandemic on the indicators of achieving sustainability in the human, economic, social, and environmental dimensions and its unprecedented challenges to achieving sustainability is a crucial field of study and research ^{[3][4][5]}.

1.1. Human Sustainability

Human sustainability aims to preserve and improve the safety of the human element in society through programs under the umbrella of human sustainability; investments in health and education systems; and access to services, nutrition, and knowledge. In addition to sustainability in the natural resources and available spaces, it balances continued growth and improvements in the health and well-being of all. Human sustainability focuses on the person who participates directly or indirectly in maintaining this sustainability ^{[2][3]}. Therefore, activities or businesses used to obtain basic materials and resources may affect individuals all over the world positively or negatively. Human sustainability promotes business values that respect human capital, as the goal is to develop and enhance the protection of the individual ^[4]. Therefore, the primary purpose of human sustainability is to support people to live healthier and promote well-being for all ages ^{[2][3][4]}.

1.2. Social Sustainability

The concept of social sustainability accommodates a larger worldview regarding societies, cultures, and globalization. It aims to preserve social capital through the investment in and the creation of services that form the framework of our community. Social sustainability is based on perpetuating quality by supporting it with concepts that call for solidarity and societal cohesion, imparting a spirit of selflessness, reciprocity, and honesty, and allowing others to contribute to society ^{[1][2][5]}. The importance of relationships between people and consideration for others can create sustainability that extends its impact on future generations—realizing that what we are doing now has a significant effect on the planet and the future

life of future generations represents the spirit of community sustainability. Of course, this needs to be supported by laws, information, and shared ideas about equality and rights ^{[1][5]}.

1.3. Economic Sustainability

Economic sustainability is fundamentally about keeping capital healthy and improving the standard of living. Genuine sustainable development is more than just economic growth; it is the quality and quantity of change and the maintenance of high and stable levels of economic growth. Economic sustainability can be accomplished through the incorporation of environmental and social components. It challenges the mantra of capital that continued development is good and, more importantly, better if it risks harm to ecological and human systems ^{[1][6][7][8]}.

1.4. Environmental Sustainability

Environmental sustainability depends on protecting natural capital such as land, air, water, minerals, and everything else that exists in nature and benefits humanity as a resource. The population's essential needs to live on the planet can be achieved without compromising the needs of future generations. When achieving positive economic results, companies must pay attention not to cause any collateral damage to the environment in the short or long term. Environmental sustainability aims at integrating all four pillars of sustainability and treating everyone equally. The four types present unique characteristics that must be preserved, although these may overlap in some cases. Thus, proper planning and balanced, sustainable policies urge giant organizations and companies to incorporate the chosen strategic approach into their policies and procedures to identify a specific type of green business to focus on ^{[9][10][11]}.

2. Effects of COVID-19

The COVID-19 pandemic caused by the emerging COVID-19 virus, severe acute respiratory syndrome 2 (SARS-CoV-2), has infected more than half a billion individuals, increasing daily and resulting in the death of several millions of people worldwide at the time ^[12]. With its unclear nature, this highly contagious virus significantly impacts humans, their behavior, and the surrounding nature. The global pandemic of the COVID-19 virus has caused many social, psychological, and economic problems worldwide, as most countries closed their borders and announced strict measures to eliminate the virus ^{[13][14][15][16][17][18][19]}. Nevertheless, this unprecedented pandemic had some positive aspects in many areas. The COVID-19 virus pandemic hugely affected the environment and climate in several parts. The sharp decline in travel, industry, social, and commercial activities all have resulted in a decrease in the level of air pollution in many regions all over the world. Since the beginning of the pandemic, the world has witnessed a severe decline in air pollution, specifically carbon monoxide and nitrogen dioxide, as most factories and the transport sector have closed due to the pandemic; therefore, this significant decrease has occurred ^{[20][21][22][23]}. The environment has also witnessed the purity of pollutants as the water in the channels became clearer and gained better flow ^[24].

The increase in pure water is due to the stability of the sediments that are usually scattered due to the movement of the boats at the bottom of the canals, and the water pollution along the waterways has decreased. The shutdown of most industrial processes worldwide has resulted in a significant improvement in air quality. Satellite images showed a decrease in the concentration levels of nitrogen dioxide in the world, a toxic gas emitted mainly from car exhaust and factories and one of the most significant causes of air pollution in many cities ^{[26][27][28][29][30][31][32][33][34]}. Not all environmental changes in the recent period have been positive. One of the adverse effects of the pandemic is the significant increase in plastic waste, from medical gloves to packages and more ^{[35][36][37]}. The COVID-19 pandemic also caused a drop in carbon dioxide in the air around the world. Due to the sizeable stopping of economic activity in most countries, the emission rate of this gas decreased, which also happened before during the global financial crisis in 2008 ^[38].

In addition, traffic restrictions in the streets saved the lives of many stray animals from being run over in road accidents.

The absence of humans led to the disappearance of breadcrumbs in the garden, forcing other animals, such as birds, to find food in a manner befitting its original nature. In addition, the lack of movement of tourist boats contributed to the purity of the water and the lack of impurities for the first time since it stopped moving sediment in the city's waters.

The lack of movement of transport ships in the seas gave marine creatures, such as whales, time to float quietly and undisturbed ^{[25][26][27][28][29][30][31][32][33][34]}.

In a relatively short period, the worldwide dissemination of COVID-19 has dramatically declined manufacturing operations, road traffic, and tourism. At this time of crisis, controlled human contact with nature has become a blessing to humanity

and the world. After the outbreak of COVID-19, environmental conditions, including air quality and river water quality, have improved worldwide [39][40][41][42][43][44][45][46]. Reports indicate that biodiversity was also thriving [47][48].

India has always been a pollution center with massive populations, heavy traffic, and polluting factories leading to high AQI values in all major cities. However, the air quality started to improve after the COVID-19 lockdown was announced. All other environmental parameters, such as water quality in the rivers began to give positive signs of restoration. India has always been a pollution center with massive populations, heavy traffic, and polluting factories leading to high AQI values in all major cities. Nevertheless, after COVID-19 announced the lockdown, air quality has begun to improve, and all other environmental parameters, such as water quality in rivers, have started to offer positive signs of restoration [27][28][49][50][51][52].

2.1. Effects on Air

Until 2020, the increase in greenhouse gases produced since the beginning of the industrial age has caused global average temperatures to rise, causing numerous impacts, including melting glaciers and rising sea levels. In addition, before the COVID-19 pandemic, measures expected to be recommended to health authorities in the event of the pandemic included quarantine and social separation. Independently, before the COVID-19 pandemic, researchers argued that lower economic activity would help reduce global warming and air and sea pollution, allowing the environment to prosper slowly. Due to the impact of the COVID-19 virus outbreak on travel and industry, many regions have experienced a significant decrease in air pollution and greenhouse gases [53][54][55]. Reducing air pollution can reduce both the risks of climate change and COVID-19, but it still needs to be clarified what types of air pollution (if any) present common risks to climate change and COVID-19. Researchers in New York told the BBC that the preliminary results of their research indicate that the proportion of carbon monoxide gas—produced mainly by car use—has decreased by 50 per cent compared to last year. The balance of carbon dioxide, which causes high temperatures, has also been significantly reduced [56].

Nevertheless, there is a fear that the levels of these gases will return to rising after the end of the epidemic. Unsurprisingly, the percentage of gases produced by energy production, transportation, and transportation has decreased amid the global economic activity slowdown because of the epidemic outbreak. NASA satellite data revealed significant reductions in air pollution over major cities.

In China and Italy, significant reductions in nitrogen dioxide have been recorded because of reduced motor vehicle use and generally lower industrial activity.

Nitrogen dioxide is known to be a dangerous, polluting gas in addition to its contribution to rising temperatures [53][54][57][58][59][60]. Furthermore, with the movement of air transport towards a complete stop and the increase in the number of employees who take work from their homes, harmful emissions will likely decrease in many countries of the world.

The Federal Laboratories for Materials Science and Technology (Empa) researchers concluded that nitrogen oxide concentrations decreased in most traffic-related sites in Switzerland by up to 50% due to the lockdown measures and despite the significantly low ozone concentrations. It should be noted that ozone at ground level is a harmful air pollutant. In general, ozone concentrations were low due to lockdown measures but increased across Switzerland due to the inverse relationship of this pollutant to nitrogen oxide, so it is not easy to draw clear conclusions. In China, closings and other actions have resulted in a 25 percent reduction in carbon emissions, which one Earth Systems scientist estimated might have saved at least 77,000 living creatures over two months. Despite this, the outbreak has hindered environmental diplomacy, including postponing the United Nations Climate Change Conference 2020, and economic repercussions from it are expected to slow investment in green energy technologies. In multiple forms, human activity has caused environmental degradation due to a fully human-made effect [53][54][57][58][59][60]. The Center for Energy and Clean Air Research reported that methods to contain the spread of the COVID-19 virus, such as quarantine and travel bans, had reduced carbon emissions by 25% in China [35][57][61][62].

China produced nearly 200 million metric tons less carbon dioxide than in the same period in 2019 due to reduced air traffic, oil refining, and coal consumption [39][63]. According to Earth systems scientists, this regression may have saved at least 77,000 organisms. NASA and the European Space Agency are watching how nitrogen dioxide gases decrease significantly during the first stages of the COVID-19 pandemic in China [39][63][64]. The economic slowdown caused by the virus has dramatically reduced pollution, especially in cities like Wuhan in China, by 25%. NASA uses the Ozone Monitoring Tool (OMI) to analyze and monitor the ozone layer and pollutants such as NO₂ and aerosol [35][57][62]. These tools have helped NASA to process and interpret data received due to lockdowns worldwide. According to NASA scientists, nitrogen dioxide pollution in Wuhan, China, has slowly spread to the rest of the world. The decline was also

severe because the virus coincided with China's Lunar New Year [39][53][54][57][58][59][60][63][64][65]. Due to the festival, factories and companies are closed in the last week of January to celebrate the Lunar New Year festival. However, these closures were more comprehensive and extended due to procedures, so their impact was more evident. China's low nitrogen dioxide has not achieved standard air quality for what health authorities consider acceptable. Other pollutants remained in the air, such as aerosol emissions [66].

2.2. Effects on Water

The scientific interest in studies of COVID-19 viruses on one side and social and environmental systems, including the interaction between climate, water, and soil on the other side, is justified globally due to the joint influence of all these factors. In Venice, the water in the canals has become more apparent and has seen an increase in the presence of fish and waterfowl. The first impacts are divided between rapid and direct environmental improvements, which include fresh air and improved water quality due to less pollution. Other changes, such as those resulting from sewage disposal, are among those positive impacts, mainly short-term and long-term. The mayor's office of Venice explained that the increase in the purity of the water is due to the increased sedimentation, which is disrupted by the movement of boats, and mentioned a decrease in air pollution along the waterways [32][33][34][35][36][37]. On the other hand, the disposal of sanitary consumables, such as personal protective equipment, facemasks, and gloves, is already raising concerns about the significant negative impact of this epidemic event on sewers, rivers, water bodies, and the environment in general.

By May 2020, many reports alleged severe damage to the aquatic environment, especially along beaches in Hong Kong, Canada, and other countries, due to sewage and disposal of medical activities or personal protection, including those that do not comply with approved global standards [32][33][34][35][36][37].

Venice's canals are cleaner and more transparent than they were after the quarantine imposed in Italy stopped normally polluting boats.

Nevertheless, as a positive side effect of the health crisis, the waterways are much cleaner since boat traffic stopped due to the COVID-19 pandemic. It became possible again to see fish swimming in the water [67][68].

Although human destruction of the environment seemed irreversible at first glance, studies have proven the opposite [67][68][69]. The pandemic has positively affected the environment around the world, as the canals of Venice were clean and clear again, and the air over Italy was less polluted. According to new data from the European Space Agency's Copernicus Sentinel-5b satellite, this is due to slowing emissions from power plants, cars, and other industrial sources [70].

2.3. Effects on Animals

The impact of the COVID-19 virus pandemic was not limited to humans, but extended to animals that also face the consequences of spreading the virus.

The virus evolved over long periods, perhaps millions of years, and appeared in other forms and types compared to the present time. This is known because it has appeared in bats and other wild animals, which are considered a delicacy in China.

All these things need pathogenic agents and other host species that stand between disease and infection from those diseases—not only humans but also animals and crops [71]. For the first time, it was confirmed that a tiger was infected with the COVID-19 virus in Bronx Park in New York, and it is believed that one of the infected workers in the park transmitted the virus to him. Six tigers and other lions were also reported to show disease symptoms [72]. According to experts in bio-conservation science, the emerging COVID-19 virus can also threaten animals, such as wild gorillas, chimpanzees, and orangutans, and the transmission of the virus from animal to humans requires unfamiliar intermediate animals that can break several disease barriers between animals and humans [72]. Scientifically, many other viruses are found naturally in land mammals and birds worldwide. According to scientists, human activity leads to the emergence of new pathogenic viruses. Climate and environmental changes in the ecosystem lead to the development of new types of viruses through logging, killing wild animals, and destroying typical habitats [72][73][74].

The spread of viral epidemics in past ages affected the development of all life on Earth and intervention viruses in the human body composition. About 8% of the human genome consists of parts of viruses called retroviruses or retroviruses. These genetic "fossils" remain of the viral epidemics our ancestors survived [75][76]. Environmental experts recommend addressing the multiple and often interacting threats to ecosystems and wildlife to prevent the emergence and transmission of zoonotic diseases to humans, including habitat loss and extinction, illegal trade, and pollution. Thus, the

impact of climate change and scientists cannot anticipate the spread and transmission of viruses to humans, so developing vaccines proactively is not an option. Moreover, according to the World Economic Forum website, there is talk about discovering a “comprehensive influenza vaccine” that would provide immunity against all influenza virus mutations. Nevertheless, this has not yet been possible, so humans must conserve ecosystems, including wildlife, for their intrinsic value and as a potential source of disease-causing viruses and epidemics [77].

A new study showed that mice sold in Southeast Asian markets and restaurants embrace several types of COVID-19 viruses known as COVID-19 Infection Rates with different strains of the COVID-19 virus have increased among these animals during their journey from their “environment in the fields to the tables”, indicating they transmit the viral infection to each other during this process [78]. However, the COVID-19 virus strains discovered in these mice differ from the emerging COVID-19 virus currently spread among humans and cause COVID-19 disease. There is no conclusive evidence that they pose a threat to human health until the present time. However, scientists have long warned that the wildlife trade could increase disease rates because animals are incubators for many viruses. A research team from the United States and Vietnam has warned that the presence of several types of COVID-19 viruses in the animal supply chain of restaurants is indicative of the spread of these viruses among them. It is believed that the origins of the current epidemic lie in the trade of wild animals, as the disease appeared in bats and then transmitted to humans through other intermediate animals.

Although these are not yet known precisely, there are still first direct results in mice but they may apply to other wild animals, such as civets and pangolins, which are hunted and transported together in large numbers [78][79].

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