



# Disruption in global supply chain and socio-economic shocks: a lesson from COVID-19 for sustainable production and consumption

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## Abstract

The novel COVID-19 has emerged as a severe threat to global health globally, affecting over 210 countries and regions. The profound dilemma interrupted global trade and social activities and enormously influenced daily lives through social distance and confinements. The outbreak of COVID-19 has exacerbated human misery due to the crippling of economies globally. The effects are substantial on health, economy, environment, and society. Nearly every country is trying to prevent the transmission of this communicable disease. Remedial policies include testing and treating patients, isolating suspects through contact tracking, banning public gatherings, and asserting a complete or partial shutdown. In this context, the present paper's core objective is to investigate the impact of the COVID-19 pandemic on the environment and energy market, society, economy, and global protective measures taken to reduce COVID-19 transmission. The study's main contribution is revealed lessons to provide insights for business and the efficacy of governments' initiative globally. Finally, this paper describes future actions for governments, leaders, energy providers, and all stakeholders in response to the global pandemic crisis.

**Keywords** COVID-19 · Sustainable production · Sustainable practices · Environmental policies · Renewable energy · Sustainable consumption

## 1 Introduction

One hundred years ago, history's worst influenza pandemic (Spanish flu 1917-18) devastated communities and left millions of survivors, friends, and family to bear the heavy losses. Since then, human civilization has encountered several pandemics that mainly include; H1N2 Asian flu in 1957-1958, HIV/AIDS in 1981, SARS in 2003-2004, H1N1 in 2009-2010, Ebola in 2014-2016, Zika virus 2015-2016, and Ebola again in 2019. Recently, the world has

encountered another epidemic disseminated as COVID-19 originated in Wuhan, China (Zhu et al. 2020; Huang et al. 2020) and spread worldwide that induce World Health Organization (WHO 2020) to declare it as pandemic on March 11, 2020. By definition, a pandemic is a worst-case scenario when an epidemic spread beyond a country's borders. These epidemics globally impinged the number of mortalities, health risks and cost billions of dollars (Khan et al. 2020a; Awan et al. 2020; Allocati et al. 2016; Fan et al. 2019). These pandemics increase concerns regarding public

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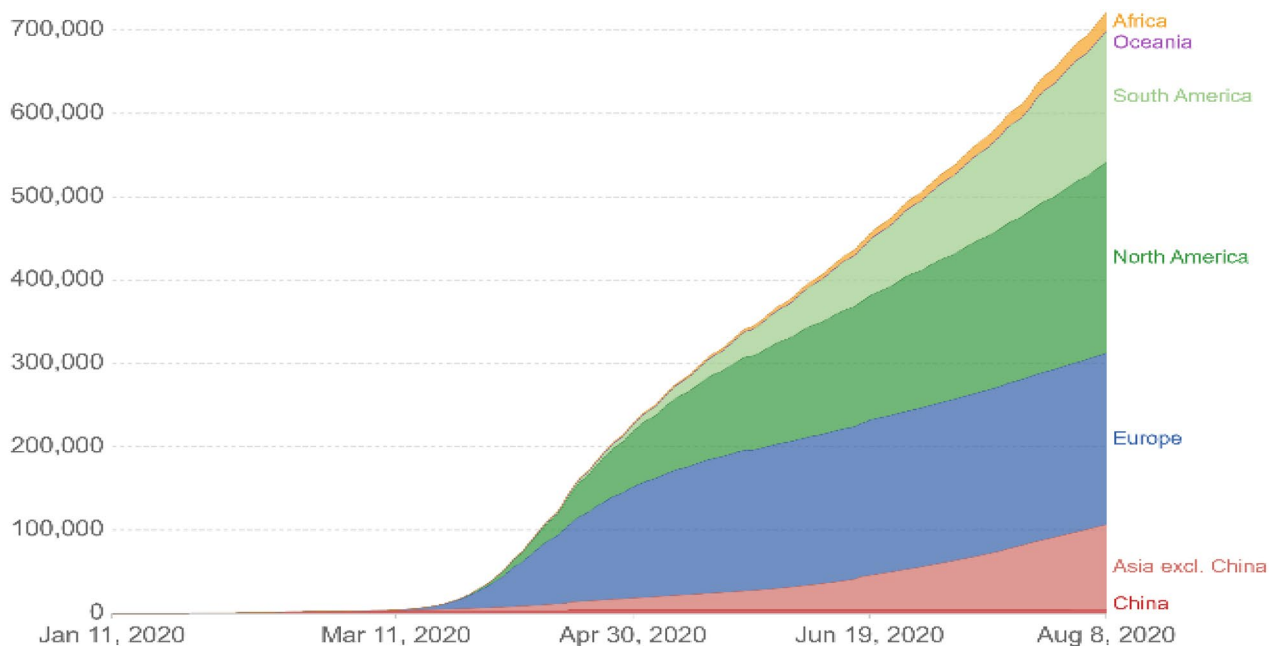
health and instigate ruinous socio-economic crises in the disease-ridden regions.

Amid rising socio-economic shocks of COVID-19 across the globe, about 40-60 million people fall into extreme poverty due to the informal sector's highest unemployment rate. Social insurance companies secure a few percentages of affectees. However, a major portion of about 55% of the world's population (as many as four billion people) is not covered by social insurance or social assistance. Besides, millions of people are trapped in the vulnerable category, prone to fall in poor with nominal economic shock. On the other hand, about 70% of COVID-19 quarantining women faced domestic violence that distorts their social status. These damages jeopardize our education system as nearly 1.2 (68% of total) a billion students are out of school. Furthermore, 1/3 of the world's IDPs live in 10 countries most at risk, about 1.6 billion informal workers lost 60% of their income, remittances are expected to fall by almost 20%, cutting off a significant lifeline to many vulnerable households, 27% decline in global trade, about 265 million people in low and middle-income countries at risk of acute food insecurity, about 850 million to 1.1 billion loss of international tourists and about 100 to 120 million jobs of tourism-based industries (UNDP 2020).

The outbreak has hysterically spread out to 210 countries worldwide and exceeds 19,804,420 confirmed infected cases, while 729,591 testified deaths as of 9th Aug 2020 (Worldometer 2020). In order to 'flatten the curve' (Avi

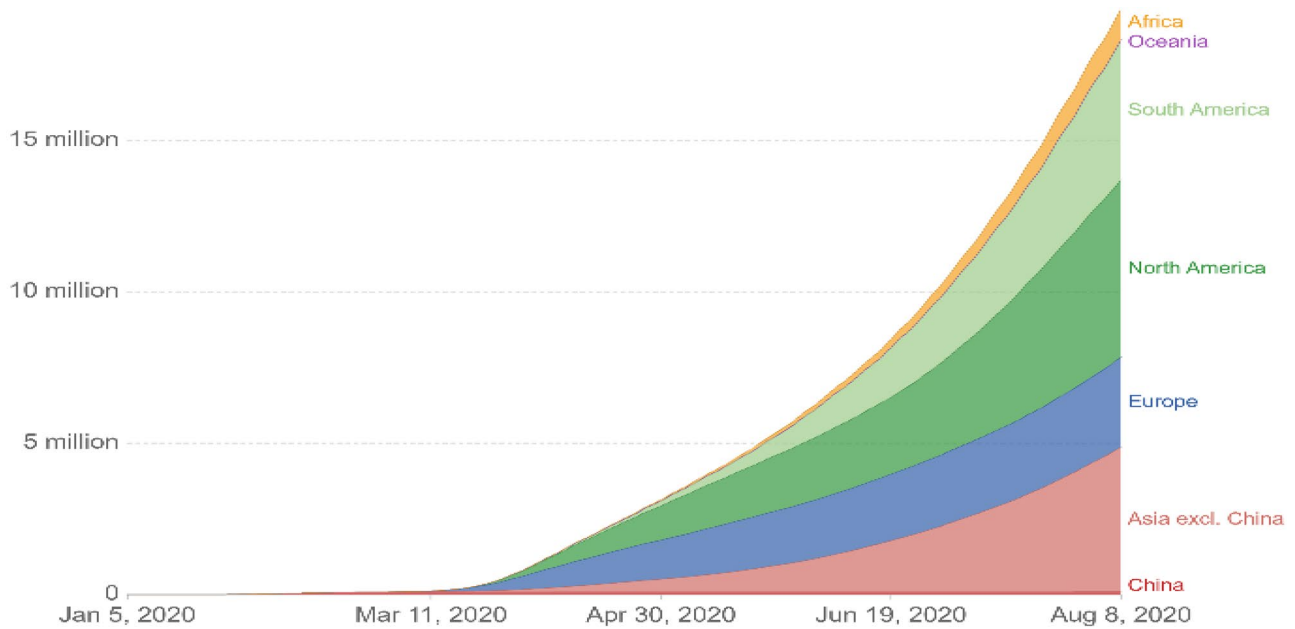
2020), governments have imposed travel restrictions, border shutdowns, business discontinuity, and quarantine (GOV UK 2020; CPN 2020) in countries which comprise the world's largest economies, sparking uncertainties of an imminent recession and economic crisis (Buck et al. 2020). Despite these efforts, some countries are still shown persistent growth in confirmed cases and deaths (Bai et al. 2020; Awan et al. 2018; Lai et al. 2020). This unforeseen fallout appears due to the inaccessibility of the disease-resistant vaccine and drug. Nonetheless, the top ten most affected countries, United States, Brazil, India, Russia, South Africa, Peru, Colombia, Chile, Spain, are worsening as 5,149,723 confirmed cases and 165,070 deaths 8<sup>th</sup> Aug 2020 (Worldometer 2020). The regional distribution of confirmed infected and deaths are given in the below Fig. 1 and Fig. 2.

Apart from global health risk, the social distancing and unprecedented business closures as a part of policy measure smashed host economies (Chakraborty & Prasenjit 2020), and fewer economic activity curtails industrial energy consumption, halting traveling activity that refines the environmental quality in terms of lower emissions and restoration of stratosphere Ozone (Zambrano-Monserrate et al. 2020; Tobías et al. 2020; Khan et al. 2020b; Khan et al. 2020c; Collivignarelli et al. 2020). A significant reduction (about 20%-30%) of NO<sub>2</sub> is observed in the most affected countries such as the USA, China, Spain, France, and Italy (Muhammad et al. 2020; Dutheil et al. 2020); Wang



Source: Ourworld database

**Fig. 1** Total Number of Confirmed COVID-19 Cases



Source: Ourworld database

**Fig. 2** Total Number of COVID-19 deaths

and Su 2020). Similarly, Kanniah et al. (2020) proposed that industrial and anthropogenic activities cessation due to COVID-19 lead to a significant reduction of harmful pollutants, which noticeably stemmed from the retrieval of ecosystems. Besides these studies, scientific calculations and satellite images confirm that air pollution in the form of nitrogen dioxide (NO<sub>2</sub>) emissions has dropped, which fosters the recovering rate of the stratosphere ozone layer (NASA 2020).

The temporary shutdown of global economic activities at once "retune" the ecosystem; however, the impending challenge is much harder than the prevailing one. Whopping unemployment rate and smashing economies around the globe, creating several social hazards that have far beyond

the impact on human life and natural balance. COVID-19 turmoil impact on society and economy can be judge through the shrinking of agriculture prices by 20% due to lower demands from restaurants; Brent Crude dropped by 24% from \$34/barrel (NPR 2020) to stand at \$25.70 (Business insider 2020), 1.2% reduction in Chemical industry the worst growth for the sector since the 2008 financial crash<sup>5</sup>. Moreover, a survey of the British Plastics Federation (BPF) shows 80% of respondents anticipated a decline in turnover over the next two quarters, with 98% admitting concern about the negative impact of the pandemic on business operations (BPF 2020). Table 1 further elaborate on the shrinkages in energy demand due to the closure of business activities across different countries that leads to lower emissions.

**Table 1** Reduction in energy demand in the lockdown period

Country	Lockdown Start	Lockdown End	Energy demand (ED)
USA	22nd March 2020	29th May 2020	ED decrease approx. 9% to 13%
Australia	23rd March 2020	15th May 2020	ED decrease approx. 8% to 10%
Belgium	18th March 2020	19th April 2020	ED of the industrial and commercial sector decreased by 70%
China	23rd January 2020	8th April 2020	ED decrease by 8% (Jan & Feb compared to the same period in 2019)
France	17th March 2020	11th May 2020	ED decrease by 6% to 12%
Germany	20th March 2020	20th April 2020	ED decrease by 4% to 6%
India	25th March 2020	4th May 2020	ED decrease by 30%
Italy	9th March 2020	4th May 2020	ED decrease by 10.1% in March and 22% after 22nd March
Portugal	13th March 2020	11th April 2020	ED decrease by 3% to 5%

Source: (EIA 2020; AEMO 2020; Rajvikram et al. 2020; S&P Global 2020)

Although a deceleration in the number of COVID-related deaths has caused some stabilization of oil prices and the stock market, there is still much uncertainty regarding the future of economies. The most devastating fallout of COVID-19 is on global poverty. According to the Oxford poverty human initiative (OPHI 2020) estimates that aggregate global multidimensional poverty (MPI) across the 70 countries could increase from 0.095 to 0.125 in 2020, which is the same value as around 2015. This increase in deprivations because of COVID-19 would set poverty reduction back by 5.2 years, with an additional 237 million people falling into multidimensional poverty across the 70 countries.

It is imperative to recognize the socio-economic impact assessment of COVID-19 to ensure food security, employment, poverty elevation, economic restorations, and sustainable development goal. Economies worldwide are injecting stimulus packages and incentive schemes to improve their inhabitants' socio-economic status, leaving additional debt burden on government deficits; stretching fiscal imbalances, amongst others. This may cause any future economic turmoil/crises; thus, global financial regulators and participating economies need to devise long-term socio-economic policies, where a reasonable investor would allocate to health infrastructure to counter any future set-back while ensuring the country's financial stability.

The next section explains the impact of COVID-19 on environmental pollution and the association between human health and pollution. Chapter three thoroughly evaluates economic fallouts of COVID-19 at a global level. Chapter four briefly explains the social consequences that emerged from the COVID-19. Chapter five concludes the entire discussion and provides policy implications and suggestions for regulatory bodies, the corporate sector, economists, and environmentalists to maintain environmental sustainability and compensate socio-economic losses due to COVID-19, which also paves a way towards sustainable development.

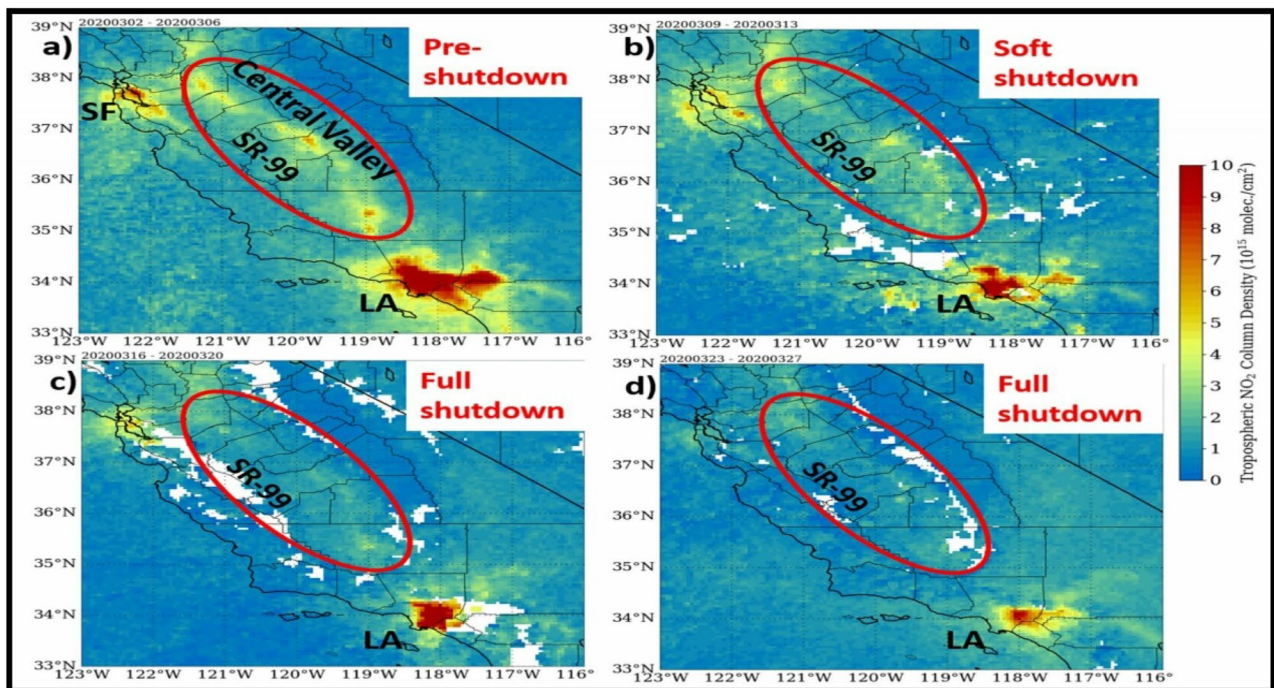
## 2 COVID-19: Opportunity to restore environmental sustainability

A rare benefit of COVID-19 is mainly attributed to the reduction of global pollution and restoration of natural ecology (Zambrano-Monserrate et al. 2020; Tobías et al. 2020; Collivignarelli et al. 2020). Several empirical studies, satellite images, and air quality ground data echo that air pollution in the form of carbon emissions, O<sub>3</sub> pollution, nitrogen dioxide emissions, carbon monoxide, amongst other pollutants, are reduced significantly. This also highlights that extreme pollution is a human-made phenomenon, and restoration of nature is imperative, indicating the potential to achieve sustainable production and consumption to avoid such environmental hazards.

Abrupted widespread of the COVID-19 leaves a mark on human socio-economic and ecological aspects. A unanimous lockdown and halted economic activities in China, Europe, and the USA tend to lower emissions that mainly emerged from industrial and transport activity (Shrestha et al. 2020; Zhang et al. 2019; Zhang et al. 2020). In order to minimize the COVID-19 impact, the social distancing and economic discontinuity measure improved terrestrial air quality by 20 to 30 percent in the USA, China, Spain, France, and Italy (Muhammad et al. 2020; Khan and Zhang 2020; Dutheil et al. 2020; Zhang and Khan 2020; Khan et al. 2021; Wang and Su 2020). In the same vein, Kanniah et al. (2020) confirm a reduction of O<sub>3</sub> pollution in industrial and anthropogenic activities due to cessation of economic activity as a response to widespread cases and deaths of COVID-19 patients. Similar insights are observed from Fig. 3, visualizing that environmental pollution progressively reduced after the closure of economic activity (Shutdown) and reach its minimal level in full shutdown. Figure 4 shows that lockdown measures until 25-April reduce the level of global carbon emissions by 15.1%.

On the other hand, a higher pollutant exaggerates the vulnerability of contagious diseases like SARS, MARS, and COVID-19 in the form of lungs infection and other respiratory disorder, which lead to higher mortality and morbidity rate; thus, pollution creating an overall adverse effect on global public health (Manisalidis et al. 2020; Khan et al. 2019; Khan and Dong 2017b; Pothirat et al. 2019). This phenomenon is empirically tested in Italy by Fattorini et al. (2020), who yields that respiratory diseases worsen in highly polluted cities. Likewise, the medical research also found a strong correlation between air pollution and severe health problems such as chronic obstructive pulmonary disease, breath shortness, and scratchy throat and further lead to worst diseases of lungs such as asthma (Linardon et al. 2020; Martelletti and Martelletti 2020; Khan et al. 2019b; Arjomandi et al. 2018; Khan et al. 2017; Yin and Wunderink 2018; Khan et al. 2018; Khan and Dong 2017; Wilson et al. 2017; Khan 2019; Carugno et al. 2016), which are similar to the indications adhered by novel COVID-19. Figure 5 visualizes the historical fossil fuel consumption globally, representing an increasing trend till 2019. However, after the 2020 COVID-19 lockdown measure, the emissions level dropped sharply.

The COVID-19 exposes the global health system's resistance capacity and infrastructure that highlights the importance of additional public health measures in higher R&D to deal with contiguous diseases while improving necessary health infrastructure. Moreover, a sustainable economic system with minimal pollution and resource conservation is a prerequisite to increasing people's immunity and resistance. Tough undesirably, nature nowadays is observed as a "retuning" for ecosystem and humans, given the ecosystem a "recuperative time" with decreased interference of humans in the natural environment. For the sake of brevity, some recent empirical studies are concluded in Table 2.



Source: NASA (2020)

Fig. 3 Environmental pollution before and after shutdown

### 3 COVID-19 and longlasting economic Losses COVID-19 and longlasting economic losses

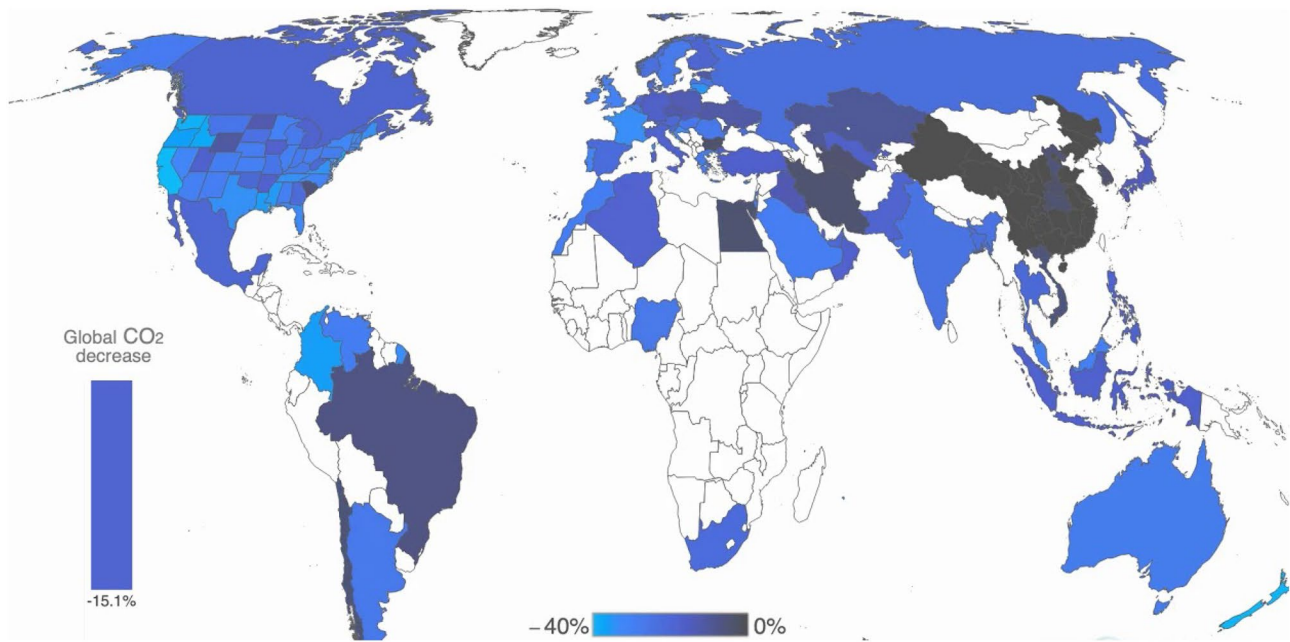
After the global financial crisis, the world economy faced new COVID-19-related obstacles that turned into an economic crisis response to state closures of economic activities. The current pandemic outbreak (COVID-19) has a profound impact on national and foreign economies. Apart from the massive loss of human lives, the world economy has undergone destruction on an unparalleled scale in many economies. COVID-19 may destroy individual livelihoods, companies, markets, and economic activities in general. From 21<sup>st</sup> February to 24<sup>th</sup> March 2020, the COVID-19 crisis escalated worldwide, with an increasing number of confirmed cases every day. Numerous organizations are experienced multiple issues with a definite amount of damages. Primarily, companies are suffering a multitude of challenges as a deterioration in demand, interruptions in the Supply chain, revocation of export orders, shortage of raw material, and distortion in transportation networks (Naqvi 2020). However, companies worldwide are witnessing the substantial consequences of the current outbreak on their business operations (World Economic 2020).

Williams (2013) observed that the epidemic diseases severely undermine the country's business operations, as

economic activities are highly reliant on money mobilization, which is adversely affected by the current pandemic. The economic and social consequences of the epidemic can be seen in locking cities worldwide, constraints on labor mobility, travel prohibitions, shutdown airline operations, and slowing down economic activities.

COVID-19 would significantly impact developing countries, making it much harder to introduce effective stimulation without experiencing strict foreign exchange restrictions (UNCTAD 2020). The most fragile countries are those with poor health infrastructure, highly reliant on trade and tourism, heavily indebted, and consist of unsteady capital flows (World Bank 2020a). The management of the outbreak of COVID-19 is attempting to revive the economy, but even after 2020, there is still a high risk of continued financial stress until economic activities resume properly. (World Bank 2020a).

The COVID-19 outbreak is anticipated to have substantial implications for overall GDP growth (World Economic, 2020). In the trend, global development is projected to rebound in the second quarter of 2020. In 2021, growth is expected to rise to 5.4%, almost 0.4% below the April forecast. Consumption is expected to rise next year with strengthening investment steadily. In 2021, the Global GDP as a whole is projected to exceed its point of 2019. Nevertheless, the IMF predicts this year's global economy



Source: Global Carbon Project 2020

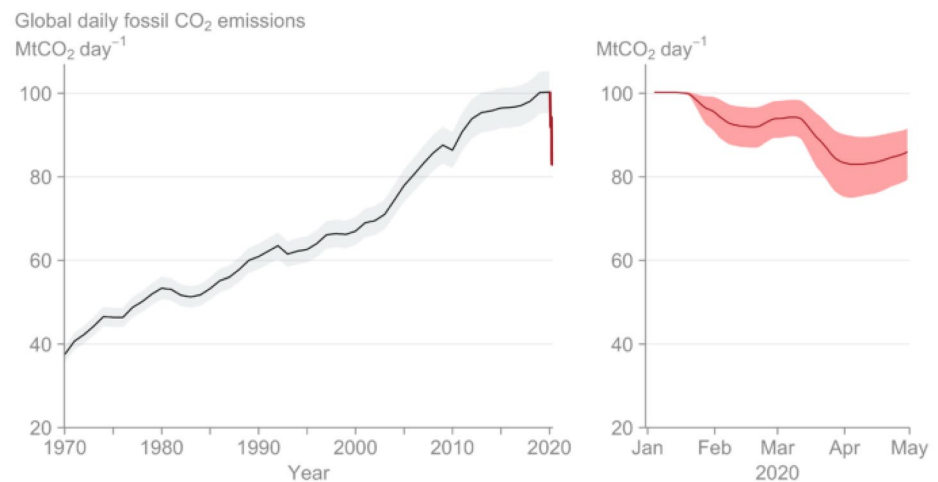
**Fig. 4** Changes in CO<sub>2</sub> emissions (during the COVID-19 forced confinement)

will diminish by 3%. Figure 6 exhibits the projected GDP growth indicating an increasing trend in COVID-19 and a progressive recovery in the subsequent quarter.

While it said the COVID-19 pushed the planet into a "crisis like no other," it predicted that global economic growth would accelerate to 5.8% next year if the outbreak disappeared in the second half of 2020 (IMF 2020). Recovery in major services-related economies, such as the UK or Italy, severely affected by the outbreak anticipated

being a slow process. The growth rate in 2021 for developed and emerging markets is anticipated to accelerate to 5.9%, mainly reflecting China's revival forecast (8.2 percent). The group's growth rate, excluding China, is forecast to be 5.0% in 2020 and 4.7% in 2021, leaving 2021 GDP marginally below its 2019 rate for this segment of emerging markets and developing economies (Economics 2020). Table 3 compiles real GDP growth comparison with corresponding past and projected future values.

**Fig. 5** Global daily fossil CO<sub>2</sub> emissions

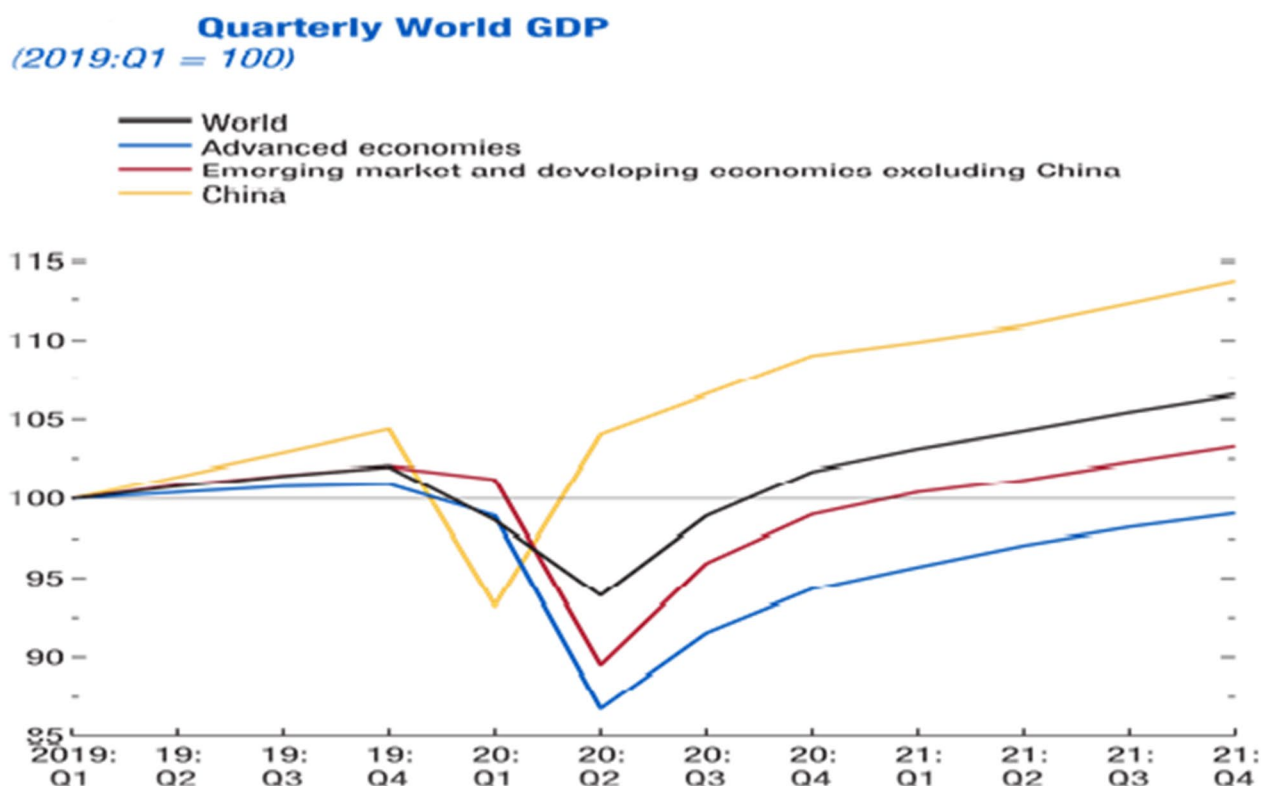


Nature Climate Change (2020); Global Carbon Project

**Table 2** Summary of the relationship between COVID-19 and environmental pollution

Authors	Title	Time/Country	Variables	Finding
Berman and Ebisu (2020)	Changes in US air pollution during the COVID-19 pandemic	January 8th–April 21st in 2017–2020. USA	# of COVID cases, Nitrogen dioxide (NO <sub>2</sub> ), Particulate matter (PM <sub>2.5</sub> )	↑ COVID ↓ NO <sub>2</sub> ↑ COVID ↓ PM <sub>2.5</sub>
Pata (2020)	How is COVID-19 affecting environmental pollution in US cities?	January 15, 2020 to May 4, 2020 US States	COVID-19 Shocks (lockdown), Particulate matter (PM <sub>2.5</sub> )	↑ COVID ↓ PM <sub>2.5</sub>
Zoran et al. (2020)	Assessing the relationship between surface levels of PM <sub>2.5</sub> and PM <sub>10</sub> particulate matter impact on COVID-19 in Milan, Italy	1 January–30 April 2020 Milan, Italy	# of confirmed COVID cases and deaths, Nitrogen dioxide (NO <sub>2</sub> ), Particulate matter (PM <sub>2.5</sub> PM <sub>10</sub> )	↑ PM <sub>2.5</sub> ↑ COVID ↑ PM <sub>10</sub> ↑ COVID
Broomandi et al. (2020)	Impact of COVID-19 Event on the Air Quality in Iran	21st March to 21st April in 2019 and 2020 Tehran, Iran	# of confirmed COVID cases and deaths, NO <sub>2</sub> , Sulphur dioxide SO <sub>2</sub> , Ozone pollution O <sub>3</sub> , PM <sub>2.5</sub>	↑ COVID ↓ NO <sub>2</sub> ↑ COVID ↓ SO <sub>2</sub> ↑ COVID ↑ O <sub>3</sub> ↑ COVID ↑ PM <sub>2.5</sub>
Menut et al. (2020)	Impact of lockdown measures to combat COVID-19 on air quality over western Europe	March 2020 Western Europe	# of COVID cases/Lockdown, Nitrogen dioxide (NO <sub>2</sub> ), Particulate matter (PM <sub>2.5</sub> )	↑ COVID ↓ NO <sub>2</sub> ↑ COVID ↓ PM <sub>2.5</sub> ↑ COVID ↓ O <sub>3</sub>
Dang and Trinh (2020)	Does the COVID-19 Pandemic Improve Global Air Quality? New Cross-national Evidence on Its Unintended Consequences	From October 1st, 2019 to June 1st, 2020. Global Sample	# of COVID cases/Lockdown, Nitrogen dioxide (NO <sub>2</sub> ), Particulate matter (PM <sub>2.5</sub> )	↑ COVID ↓ NO <sub>2</sub> ↑ COVID ↓ PM <sub>2.5</sub> ↑ COVID ↓ O <sub>3</sub> ↑ COVID ↓ AQI
Shahzad et al. (2020)	Asymmetric nexus between temperature and COVID-19 in the top ten affected provinces of China: A current application of quantile-quantile approach	From 22 January 2020 to 31 March 2020 Ten most-affected provinces in China	# of COVID cases and Temperature (Temp)	↑ Temp ↑ COVID
Yongjian et al. (2020)	Association between short-term exposure to air pollution and COVID-19 infection: Evidence from China	January 23, 2020 to February 29, 2020 China	# of COVID cases and Air quality indicators	↑ NO <sub>2</sub> ↑ COVID ↑ CO ↑ COVID ↑ PM <sub>2.5</sub> ↑ COVID ↑ PM <sub>10</sub> ↑ COVID ↑ O <sub>3</sub> ↑ COVID
Persico and Johnson (2020)	The Effects of Increased Pollution on COVID-19 Cases and Deaths	66 administrative regions Italy, Spain, France, and Germany.	# of COVID deaths	↑ NO <sub>2</sub> ↑ COVID

Source: Authors Compilation (↑ = Increase/decrease, COVID = Pandemic)



Source: IMF 2020

**Fig. 6** Projected GDP growth before and after COVID-19 crises

The global COVID-19 outbreak is anticipated to impact global GDP between 2.3% and 4.8% (ADB 2020). This persistent epidemic has also been projected to decline overall FDI by 5% to 15% (UNDP 2020b). UNCTAD report stated that the world desperately required a \$2.5 trillion support package to deal with the damages (UNDP 2020a). Therefore, the current global recession is expected to be much worse than the crisis of 2008 (UNCTAD 2020). Also, the International Labor Organization (ILO) found that around 25 million people worldwide could lose their jobs (income losses of workers as high as US\$ 3.4 trillion) (ILO 2020b). Developing countries' income losses are expected to reach \$220 billion (UNDP 2020b).

Moreover, World Bank anticipated that South Asia might appear in its worst economic outlook in 40 years, as almost half of the nations dropped into severe recession (World Bank 2020b). Worldwide businesses, regardless of scale, dependent on China's materials, have begun to experience production contractions. Suspension of transport channels between countries further hindered global economic activity. Furthermore, some customer and company turmoil has disrupted normal business trends and generated market anomalies.

The business activities of micro, small, and medium-sized enterprises are the primary victim of COVID-19.

Compared to large enterprises, they typically lack adequate resources, particularly monetary and managerial resources, and therefore are not equipped for these shocks that are persistent in staying longer than anticipated (Bartik 2020). Moreover, access to labor, production stagnation, raw material shortages, and transportation constraints would significantly affect these enterprises.

#### 4 The social disruption of COVID-19

The COVID-19 pandemic has headed all suffered economies worldwide to unprecedented action, trade interruptions, and an intense global economic crisis. These all challenge the supply of essential medicines and other resources. The distributors' export restrictions of both COVID and non-COVID goods, i.e., India, banned various critical active pharmaceutical ingredients (APIs) and finished products, while these restrictions have since been revoked in the UK, similar exports have been suspended. Moreover, medicines' slow production process severely exaggerated many countries (Anthony McDonnell 2020). The COVID-19 pandemic has raised a sophisticated threat to Healthcare worldwide. In general, healthcare Workers are facing one



**Table 3** Real GDP Growth (Past, Current and Projected)

Selected Economies	Real GDP Growth (Percent Change)			Projections		The difference from April 2020 WEO Projec- tions 1/
	2018	2019	2020	2021	2020	2021
Argentina	-2.5	-2.2	-9.9	3.9	-4.2	-0.5
Australia	2.8	1.8	-4.5	4.0	2.2	-2.1
Brazil	1.3	1.1	-9.1	3.6	-3.8	0.7
Canada	2.0	1.7	-8.4	4.9	-2.2	0.7
China	6.7	6.1	1.0	8.2	-0.2	-1.0
Egypt 2/	5.3	5.5	2.0	2.0	0.0	2.8
France	1.8	1.5	12.5	7.3	-5.3	2.8
Germany	1.5	0.6	-7.8	5.4	-0.8	0.2
India 2/	6.1	4.2	-4.5	6.0	-6.4	-1.4
Indonesia	5.2	5	-0.3	6.1	-0.8	-2.1
Iran 2/	-5.4	-7.6	-6	3.1	0.0	0.0
Italy	0.8	0.3	12.8	6.3	-3.7	1.5
Japan	0.3	0.7	-5.8	2.4	-0.6	-0.6
Kazakhstan	4.1	4.5	-2.7	3.0	-0.2	-1.1
Korea	2.9	2.0	-2.1	3.0	-0.9	-0.4
Malaysia	4.7	4.3	-3.8	6.3	-2.1	-2.7
Mexico	2.2	-0.3	10.5	3.3	-3.9	0.3
Netherlands	2.6	1.8	-7.7	5.0	-0.2	2.0
Nigeria	1.9	2.2	-5.4	2.6	-2	0.2
Pakistan 2/	5.5	1.9	-0.4	1.0	1.1	-1.0
Philippines	6.3	6.0	-3.6	6.8	-4.2	-0.8
Poland	5.3	4.1	-4.6	4.2	0.0	0.0
Russia	2.5	1.3	-6.6	4.1	-1.1	0.6
Saudi Arabia	2.4	0.3	-6.8	3.1	-4.5	0.2
South Africa	0.8	0.2	-8.0	3.5	-2.2	-0.5
Spain	2.4	2.0	12.8	6.3	-4.8	2.0
Thailand	4.2	2.4	-7.7	5.0	-1.0	-1.1

Source: IMF-World Economic Outlook-June 2020

of the world's most disadvantaged health issues. High healthcare prices, shortage of safety equipment like N95 Masks, and low ICU beds and ventilators determined vulnerabilities in patient care quality.

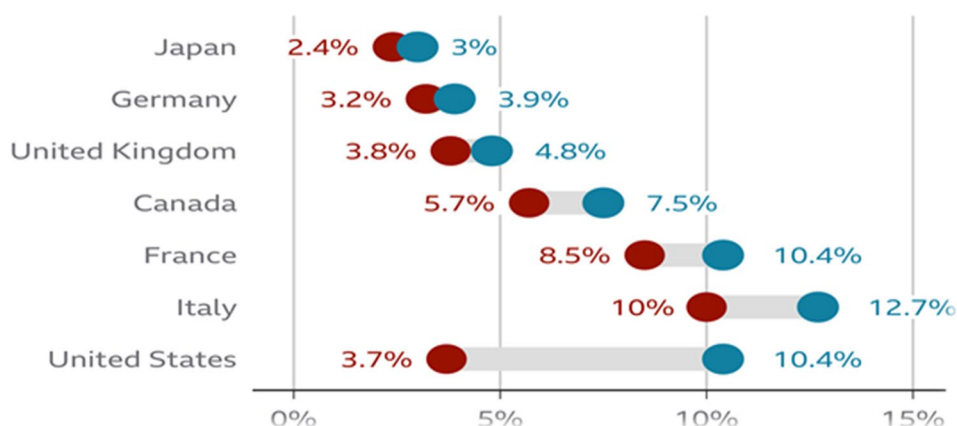
Although the outbreak's economic effect persists and becomes more and more volatile, it is quite clear that developing thrifths will be unexceptional before it is strengthened. (UNCTAD 2020). However, poverty is projected to be raised at approx. 11 million people. (World Bank 2020a). The pandemic of COVID-19 gradually became the greatest economic and human catastrophe in our lives, spreading to all nations. The pandemic's consequences affected the most fragile and pushing them behind. The United Nations report found that COVID-19 has reversed the growth of poverty, Healthcare, and education. During the short period, the COVID-19 pandemic triggered an extraordinary disaster, causing more damage to Sustainable

development, with the world's poor and vulnerable most affected (United Nations 2020). A more recent ILO study indicates that 81 percent, or approximately 2.7 billion employees, of all global employees (ILO) are affected by the lockdown (ILO 2020a). Figure 7 displays the strike in unemployment between 2019 and 2020.

According to the IMF (2020), the share of unemployed people in the United States reached 10.4 percent and marked the end of this decade of growth as one of the world's leading economies. Millions of the workforce have also been placed into government-supported job protection schemes as economic sectors such as tourism or hospitality have been shut down (Jones 2020). Moreover, the COVID-19 economic downturn badly hit women's workforces and create an anomaly of gender inequality. Unlike previous crises, women's employment is a considerable risk than men's, mainly due to the service sector's downturn.

**Fig. 7** Countries with the striking unemployment rate

### Yearly unemployment rate change, 2019-2020



Sources: IMF-World Economic Outlook- June 2020.

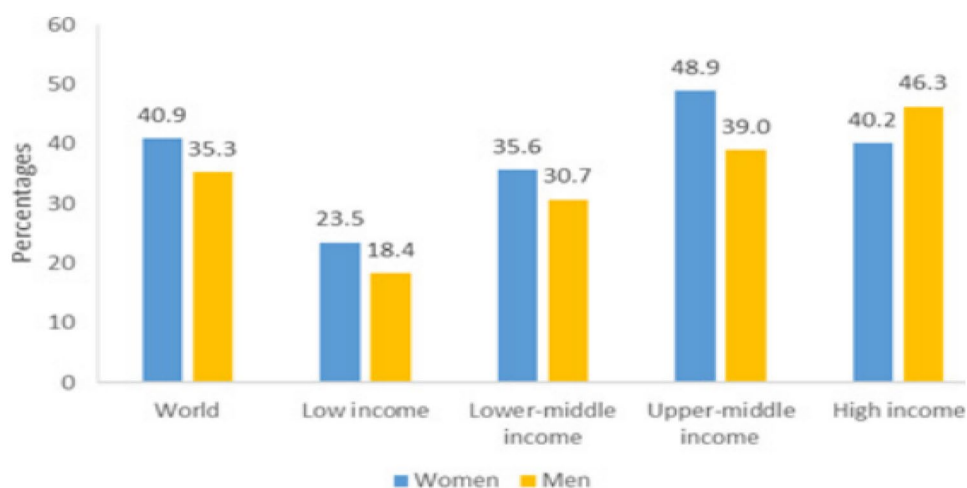
Simultaneously, women represent a significant proportion of front-line employees, particularly in the health and social care sectors.

Furthermore, the increased burden of unpaid treatment caused by disasters affects women more than men. Until the COVID-19 crisis, 1.3 billion or 44.3% of women worldwide were employed, compared to 2 billion or 70% of men (ILOSTAT 2020). However, economic downturns impact males more than females, considering that males appear to be involved by industries closely linked to economic cycles (e.g., construction and production), while in industries less vulnerable (e.g., health care and education), females dominate. The economic downturn of COVID-19 varies from previous crises, considering that industries desensitized to economic instability absorb a significant proportion of female jobs. In 2020, 527 million women work in these industries, comprising 41% of total female jobs than 35% of total male jobs. This means that the current epidemic is likely to upset women's jobs more severely than

men's (ILOSTAT 2020). Since the COVID-19 crisis has a substantial impact in specific ways on women workers, there is a possibility that some developments from these decades will be reversed, and gender inequalities intensified in the labor market. Figure 8 shows the global status of vulnerable employees due to lower wages and fewer working hours.

COVID-19 reforms trigger haphazard conditions in many of the world's counterparts, resulting in scarcity of food for consumption, contributing to rising food prices across countries that ultimately curtail the general public's purchasing power. Even though the distortion in the global supply chain of food has gained public interest. The influence of the current pandemic on agricultural output has not been fully understood; most current studies are based on logistics and supply of goods FAO (2020a); Gong (2020); Gray (2020); Reardon (2020). Throughout the outbreak, typical offline distribution networks were ineffective. Also, on one side, the short-term demand for agricultural products collapsed due to the quarantine policy. "Closed community/

**Fig. 8** Share of employment currently at high-risk of reduction in working hours, cuts to wages and layoffs, by sex, 2020



Source: ILO calculations based on ILO.

village management” and “outdoor family restrictions” laws drastically reduced recurrence rates and outside consumption. The closing of traditional urban sales departments compelled buyers not to purchase as intended. On the other hand, due to logistics restraints, supply chains were shattered. Both inter-regional and intra-regional logistics instantly gave way to medical workers and supplies.

China’s lessons revealed that the shutdown of people’s activities/movements against COVID-19 interrupted production in all affected economies. That is a substantial hazard to the long-term food supply (FAO 2020b). However, such cases are not only observed in China but also in other economies. This revealed that the extensive pandemic had a more significant effect on unpreserved agricultural output. Although the prevention and control measures disrupted the existence growth cycle of agricultural goods, further disrupting regular food supply cycles and rising medium-term market volatility. In Asia, where the population is enormous, and the demand for essential grain is exceptionally inelastic. Lower supply may lead to higher prices. Additionally, the current epidemic might perhaps accelerate the swing of the “double season” rice crop system into a “single season,” a long-term threat to overall production and lead towards an extreme shortage of food (Qiu 2020).

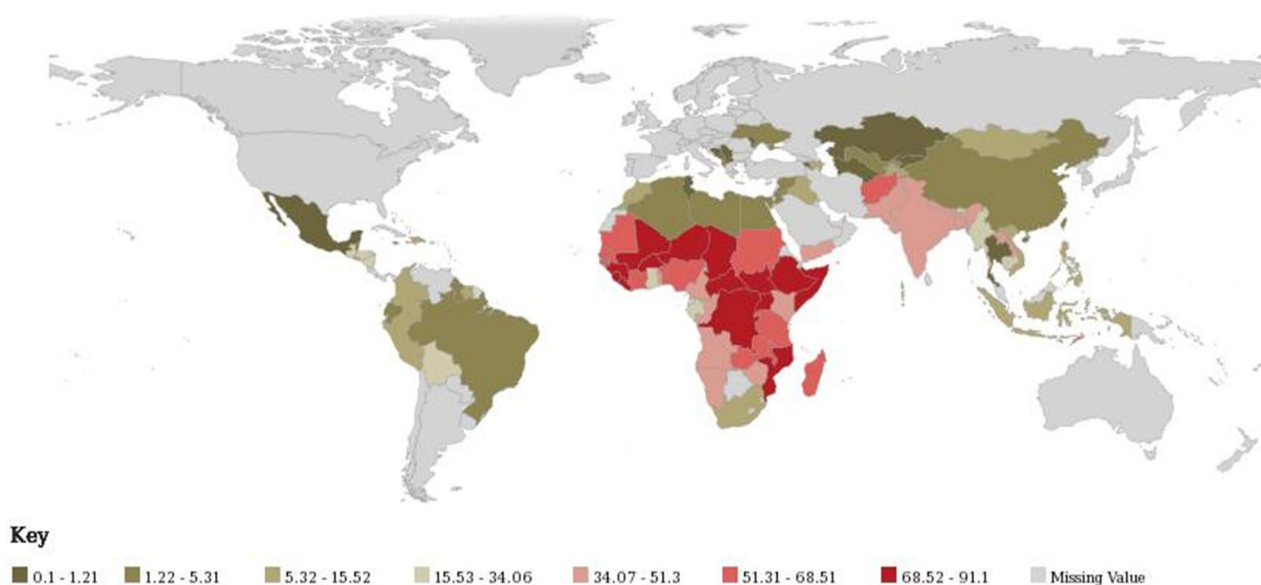
Figure 9 shows the spatial distribution of multidimensional poverty across the globe. The dark red color indicates higher multidimensional poverty in most of the COVID-19 affected countries, among others.

## 5 Conclusion and policy implications

SARS-COV-2 pandemic has truly transformed the world, sparing no country in its path; the communicable disease due to globalization spread quickly worldwide. To prevent the spread, governments worldwide are propagating; 20s soap water handwash, facial cover (mouth and nose), sanitizer, social distancing (avoid crowded places), avoid contact with sick people, and the stricter countermeasure includes lockdowns and smart lockdowns. The world is trying to adjust as the impact has been on all three P’s: profit, people, and the planet. Profit and people are negatively affected; however, COVID-pandemic has been a blessing in disguise for the planet.

The lockdowns are the most strict measure to counter the communicable disease, restricting public movement. In this restriction, a stark decline is observed in consumer demand for both tangibles and intangibles products. The effect is demand and supply and the restriction of idle factories to protect the massive workforce infected with the deadly virus. Businesses are now at a standstill and even fear closure permanently. In the aviation industry, the International Air Transport Association (IATA) is expected to book a loss of US\$ 84 billion in 2020, with hundreds and thousands lay off (Khan et al. 2021b; IATA 2020).

The societal impact because of movement restriction is affecting public mental and physical health. Work from home is new for employees whose social-economic conditions are better. The work from home and



Source: OPHI, 2020

**Fig. 9** Spatial distribution of Multidimensional poverty (H) (%)

unemployment in the pandemic will result in a high fertility rate worldwide. Husbands and wives and partners now have more time to think to increase their family. The other reason for a higher rate is less awareness of contraceptives and education in developing countries. A disturbing trend that is also observed in COVID extended lockdowns is the high rate of divorces. The measure of social distancing has its fallout, too; people cannot socialize, which has psychological consequences like violence and early stages of depression.

The most troublesome societal impact is on patients with severe ailment who needs cancer radiation therapy, kidney dialysis, or children with routine vaccination and pregnant mothers are one of few such examples. Hospital logistics faces failure in both developed and developing countries as the current health system has collapsed. The food supply and education sector are also severely affected; countries and cities have good technological infrastructure coped by conducting online classes in schools and universities. Food supply, although it is still a looming crisis in densely populated cities. However, as time pass, governments and corporates are learning to handle food logistics. Due to less supply of commodities, prices have risen. Along with the price hike of essential goods, there is an observable escalating unemployment rate to a dangerous level globally and, as a result, climbing crime rate.

Government lockdown has been a blessing in disguise for the planet and environment, the only positive impact observed by researchers. Hard facts prove that air quality worldwide has improved with decreasing CO<sub>2</sub> emissions. As a result, a sharp decline of 3 to 4C is recorded, and ozone in many parts of the world is repaired due to less air pollution. The main reason for fewer carbon emissions is the closure of non-essential factories, restriction on air travel, and the ban on public transport for the daily commute. Oceans and lakes ecosystems are globally repaired due to less traffic. Medical waste is the only negative on the environment, as PE dresses and disposal mask usage has increased many folds, PE used by medical staff and disposable facial masks. The positive impact on the environment is significant in contrast to medical wastages. Air quality test results make headlines and much relief for the public to breathe fresh air (Picheta 2020). However, it is pertinent to mention that the repair is for till lockdowns are in place. In this COVID pandemic, the only good news is that the Himalayas are visible for the first time in 50 years, quite welcoming and remembered.

We suggest government officials, Healthcare personal, and environmentalists worldwide the following short term actions and long term strategies fight the COVID pandemic more effectively:

## 5.1 Short term actions

1. To immediately form a pandemic task force, enabling them with technology and human resource. The task force will serve as an anchor for all the coordinated actives needed to countermeasure the pandemic. As the decision making will be centralized, the multi-echelon network can easily balance the essential requirements of food and medical items in the whole system. Further correct information at the right time can be shared with all stakeholders.
2. Regional food and medical supply warehouses and small distributions centers are needed to be built in public parks or at the center of the cities for efficient distributions in densely populated areas.
3. Health care facilities should be mobilized; lorries, cars, and motorbikes can be used for the purpose. Motorbikes can be most effective in densely populated areas, quickly responding to any emergency.
4. Smart lockdown is the most effective measure which can help the economy and prevent further spread. The only area which is affected the most be quarantine and people in other areas with necessary measures (facial mask and social distancing) can operate with ease.
5. AAA (accessible, affordable, and available) communication should be provided to the masses. 3G or 4G internet technology is most suited for the purpose. AAA communication can help authorities to connect and assist the public during emergencies. Cellular technology and smartphones are the most reliable.
6. Telehealth portals' formation can reduce pressure on hospitals as sick patients can avoid going to the already stressed health system due to COVID infection.
7. Agri emergency on the essential item is also an important step to prevent any shortage during the COVID crisis as the crisis global, and all agri-exporting countries are still recovering from lockdowns.
8. TTT (track, trace, and test) for early COVID detection has been very effective and should be implemented in every country. This will also assist in smart lockdowns, and businesses in areas with no infections can function normally.
9. Combine testing of 20 or more suspected COVID patients can reduce overall testing costs. A large population can be tested in less time.
10. Mobile Testing should be conducted to identify most infected areas in cities, which help in smart lockdown and health personal can better focus as per data.
11. Awareness campaigns with NGOs' help should start on all mediums, so people can better care and help to stop the spread. Rural areas in developing countries are always not well connected. Person to person interaction by a health worker would guide for better prevention.

## 5.2 Long Term Strategies

1. Disaster management is now the most important matter at hand. Countries need to enact laws and built provisions to deal with such calamity in the future. An organized agency should be established to handle matters more efficiently.
2. The collection of public data is essential to organize healthcare and food supply activities. However, privacy laws in many countries prevent the government from collecting any such information. This should be handled amicably, removing any public mistrust in the exercise. Encrypted data and blockchain will be beneficial, as ledgers will not easily be decoded to extract personal information.
3. Reshoring of essential items should, for some items, be planned to avoid any food and medical shortages. Laws should be made for ease of business.
4. Food logistics is the most neglected of all areas, which has caused crises during the COVID pandemic. Permanent regional distribution centers must be an integral part of city planning.
5. Water and sanitation need improvement, especially in developing countries. Budget and designated offices should overlook the system for a continuous supply. Countries with coastal areas should use seawater by adopting desalination filtration technology for continuous water supply, drinking, or personal hygiene.
6. Environmental gains that the world has yielded should not be forgone, and laws must be enacted to keep the pace steady. During the lockdown, power consumption has risen, and the world needs an alternate source of clean energy. The most reliable and ecofriendly source is the sun. Countries should levy taxes on furnace oil and coal to discourage use. The collected tax amount should be spent to make solar technology more affordable. If a country does not possess such scientific infrastructure, tech companies should be engaged to import technology, which trains locals for self-sustenance.
7. Air is another clean source for power production and should be exploited. Coastal areas are the best site selection for such installations.
8. Transport and automobile are some of the contributors to carbon emission. Developing countries must improve public transport to reduce air pollutions. City Governments should encourage the use of circular trains by keeping fare low. The government should encourage companies to invest in eco-friendly electric cars and motorbikes to reduce carbon emission further since the global temperature has reduced to 3 to 5C, which is very encouraging and motivating.
9. Countries must rethink city planning; densely populated areas should be replanned to avoid any such calamity in the future. If the population influx from a rural area is work-related, more opportunities should be provided, so population influx should stop, putting less burden on city infrastructure.
10. Countries with the tourism industry should opt for seasonal tourism only. Seasonal tourism will allow the ecosystem to repair. Environmental test results in the COVID pandemic is clear evidence that people are the most anthropogenic stressors.

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