PART 4

02

COVID-19, Lockdown and the Environment: Policy Response and the Way Forward

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Crisis and Fragility: Economic Impact of COVID-19 and Policy Responses

COVID-19, Lockdown and the Environment: Policy Response and the Way Forward

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Abstract

The Coronavirus, which originated in China, has been declared a global pandemic and already affected over 24 million people and caused over 830,000 deaths globally. Unlike many countries that attempted a short or partial lockdown of their territories, India has enforced a preemptive national lockdown. Through this, India could avoid the rapid spread of COVID-19 during its initial months of the pandemic when the system and society was unprepared. Now, although COVID-19 is on an exponential growth path, India could manage to have the highest recovery rates and lowest fatality rates among all countries in the world, which can be attributed largely to the national lockdown. It could also avoid the incidence of mortality to the tune of 13 times the registered mortality. The great Indian lockdown, due to its longer span and the huge Indian population, has many negative impacts and yet some very positive impacts. This paper explains all such impacts and also analyses the opportunities that this crisis has brought to the fore and makes suggestions for converting the changes into transformations.

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1. COVID-19 – The Global Pandemic[1]

The Coronavirus, which originated in China during the later part of 2019, has affected 215 countries and territories in the world and the resulting COVID-19 disease became a global pandemic as declared by the World Health Organization (WHO). The total number of infections reported across the world are 24,339,123 as on 28th August 2020 (20:00 IST) of which 829,742 have died of COVID-19 related complications and 16,877,167 cases have recovered from the infections. There are still 6,632,214 infections being treated globally. With daily new cases registered globally on the rise the pandemic has yet to reach its first peak.

Though very small compared to the Plague (100 millions deaths) and Spanish Flu (500 millions infections and 50 million deaths), the present pandemic has affected about 25 million people globally. The fact that 50% of these cases are coming from only three countries and many other heavily populated countries such as China, Indonesia, Nigeria and Vietnam have yet to be exposed to the COVID-19 pandemic presents an imminent threat to the world.

Among the major countries affected by this pandemic so far, India has the lowest tests per million population and also the lowest fatality rate at 44-deaths/million population. Observing the progression of the pandemic in the US and India, it is clear that India has flattened the curves during the initial months of the pandemic and that has saved India from a surge of cases and fatalities in the initial and vulnerable periods of the pandemic. This establishes the fact that India has dodged effectively the front-runners disadvantage[2] into the pandemic. Although the first case in the US and India appeared at the same time (February 2020), India could flatten the curve of daily cases as well as total registered cases and that has resulted in a much better situation with respect to the fatality rate (44 deaths in India against 554 deaths in the US per million population). As shown in Figure 1, the area in the dashed line represents the COVID19 cases avoided in the initial months of the pandemic in India. Consequently, the daily deaths avoided during the same period in India are highlighted by the dashed line in Figure 2.

1. Data as on 28th August 2020 was used in this analysis. As the pandemic progresses, the numbers tend to change.
2. Front-runners are the countries that are subjected to certain disadvantages such as low awareness about the disease and poor preparedness of the system and lack of established disease management protocols.

2. The *Great Indian Lockdown* and the Controlled Fatality of the Pandemic

As the development of a vaccine takes at least a year's time (now expected to have it by early 2021), the onset of the pandemic has been managed by adopting *social distancing*[3] and imposing lockdowns. Given the severity of the infection and its fast-spreading nature, a number of countries have locked down their respective territories and confined their citizens to indoors as it has been considered as the only option to contain this global pandemic. Following many pandemic-hit countries globally, India also has resorted to a national lockdown.

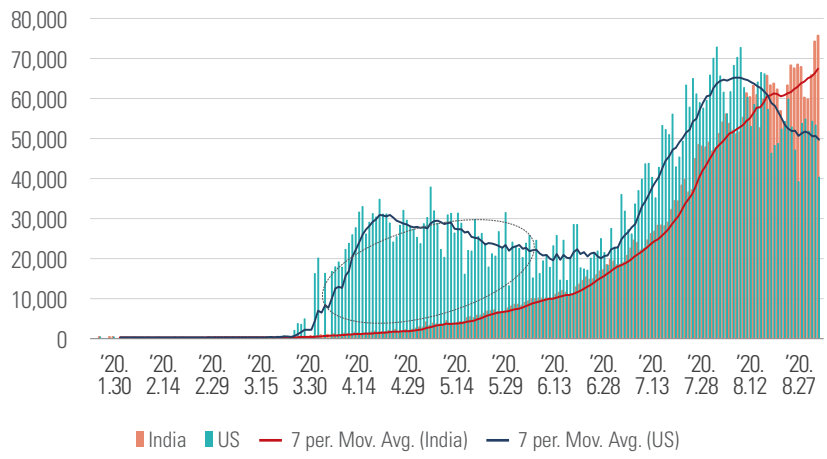
2.1. The Great Indian Lockdown

India has been one of the countries to announce a nation-wide lockdown at an early stage of the pandemic when the confirmed infection cases were around 500 only. The first lockdown (LD.1) was announced on 24th March for 21 days, bringing one of the largest lockdowns ever in the world to reality. A population of over 130 million was confined to their homes and the entire economic activity came to a standstill. Only essential services were exempted from the lockdown. The Government of India has extended the lockdown further in four phases, as shown below.

3. Social distancing is the maintenance of 3ft (or 1 meter) distance between individuals.

Figure 1.

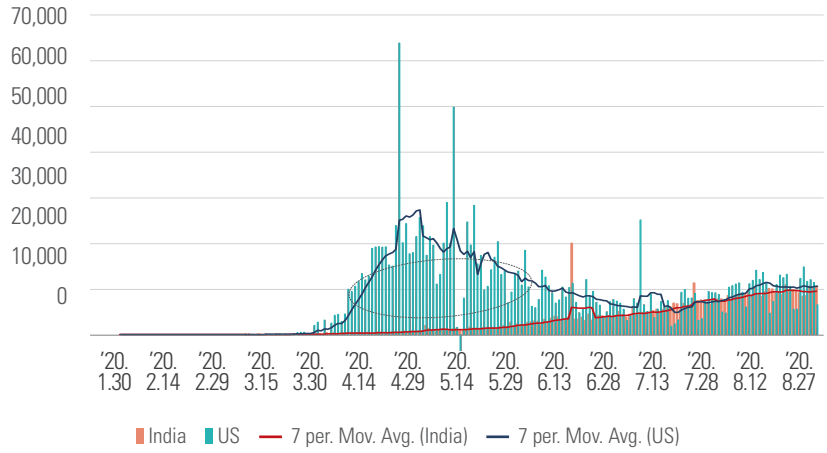
Comparison of Daily New Cases Registered in the US and India



Source: Graph developed by the author using data collected from the World Health Organization
Note: Trend line is a 7-day average of the data

Figure 2.

Comparison of Daily Deaths Registered in the US and India



Source: Graph developed by the author using data collected from the World Health Organization.
Note: Trend line is a 7-day average of the data.

Nationwide lockdown (68 days)

Phase 1	24 March 2020 – 14 April 2020	(21 days)
Phase 2	15 April 2020 – 3 May 2020	(19 days)
Phase 3	4 May 2020 – 17 May 2020	(14 days)
Phase 4	18 May 2020 – 31 May 2020	(14 days)

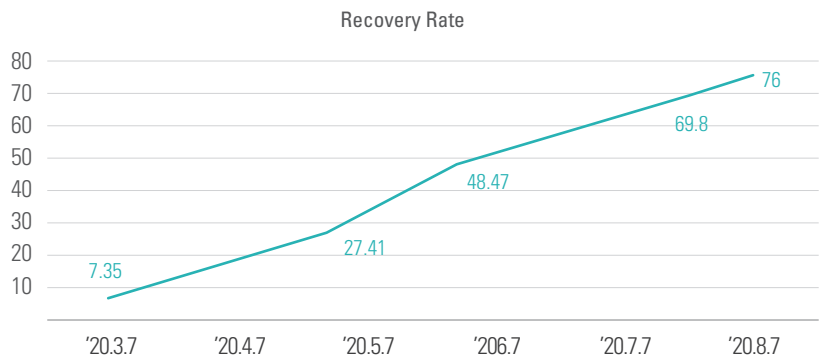
During Lockdown 3.0, by categorizing the cities into RED, ORANGE and GREEN zones based on the incidence of Corona infection, the Government has provided an exception for local activities in zones where the spread of Corona is under control (GREEN).

- Better awareness among people, which resulted in improved protective measures such as wearing face masks, hand gloves and regular use of sanitizer and washing of hands.
- Higher preparedness for disease handling at the time of explosive growth by observing social distancing in public places.
- Continued restrictions even after 160 days on mass gathering domains such as universities, schools, festivals and large public meetings.
- Availability of better treatment protocols for COVID-19 and arrangement of large medical facilities with the necessary supplies and equipment.
- Made available enough supplies of PPE kits (Personal Protective Equipment) for medical staff, drugs and other essentials to fight COVID-19.
- Availability of more effective drugs such Remdisvir and Faviflu.

As explained in Figures 1 and 2, the nation-wide lockdown has helped India flatten the infection incidence curve to a large extent, protecting its population from serious exposures. This has resulted in the flattening of the pandemic progressions, and also resulted in higher and improved recovery rates and lowered fatality rates. The recovery rate in India is the highest at 76% as compared to the global average of 69%. Benefitting immensely from the nation-wide lockdown and the valuable preparation time made available for the system to respond better, the recovery rate in India has been rising over time as shown in Figure 3.

Figure 3.

Improvement of Recovery Rate from COVID-19 cases in India

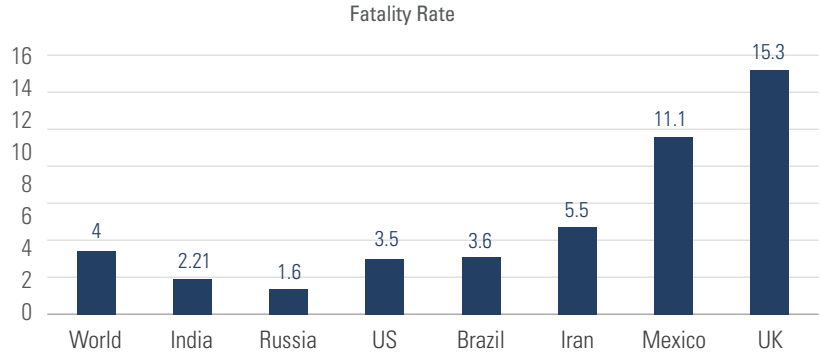


Source: Graph developed by the author using data collected from https://www.worldometers.info/coronavirus/

This has further resulted in falling fatality rates in India. As on 28th August 2020, the Indian fatality rate was recorded as 1.98%, which is far lower than the global average of 4%. Fatality rates of various countries in the world are shown in Figure 4. It is evident from the figure that India has gained significantly from its nation-wide lockdown and it has been successful in fighting this pandemic better than other major affected countries. The highest fatality rate of the UK is 8 times higher than India, and the US and Brazil have recorded fatalities twice that of India. India has been increasing its testing activity on a continuous basis and that did not halt the improving fatality rate and recovery rates.

Figure 4.

Comparison of Fatality Rates of COVID-19 in different countries in the world



Source: Graph developed by the author using data collected from the https://www.worldometers.info/coronavirus/

2.2 Lockdown and the Avoided Fatalities in India

Countries such as the US, Russia and Brazil did not embark on a complete national lockdown, and as a result along with other factors, they have recorded very high fatality rates. The non-imposition of a lockdown would have resulted in a much wider spread of the coronavirus in India, and the unprepared population and medical management system would have resulted in a much higher fatality rate than the UK, and that would have meant the worst possible scenario for the country. Exploring such scenarios in order to find the fatalities avoided due to the nation-wide lockdown, the total fatalities are calculated by taking a few higher fatality rates from different countries in the world. The scenario results presented in Table 1 explains the potential mortality avoidance that the Indian lockdown has achieved. In the worst-case scenario, India would have recorded a whopping 856,000 deaths due to this pandemic. Mortality avoided by India by pitching an effective lockdown is in the range of 86,140 – 796,211. That is about 1.42 -13.13 times the registered mortality.

Table 1.
Scenario of Fatalities in India based on Fatality rates in different COVID-19 dominant countries

Scenario	Fatality Rate (Death/ Million Population	Total Deaths	Total Estimated Deaths in India based on Different Scenarios of Fatality Rates
India	44	60,629	
World Average	106.4	829,742	146,769
USA Scenario	554	183,653	765,628
UK Scenario	610	41,465	843,020
Spain Scenario	620	28,971	856,840
Brazil Scenario	553	117,756	764,246

Source: https://www.worldometers.info/coronavirus/#countries accessed on 27th August 2020, 11:30 IST.
Note: The scenarios were built based on the data sourced from above.

The lockdown has resulted not only in lesser cases, but also in a lower fatality rate. Apart from the possible immunity support resulting from the use of drugs for the control of malaria and other infections, enhanced awareness among people, use of tools such as social distancing, improved

personal hygiene, improved preparedness of the health system in the country and availability of better 'disease management protocols' and drugs, made this avoidance possible in the case of India. Therefore, this has been termed as the "Great Indian Lockdown" and some of the opinions expressing the same are presented below.

- "India's lockdown as one of the most stringent in the world, scoring 100 out of 100 on their tracker" - *A group of researchers at the University of Oxford*
- "It was predicted that lockdown (1.0 + 2.0) helped avert 14-29 lakh cases and 37,000-78,000 deaths till 15 May" - *MoSPI*
- "1.2L - 210,000 lives were saved and 36-70 lakh cases were averted due to the lockdown till 15 May" – *Boston Consulting Group based on various estimation models*
- "78,000 deaths were averted during the lockdown period" – *Prediction by Public Health Foundation of India*
- "Indian Lockdown is timely, comprehensive and robust" – *WHO Representative to India*

As the economic activity became seriously affected and the hardships of people soared, the Government of India after careful stocktaking of the situation has implemented a progressive unlocking process in phases as presented below.

Unlock Process (Over 92 days)

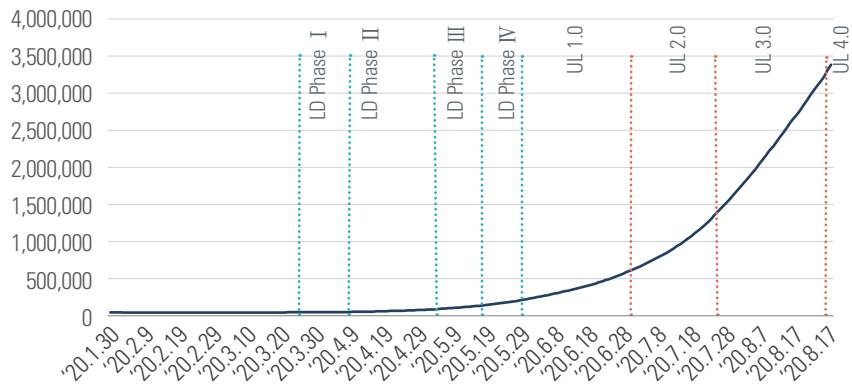
Unlock 1.0	1 June 2020 – 30 June 2020	(30 days)
Unlock 2.0	1 July 2020 – 31 July 2020	(31 days)
Unlock 3.0	1 August 2020 – 31 August 2020	(31 days)

The Ministry of Home Affairs has come up with an unlocking process to regain "economic focus" in the country. Imposing lockdown restrictions only in containment zones, the country has restarted economic and commercial activities in a phased manner. In the first phase termed Unlock 1.0, commercial places such as shopping malls, hotels and restaurants were allowed to reopen from 8 June. While inter-state travel was allowed, large gatherings were banned during UL 1.0. Night-time restrictions (night curfew) from 9 p.m. to 5 a.m. were in force. In Unlock 2.0, the lockdown measures were only imposed in containment zones. In all other areas, most activities were permitted. Night curfews were in effect from 10 p.m.

to 5 a.m. Inter and intrastate travel was permitted. In a mission to help expatriates return home, limited international travel was permitted as part of the Vande Bharat Mission. Educational institutions, metros, recreational activities remained closed till 31 July. Restrictions such as night curfew were relaxed in Unlock 3.0. Facilities such as gymnasiums and yoga centres were allowed to reopen from 5 August. However, educational institutions will remain closed till 31 August. Large gatherings are still restricted across the country.

Figure 5.

Phases of National Lockdown and Unlocking in India against the Backdrop of Total Case Progression

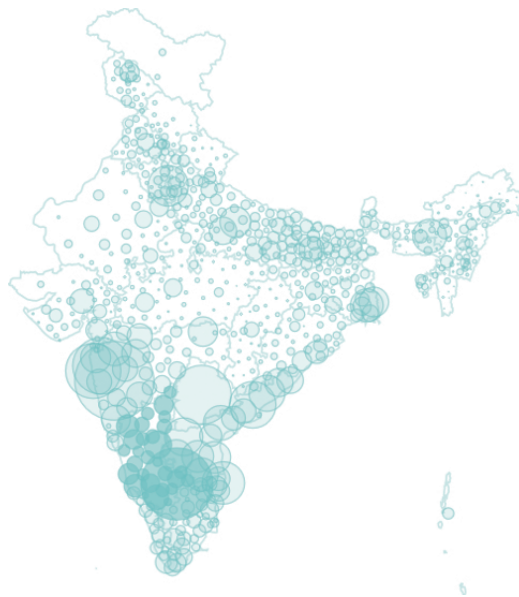


Source: Graph developed by the author using data collected from https://www.worldometers.info/coronavirus/
Note: Green lines indicate (not to scale) lockdown phases and orange lines indicate unlocking phases.

Figure 5 presents the lockdown and unlocking progression in India. While the daily new cases were under control during the four phases of lockdown, the cases started to rise during the first unlocking period (Unlock 1.0). The progression of the pandemic has taken an exponential rise from the beginning of the second unlock period and continues to rise at the same rate during the third unlock period as well. Though various estimates predict that India will reach a peak in the months of August to October, it would depend on various factors such as "new areas of spread" and "new hotspots". Figure 6 presents the geographical spread of COVID-19 in India.

Figure 6.

Geographical Spread of COVID-19 in India



Source: Extracted from http://www.eenadu.net in August 2020

As is evident from Figure 6, midland India is not as widely impacted as the coastal regions and the Indo-Gangetic Plain. Spreading to the midland, the pandemic could continue to rise. The hotspots of COVID-19 have been shifting from region to region in India. The outbreak of COVID-19 has started with Delhi as a hotspot, followed by Mumbai, Chennai, Hyderabad, Kolkata, and Andhra Pradesh. Newer hotspots may emerge, causing the pandemic to progress further. As evident from Figures 1 and 2, the US has been experiencing a second wave of the pandemic. It is yet to be seen if India also would have a second wave. It would be hard to predict at this point in time, as India is yet to show a stabilization of the curve.

The great Indian lockdown has delivered the goods for India, which is now in a better position to handle the pandemic even in its exponential growth stages. However, given the steep rise it has been experiencing now and the spread and rise expected in the next few months, India has to brace for a deeper impact of the COVID-19 pandemic. The following section discusses all the positive and negative impacts of the pandemic and the great Indian lockdown.

3. Impacts of the Pandemic

Though the nation-wide lockdown has delivered on controlling the progression of COVID-19 in the initial months, giving the system and people enough time to respond well, it has resulted in very serious negative externalities as listed below.

3.1 Adverse Impacts

- **Issue of migrant workers:** Millions of people migrated out of major Indian cities, as they became jobless after the lockdown. Many deaths were reported during the lockdown, attributed to starvation, suicides, exhaustion, road and rail accidents and denial of timely medical care. After the first period of lockdown, the Government has started rail transport to help migrant workers reach their hometowns/villages.

- **Severe slowdown of economic growth:** Due to the stalled industrial and commercial activities, India has seen serious hindrance to its economic growth rates. Estimates of growth rates by various agencies predict that the Indian economic growth rate for this financial year may be the lowest ever since the Independence. Various estimates are given in Table 2.

Table 2.
Estimates of Economic Growth in India during the COVID-19 Pandemic

Agency	Estimate of Economic Growth Rate
FICCI	-4.5%
IMF	1.9%
UN Report	1.2%
Moody's	Zero

Source: Various news reports on Indian GDP Growth Rates in FY 2020-21

- **Critically impacted SMEs and industrial activity:** The most impacted sector due to the COVID-19 pandemic is the Small and Medium Scale Enterprises (SMEs). With most migrant workers, who constitute the main workforce in SMEs, leaving cities, this sector has completely come

to a standstill, leaving millions unemployed. Even after introducing the unlocking process, this sector has yet to regain the momentum.

- **Increasing Unemployment:** With the closure of industries, SMEs and other business establishments and schools, unemployment has reached new heights in the country. The already impacted agriculture laborers are further aggrieved by the return of migrant workers to the villages, making it the worst possible scenario for employment and livelihoods.
- **Relief package by the Government of India:** The Government of India, in order to help the economy, announced an economic relief package of 1.7 Lakh Crores INR (US$24 billion) on 26th March. It was a mix of food security and direct cash transfers, primarily given to migrant labourers and daily wage labourers. Subsequently, the Government of India has announced a 20 Lakh Crores INR stimulus package to save the lockdown-battered economy and focused on tax breaks for small businesses as well as incentives for domestic manufacturing. With this stimulus package that accounts for 10% of its GDP, India has joined the likes of the US and Japan, which have rolled out the most substantial financial packages to fight the pandemic.
- **Exposed Health Care System in the Country:** This pandemic has exposed the shortfall of the health care system in the country and reestablished the need to improve it. There is a need for transformational change in the health care system and to cover all citizens for health risks.
- **Disturbed academic and learning system:** The disturbed academic system is one of the most serious impacts of COVID-19 across the world and holds even more relevant to India. All academic institutions have been closed since mid-March 2020 due to the outbreak of COVID-19. Academic institutions in India, with an exception for some in the top league, do not have online teaching resources and that made it extremely difficult for academic and curriculum instruction throughout the country and for all sections of academia. Though the missing academic curriculum is the evident impact, there are reports globally that psychological implications of this pandemic-driven hibernation on young children is a much more serious issue and is yet to be understood completely.

3.2 Positive Externalities of the COVID-19 Pandemic

While the above are some of the negative impacts of the COVID-19 pandemic, it certainly resulted in some positive developments in the society. Following are such positive externalities observed in India.

a) **Mass "reverse" migration leaving the slums less loaded:** The peculiarity of Asian urbanization is the mass rural-urban migration. With such large-scale migration, many cities in Asia have been growing into mega cities, and that has resulted in the development of slums. Slums have been vulnerable areas where the provision of basic civic services and amenities is a herculean task for city administrators. Slums have been the most under-supplied, and also due to the unauthorized and highly dense living conditions anti-social elements are increasing in these settlements. As the growth centers largely remain as unplanned urban agglomeration, the cities are compelled to have these slums and there is no simple solution to streamline them. And an alarming fact is that the migration continues to further make these settlements almost inhabitable. Dharavi, the largest slum in Asia, is a striking example.

Many efforts have been made by the governments to decongest the cities, but all those efforts have been either failures or partly successful. Navi Mumbai as a decongestion measure for Mumbai could not successfully decongest Mumbai. Similarly, slum rehabilitation programmes aimed at decongesting the slum areas in Mumbai also did not succeed, owing to various population and demographic dynamics. Many researchers have been advocating for 'reverse migration' as one of the means to decongest cities and slums, but no country in Asia could demonstrate such a phenomenon. However, the COVID-19 pandemic has resulted in mass exodus and mass reverse migration where millions of migrant workers have moved back to their villages and towns during the lockdown period.

A study reported by various governments indicates that 2.169 million workers returned to UP, 1 Million to Bihar states and 1.1 million workers have left Maharashtra state and 2.05 million workers from Gujarat. According to the Chief Labour Commissioner of India, about 9.7 million migrants have been transported back home during the lockdown period. Using a new Cohort-based Migration Metric (CMM) and railway data, the Economic Survey of India 2017 has put the interstate migration at 60 million. However, a study by Kundu and co-workers have estimated that 22 million interstate migrants were destabilized economically and a fraction of them have returned to their respective home states, estimated to be 12 million. Another 4 million would still move back by the time harvest begins, unless the urban economy picks up.

Though the unlocking process has progressed into its third month, the returned migrant workers have not headed back to their urban domains. The relief package announced by the Government of India, which includes a supply of essential commodities and money transfers to unemployed migrants apart from economic incentives to start small businesses in their own places, could be the reason. This is expected to pin down the "re-migration" process.

b) Improved Environmental Quality Index: This global pandemic, with footprints in more than 200 countries, has greatly impacted the global environment to regain its "wellness". In a study carried out by Sasanka et al., (2020) the impact of the COVID-19 pandemic on environmental quality was assessed. The environmental quality index constructed by using remotely sensed biophysical parameters such as particulate matter (PM10), land surface temperature, normalized different moisture index, normalized vegetation index and normalized difference water index, explains that the overall environmental quality in four major Indian cities has improved significantly during the national lockdown period. The following sections explain such improvements at micro levels.

c) Reduced pollution

Improved Air Quality: Lockdown followed by the COVID-19 outbreak in India has resulted in almost no travel within cities and between cities, sparing the movement of goods and individuals for essential services. That has resulted in the control of automobile emissions, which has improved the air quality in cities across the country. Delhi has experienced a phenomenal improvement in its air quality, with the air quality index falling to as low as 85. Similar trends are observed in other Indian cities as well. The closure of small-scale industries (SMEs) has further added to this environmental improvement. Almost negligible transportation within cities and between cities has literally cleared congestion on the roads and all public places including shopping malls and markets. This observation holds good for all cities in India. The following table (Table 3) presents the air quality index in Delhi reported for pre-COVID and COVID times. It is evident from the table that COVID-19 has clearly improved the air quality in Indian cities.

Table 3.

Air quality index in Indian cities during COVID and Pre-COVID times

	Air Quality Index											
	2019						2020					
City	Feb	Mar	Apr	May	Jun	July	Feb	Mar	Apr	May	Jun	Jul
Delhi	292	201	112	268	238	152	210	85	97	150	108	129
Mumbai	-	-	-	-	-	-	176	138	53	14	-	19
Bangalore	-	-	-	108	-	-	98	110	-	82	-	-
Hyderabad	-	95	63	68	62	35	92	82	-	49	47	27
Chennai	62	-	37	77	229	51	79	63	42	32	124	72

Data source: https://app.cpcbccr.com/AQI_India/ AQI Monitoring stations: Delhi – ITO; Mumbai – Airport; Hyderabad – Sanathnagar; Bangalore – City railway Station; Chennai – Alandur Bus stop

d) ***Control over Greenhouse Gas Emission:*** Due to reduced road travel on highways and within cities, and almost no train services and absolutely no air traffic, green house gas emissions (GHG) from these three important sectors have seen significant reduction during the lockdown period and to some extent during the unlocking period as well. Reduced production activity in SMEs and reduction in energy consumption in commercial sectors would further reduce the GHG emissions during this period. Using the Long Range Energy Alternative Planning (LEAP) Model Framework, the total GHG reductions due to COVID-19 are being estimated by the author (Yedla, 2015).

In a study it was estimated that the coronavirus-triggered lockdown has resulted in a steep fall in global carbon emissions and it would be as high as 17 percent in early April compared to 2019 levels. Also, India's emissions are expected to drop by 26 percent. This is the highest-ever drop in annual carbon emissions since World War II, according to the study. However, this could be followed by a surge in carbon emissions due to the restart of economy post-COVID. The Government of India is mulling over resorting to green growth models as the economy is restarting itself.

e) ***Re-blossomed bio-diversity:*** The Great Indian Lockdown seems to have a rebound effect on flora and fauna. The more frequent appearance of

wild animals in otherwise encroached natural habitats in the country is an indication that the biodiversity has re-blossomed even within this short gap in human activity. It portrays the fact that flora and fauna are stressed heavily by the encroachments by human activity in the natural habitats and eco-systems.

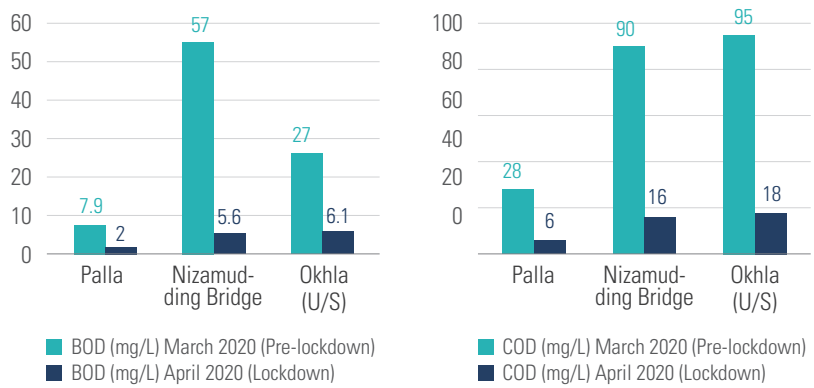
f) ***Clean rivers:*** The Government of India has been putting in a lot of efforts to clean up the rivers in India, and Clean Ganga Action Plan is one such example. Such initiatives were allocated thousands of Crores of Indian Rupees and yet they have failed to deliver impressive results. Rivers in India continue to remain polluted, and foaming in rivers such as Ganga and Yamuna in Delhi are commonly spotted in recent times. However, the water quality has improved significantly in many rivers across India during the national lockdown period. All the improvements that the heavily funded national river project could not achieve were demonstrated by the lockdown. This is one of the most significant positive externalities of the COVID-19 pandemic in India.

The nation-wide lockdown has resulted in improved water quality and quantity in Indian rivers such as Ganga and Yamuna. According to pollution control experts, this is mainly attributed to the fact that industries have stopped discharging their toxic effluents into the rivers, and there is less withdrawal of water for industrial and agricultural purposes due to the lockdown that has shut down industrial activity and agricultural work. About 80% of the pollution in the river Ganga is contributed by domestic sewage, and the rest by industrial effluent. According to the Central Pollution Control Board (CPCB), based on an assessment of Ganga water quality in January 2020, most of the stretches of Ganga till West Bengal have violated drinking water quality standards and almost zero dissolved oxygen (DO). Due to the nation-wide lockdown, for the first time in many decades, several stretches of Ganga are conforming to CPCB standards for the quality of river waters and some stretches are even meeting "fit for drinking water" standards of CPCB, with the biological oxygen demand (BOD) recording less than 3 mg/l, and dissolved oxygen greater than 4 mg/l. Owing to more western disturbances which brought more rain, the flow in the rivers improved and that led to better dilution. Zero industrial effluent coupled with more flow in the river owing to rains and reduced withdrawals has resulted in drastic improvements in river water quality.

In an effort to understand the impact of the nation-wide lockdown on river water quality in Yamuna, one of the major rivers in the northern part of India, Yamuna Pollution Monitoring Committee has undertaken a water quality analysis with the help of CPCB and Delhi State Pollution Control Board (DPCB). CPCB has monitored at three stations and DPCB has monitored at nine stations. The results have confirmed that the water quality in river Yamuna has improved due to the nation-wide lockdown. Figure 7 presents the results of the CPCB study of water quality in river Yamuna. Compared to the water quality in the month of March 2020 (pre-lockdown), water quality in terms of BOD and COD has improved significantly.

Figure 7.

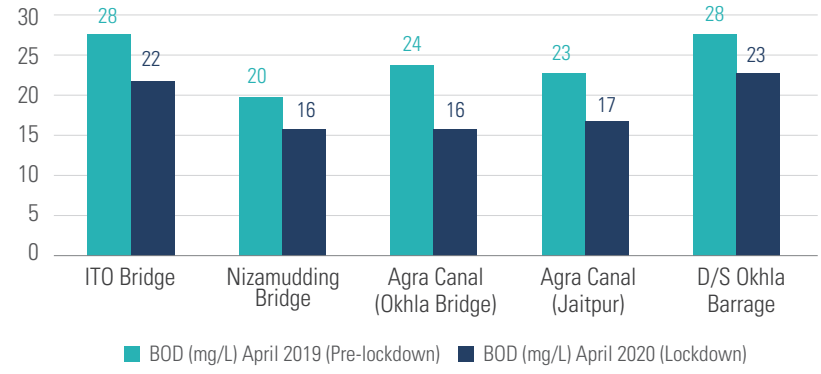
Improvements in the water quality (BOD and COD) of river Yamuna in India (by CPCB)

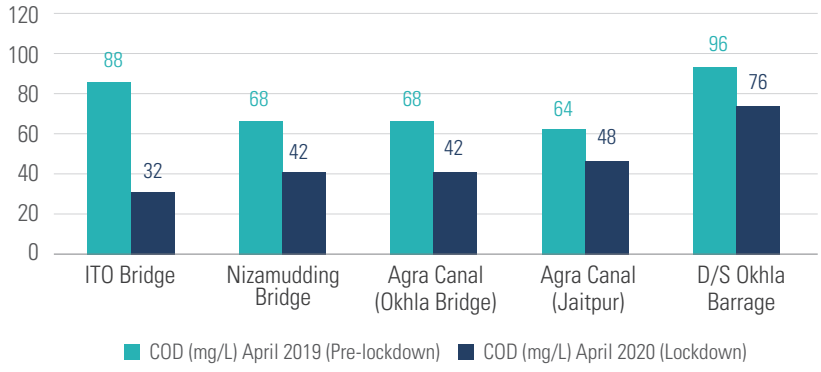


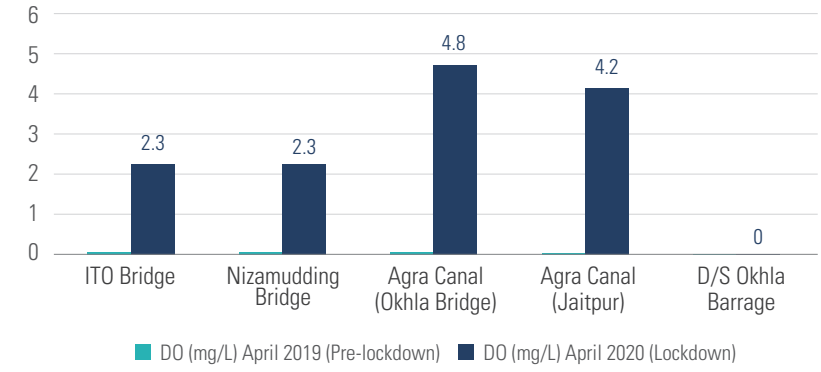
Based on the water quality monitoring done by DPCB at nine stations, it was found that water quality parameters such as BOD, COD and DO have shown considerable improvement during the lockdown period (April 2020) when compared to the reading at the same time in the previous year (April 2019). Figure 8 (a, b, c) presents the improvements in water quality noted in the river Yamuna. However, such improvements noted tend to reverse with the restarting of economic activity during the unlocking and subsequent periods.

Figure 8 (a, b, c).

Improvements in the water quality (BOD and COD) of river Yamuna in India (by DPCB)







g) ***Clear sky and picturesque backdrops:*** Due to the improved air quality, the skies in Indian cities have turned blue and the clear sky has improved visibility to greater distances. This has unveiled beautiful landscapes and the Himalayan mountain range could be spotted even from far-off cities and towns in North India, which was not the case in the recent history. For once, the environment in a developing country like India has resembled the clean and clear environment that is often seen in industrialized nations such as Japan and the US.

h) ***Reduced incidence of pollution-related health ailments:*** Though the COVID-19 pandemic has been spreading fast and mortalities are on the rise, owing to the improved air quality and water quality and the clear and clean environment, pollution-related health ailments such as tuberculosis have shown a clear decline, which can be observed from the reduced hospital visits in India than for other reasons. With a thorough estimation, this would have phenomenal economic benefits.

i) ***Improved Consumption Habits:*** India has been experiencing increasing consumption patterns in the past two decades with the influence of western culture of use and throw. This has been resulting in higher waste generation rates and an increase in food waste generation as well. This is an alarming trend for India, particularly due to its population size. Increasing food waste is a concern both for waste managers as well as for the Controller of Food Grains in India, as food waste can be linked directly to the food insecurity issue. The COVID-19 pandemic has confined all its 1.3 billion population to indoors and the fear of shortage of food stocks has brought back the old-time conservation practices. Food waste generation has reduced and waste generation in general has come down. Such a long lockdown could potentially bring the behavioral change in the Indian population towards a more resource-conservation lifestyle.

j) ***Cultural reinvention:*** Due to the forced confinement, the "family" in Indian households, which was on a transformational change to accommodate the "fast moving" lifestyle, has brought back the old habits of spending more time with the family, and their eating habits has become healthier. Children spend more time with parents and that refreshes the rich cultural roots. This also improved personal hygiene, on which Indians otherwise fall short in general.

k) ***Energy savings:*** Following the nation-wide lockdown, India's electricity demand was reported to have reduced to a five-month low on 28 March. Due to reduced industrial activity and almost no transportation across the country, India's energy consumptions must have been the lowest in the past five months of lockdown. And a similar observation can be made at the global scale, although to a lesser extent. As part of the climate change mitigation efforts, it is the aim of the global community to see a dip in per capita energy consumption, and the COVID-19 pandemic for a change must have brought it up. As the global energy consumption data becomes available, such a fact would be established empirically.

l) ***Newer Challenges:*** The COVID-19 pandemic has also brought newer challenges such as increased generation of bio-medical waste and infectious waste in particular in the form of PPE kits. This would pose a serious threat to sanitary workers in the days to come. However, this problem will remain a short-term concern, as the pandemic is not to stay too long. Other such challenges include the collapsed waste management system due to the non-availability of a complete work force and the lack of people participation due to the compromised services of garbage collection.

The Indian lockdown has unlocked the population from many unhealthy life styles and habits. Unlearning a habit is the most difficult part of behavioral change and COVID-19 has forced people to unlearn many things. People travel less, they do not waste food, there is a growing respect for cleaning tasks and the people doing that job, commodities are conserved, people spend more time with the family, avoid unnecessary purchases, eat less of outside and unhealthy food and more of home-cooked and healthy food, spend quality time with the kids and help them in studies; hone hobbies and hidden talents and more importantly, breathe fresh air as they step out of homes. Undoubtedly, these are the ideal ways of living, which we are all deprived of in the wake of the modernizing world. Following are a few important behavioral and functional changes that are observed during the lockdown and the unlocking process in India which are transformational in nature.

- New work culture, such as working from home
- Less travel
- Less waste generation

- Resources conservation
- Dignity of labour
- Family re-defined
- Healthy lifestyles, and
- Re-starting the economic activity and re-initiating the industrial/ production activity

3.3 Are We Wasting the Crisis?

The above points constitute the pathways for sustainable development and the COVID-19 pandemic has brought these most essential changes in the society. But will these changes pass the test of time? Are we going to waste the opportunity that the COVID-19 crisis brought to the fore?

Roads and transportation used to be the backbone of the economy and unsustainable consumption patterns powered the economy. Now due to the COVID-19 pandemic, ICT and broadband forms the backbone of the economy and sustainable consumption patterns give the economy much-needed strength. For such a transformation, India needed a cultural change, and the COVID-19 pandemic presented a unique and never-before opportunity. While the lockdown brought these healthy changes, "unlocking" can potentially take all this away. This would not only re-expose us to the potential of the virus coming back but also lock us down with unhealthy habits once again. This is the time to further these transformational changes, and the Government of India, in consultation with all the State Governments, should immediately make directives and necessary policy measures so that implementation of the same during the unlocking phase becomes easier. Or else, India will miss on the golden opportunity that this crisis has provided.

4. Post-COVID-19 Pandemic - The Way Forward

Fighting climate change needs both production-related measures as well as consumption-related measures. In the sustainability science jargon, one can say that efforts to meet both internal sustainability and external sustainability conditions need to be made in an integrated framework.

Consumption-related measures largely involve correction to the existing consumption practices and that is linked to behavioral changes. Bringing a behavioral change towards a public good is the hardest of all tasks and that precisely makes the task of climate change mitigation a herculean task, globally. The COVID-19 pandemic has brought out this unique situation where people all around the world are forced into a new consumption pattern, and now it is important to sustain that changed consumption pattern and transform the same into a behavioral change. Or else, the opportunity that the COVID-19 crisis brought would be wasted. Towards such an effort, the Government of India, while it is trying to restart the industry and get the economy rolling, the following, if included in the "unlocking" process, can make a big difference.

- Institutionalize the new work culture and make the necessary provisions
  - Work from home;
  - On Saturday and Sundays work should be from home only;
  - Video conferencing as a means for all meetings and conferences;
  - More virtual conferences avoiding long air travels;

- Re-orient the philosophy of infrastructure development in light of crisis-induced behavioral changes
  - Every house with a video-conferencing facility - Government needs to ensure improved bandwidth

- Restricted travel and travel behavior
  - Control on registration of personal vehicles per year;
  - Policies to control the use of personal vehicles;

- More automation and efficiency in production and a more rigorous Make in India campaign
  - More automation in industries;
  - More discipline in small and medium scale operations;
  - More emphasis on relying on domestic goods and non-reliance on imports;

- Introduce a new paradigm of improved industrial safety
- Odd-even policy in every domain to control congestion and consumption patterns
- Improved e-commerce by promoting monetary policies towards cashless transactions

- New system of online academic instruction
  - Conduct all school/university exams and other competitive exams online only
- New system of social and health Security – health security, unemployment security to all citizens

Some long-term and futuristic measures towards sustainable systems

- Some permanent restrictions in the cities such as restricted movements on Sunday and holidays
- Lockdown on one day of the month (i.e. the last Sunday) and declare it as a "day for the environment." On such days, people can only walk and use public transport
- No motor vehicles in university campuses and other industrial and business premises
- Introduce a regime of recycling with strict enforcements and promote EIPs
- Grab business opportunities

Apart from the above measures, the Government of India must ensure to have the following in place to gain the maximum mileage from the opportunity and conditions that were created by the COVID-19 crisis.

1. Maintain the **decongestion of cities and slums** across states
   - The Government of India has to come up with changes in the National Urban Policy and should include some structural changes such as density limitations on cities and the management of slums
   - Formalizing and limiting migrations (changes need to be made in the Constitution)
2. **A better health care system** must emerge and a new line of governance needs to be instated to handle medical emergencies
3. **Re-invent SMEs** in sustainable ways by promoting Eco-Industrial Networking Principles. This would help in maintaining clean rivers even after the COVID-19 crisis.
4. Further **groom the behavioral changes** that were seeded during the lockdown, towards sustainable consumption
5. **E-India:** E-governance, E-learning, E-meetings to become an integral part of governance in the country
6. Emphasize **online learning in the place of physical learning** at all levels of education and training

7. **Re-visit the National Policies** in light of changes in lifestyles brought about by COVID-19 with a set of stronger reforms and augmented governance

The changes in the behavior and consumption patterns that are seeded during the crisis have shown us the way to handle the environment and the climate. As more and more data becomes available, the environmental benefits that these crisis-driven changes could bring will be established. These are expected to be some path-breaking outcomes that two-decade long climate change mitigation measures could not bring. Therefore, the COVID-19 crisis has shown us the way to handle the problem of the environment and climate. It is time for India and the world to re-orient themselves and their economies towards a more sustainable and environmental friendly living. The small changes that COVID-19 brought with it can be the beginning for big transformational changes in the world. The Government of India has to revisit and revise its national policies and make some policy changes and send strong signals to the stakeholders. Rural-urban migration, which is the root cause for many unsustainable patterns of living, was reversed by the COVID-19 pandemic and the Government of India must take immediate steps to control the "reappearance" of migration for which it has to make some fundamental changes to its constitutional provisions. The Government of India has responded well so far, first by enforcing one of the strongest and longest lockdowns and then following it up with a structured and phased unlocking process. This was followed up by a robust relief package to the tunes of 10% GDP, which is aimed at reinforcing the "employability and entrepreneurship" in rural areas. Augmenting it further and similar to the suggestions made earlier in this paper, the prime minister of India, Mr. Narendra Modi, has announced the following measures to fight the pandemic, bring changes in health care and also put the economy back on the growth path but in more sustainable ways.

1. Every Indian to have a digital ID. This is expected to bring a significant change in India's health care system.
2. Development of indigenous vaccines for COVID-19.
3. Introduction of new cyber security policy. This is aimed at promoting ICT-based livelihoods.
4. Development of Ladakh as a carbon-neutral region as a demonstration to other Indian states and to the world on their fight against climate change.
5. All villages to be connected with optical fiber in the next 1,000 days. This is proposed to enhance connectivity so that changed lifestyles

such as online academic instruction and e-commerce are supported.

6. National Cadet Corps to be extended. This helps the country to have trained manpower in fighting calamities stemming from climatic changes and other natural phenomena.
7. Decision to spent Rs 100 lakh Crores (10 Million Crores) on infrastructure projects to support the changed lifestyles and sustainability.
8. These attempts by the Government of India should make substantial changes in the society, and more efforts towards control of migration, reducing travel, and cleaner SMEs linked to Eco-Industrial Networking can bring significant changes in the production and consumption patterns of India. And that would mark the best use of this crisis.

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