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Impact of COVID19 on the GDP v/s Pollution

A case of China

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Abstract: Amidst the global economic slowdown triggered by the outbreak of COVID-19 pandemic, there has been a considerable drop in the pollution levels across countries. As economies thrive to recover, there lies an opportunity to adopt some sustainable pathways towards a stable and better economy. An uncontrolled surge towards development is not a solution for the long run. Sustainable economy pathways such as low carbon investments, have already proven to be a good way to go. They not only boost up a country's GDP but also contribute towards climate action goals. The environmental benefits that the pandemic outbreak has brought could be a jump start towards a more sustainable and stable economy.

Keywords—China, GDP, Pollution control, COVID19, Climate Action, Low Carbon Development, Sustainable economy

1. INTRODUCTION

The COVID-19 disease, declared a pandemic by the World Health Organisation on 11 March 2020 has gripped onto the World, infecting more than 18,50,220 people and killing about 1,14,215 people as of April 13, 2020. The virus has hit the society devastatingly by disrupting travel, shuttering factories, cutting off groups and shaking up economic markets. It has been stretching the limits of the Health infrastructure globally. The international manufacturing sector has suffered its worst since the 2009 recession this quarter.

Being Ground zero for the pandemic, China had to take up major outbreak containment measures by imposing various restrictions including production shutdown, confinement and travel restrictions. China being the second largest Economy after the US is also a major global exporter. Thus China's influence is a major factor in the crumbling global economy. Set aside the Economic impacts, the pandemic has brought in some environmental benefits. China with a high energy consumption rate and being a major Greenhouse gas polluter has major influence on the environment too. The International disruption is leading to decrease in energy demand, which in turn reduces international greenhouse gas emissions. The production shutdown, travel restrictions, and confinement has brought down China's commercial output by 15% to 40%, leading to a kind of 25% drop in emissions over that same period. But this emission reduction due to economic slowdowns is often temporary. Because there is always a tendency that when economies try to bounce back, it results in a much larger increase in the emission rates. This trend was clearly witnessed after the global financial crisis of 2008, for an instance, international CO2 emissions from fossil fuel combustion and cement production grew 5.9% in 2010, greater than offsetting the 1.4% decrease in 2009 during the recession. With the pandemic doubtlessly triggering a worldwide economic slowdown, leaders are already searching out approaches to shore up their nations' economies. The techniques they take to stimulate economic increase will have long-lasting outcomes. This is something that is needed to be controlled or monitored. Some thoughtful interventions and control of the situation can help build a more sustainable economy, which is economically viable, environmentally sound and socially responsible.

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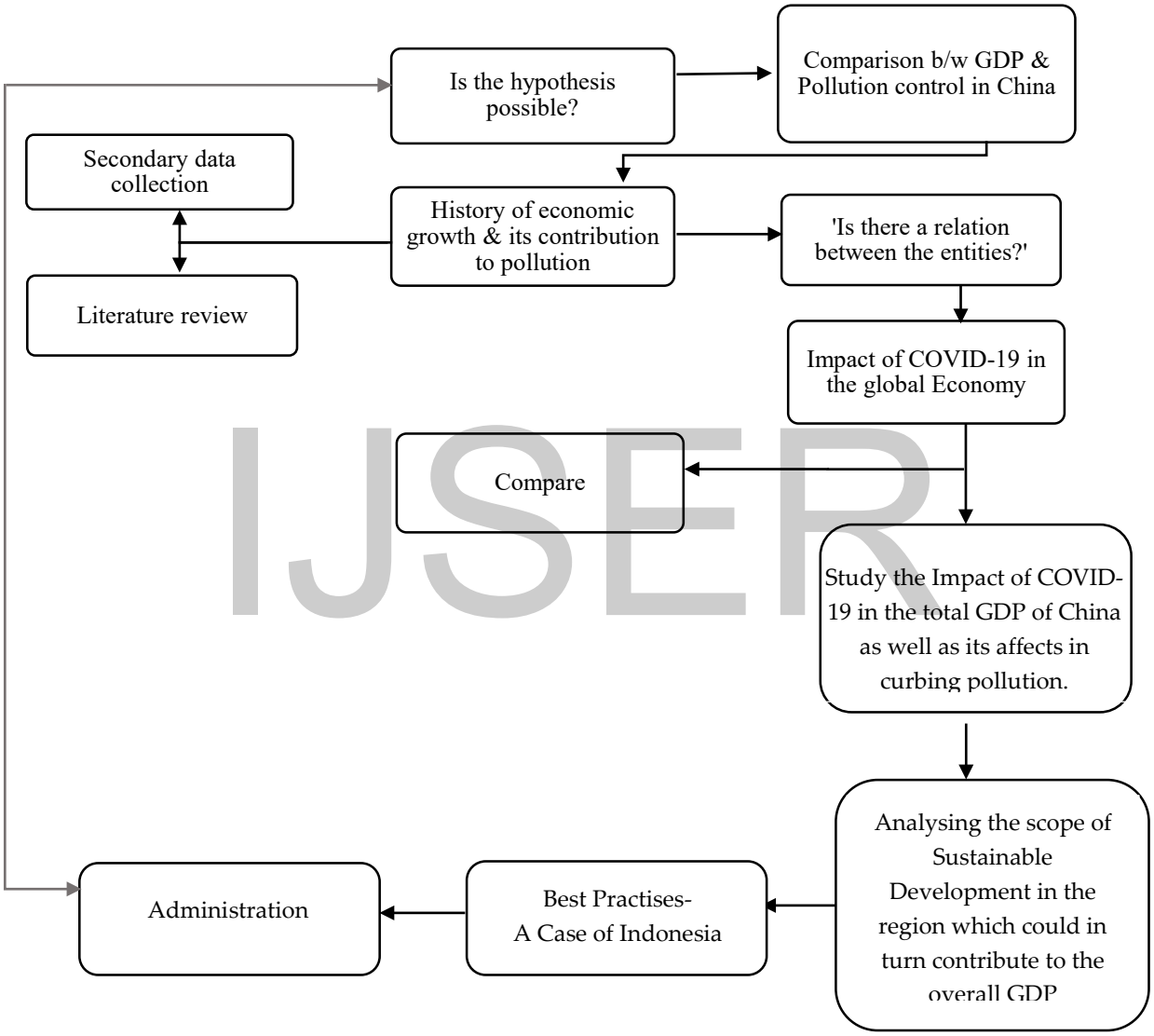
2. OBJECTIVE

The objective of this paper primarily focuses on understanding the trend of economic slowdown and its impact on the environment. To evaluate the relation between a pandemic outbreak and economic slowdown. To analyse the current scenario of COVID-19 pandemic and its possible outcomes. Realizing the need for environment sensitive economic development strategies. And possible interventions to encourage and develop a sustainable economy.

3. METHODOLOGY



4. COVID-19

Coronaviruses (CoVs) are a group of viruses that co-infect humans and other vertebrate animals. CoV infections **affect the respiratory, gastrointestinal, liver, and central nervous systems of humans, livestock, birds, bats, mice, and many other wild animals**. For example, severe acute respiratory syndrome (SARS) in 2002 and the Middle East respiratory syndrome (MERS) in 2012 were both coronaviruses that transmitted from animals to human[1]. The **source** of unexplained pneumonia was first discovered in Wuhan in Dec, 2019, and SARS-CoV-2, a new coronavirus, was isolated from the respiratory epithelium of patients. It belongs to a new evolutionary branch within the CoV. **On Feb. 11th, 2020**, the

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new coronavirus was **officially renamed "SARS-CoV-2" from "2019-nCoV"**. The disease caused by SARS-CoV-2 was called "coronavirus disease 2019" (COVID-19). According to the data released by the National Health Commission of the People's Republic of China, SARS-CoV-2 was most likely **transmitted from wild bats to humans**, and all the above three CoVs **can transmit from person to person**. SARS-CoV-2 shares a highly similar gene sequence and behaviour pattern with SARS-CoV.

On Dec. 29th, 2019, the health departments of **Hubei Province** received a report that **four employees** of the **South China Seafood Wholesale Market were diagnosed with unknown-caused pneumonia** in a local hospital, which was the **first report of SARS-CoV-2**. On **Dec. 31st, 2019**, the **National Health Commission of People Republic of China and Chinese Centre for Disease Control and Prevention** (China CDC) participated in the investigation and case-searching work. On the same day, the government of Wuhan released information about the disease outbreaks to society. Nowadays, the number of patients infected with SARS-CoV-2 continues to climb worldwide. The **early cases** were **diagnosed as excessive pneumonia** of unknown cause in Wuhan, and as soon as a pathogen was recognized, a diagnostic check advanced, the case definition changed to **only laboratory**-confirmed cases as "**confirmed cases**". By past due February, laboratory-confirmed instances had surged to greater than eighty 80,000 globally, with 96% of instances limited to China, and 80% of those in Hubei province. On 13th February, the Chinese case definition changed to encompass suspected and probable instances based totally on CT test or medical analysis, giving a higher indication of real sickness burden.

4.1. Timeline of outbreak of the disease

Figure 1 Timeline of COVID-19

31 Dec 2019
China reported a cluster of cases of pneumonia in **Wuhan, Hubei Province**.

A **novel coronavirus** was eventually identified.

1st January 2020
WHO had **set up the IMST** (Incident Management Support Team) on an emergency footing for dealing with the outbreak.

4th January 2020
WHO reported on social media that there was a cluster of pneumonia cases – with no deaths – in Wuhan, Hubei province.

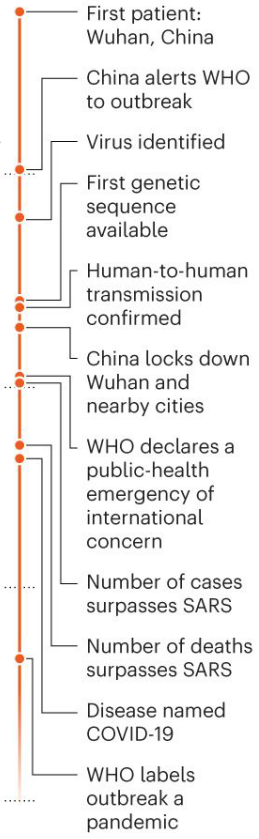
5 January 2020
WHO published the first Disease Outbreak News on the new virus.

12 January 2020
China publicly shared the **genetic sequence of COVID-19**.

13 January 2020
Officials confirm **a case of COVID-19 in Thailand**, the **first recorded case outside of China**.

22 January 2020
WHO mission to China issued a **statement** saying that **there was evidence of human-to-human transmission in Wuhan**.

New Corona Virus outbreaks in December2019



Source: Chart prepared by Ewen Callaway, David Cyranoski,Smriti Mallapaty, Emma Stoye &Jeff Tollefson

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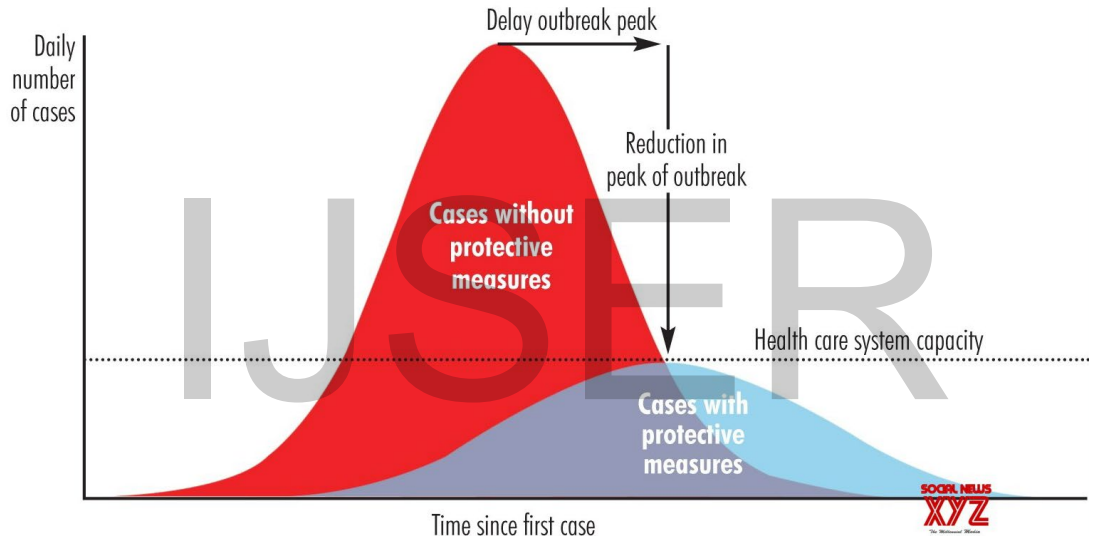
3 February 2020
WHO releases the **international community's Strategic Preparedness and Response Plan** to help protect states with weaker health systems.

11-12 February 2020
WHO convened a **Research and Innovation Forum** on COVID-19

11 March 2020
Deeply concerned both by the alarming levels of spread and severity, and by the alarming levels of inaction, WHO made the assessment that **COVID-19 can be characterized as a pandemic**.

5. CURBING THE DISEASE: A highly likely measure

Figure 2 Flattening the Curve



Source: Centre for Disease Control, The Economist

Measures taken to **flatten the curve** is to take the disease seriously by taking small steps such as **not touching the face, washing our hands regularly and to restrain ourselves at home in case of a lockdown declared by the government till the pandemic is contained[2]. Higher rates of testing, limiting/curbing large gatherings and routing for the infected** can be measures adopted by Governments in both developed as well as developing countries.

Figure 3 Projected Timeline for Treatment & Prevention

Source: Milken Institute's COVID-19 tracker

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6. CHINA – AN OVERVIEW

6.1. China's contribution to the world economy

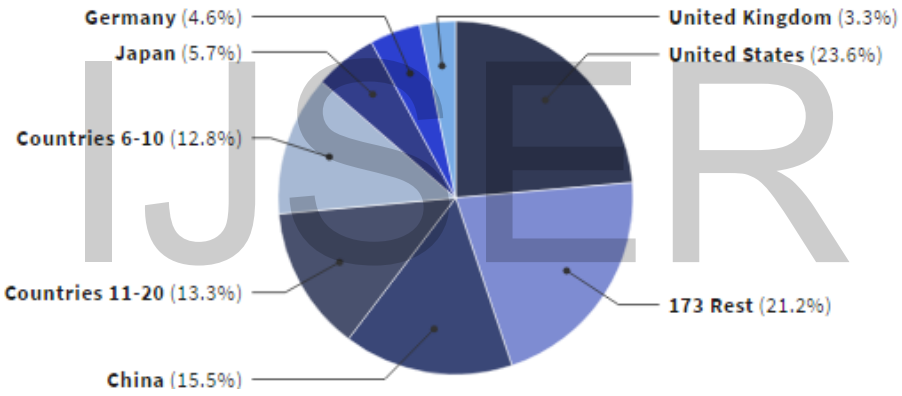
China Nominal GDP: $14.14 trillion, China GDP (PPP): $27.31 trillion

China has experienced exponential growth over the past few decades, breaking the boundaries of a centrally-planned closed economy to evolve into a manufacturing and exporting hub of the world. China is considered the 'World's factory', given its large manufacturing and export base. Dependence of other countries on China's production and economy is huge. In 1980, China grew to become the seventh-biggest financial system, with a GDP of $305.35 billion. Since the marketplace reforms were initiated in 1978, the Asian giant has had an economic growth averaging 10% annually. However in the recent years the pace of growth has slowed, although it remains excessive in comparison to its peer countries.

According to the calculations by IMF[3], the growth rate of China's GDP would be at 5.8% in 2020. Over the years the distinction in the size of the Chinese and the U.S. Economic system has been shrinking rapidly. In 2018, the Chinese GDP stood at $13.37 trillion. It was lower than the U.S. by $7.21 trillion. In 2020, the distinction is expected to reduce to $7.05 trillion and by 2023 to $5.47 trillion. However with respect to GDP in PPP, China is the biggest economy with a GDP (PPP) of $25.27 trillion. By 2023, China's GDP (PPP) could be $36.99 trillion.

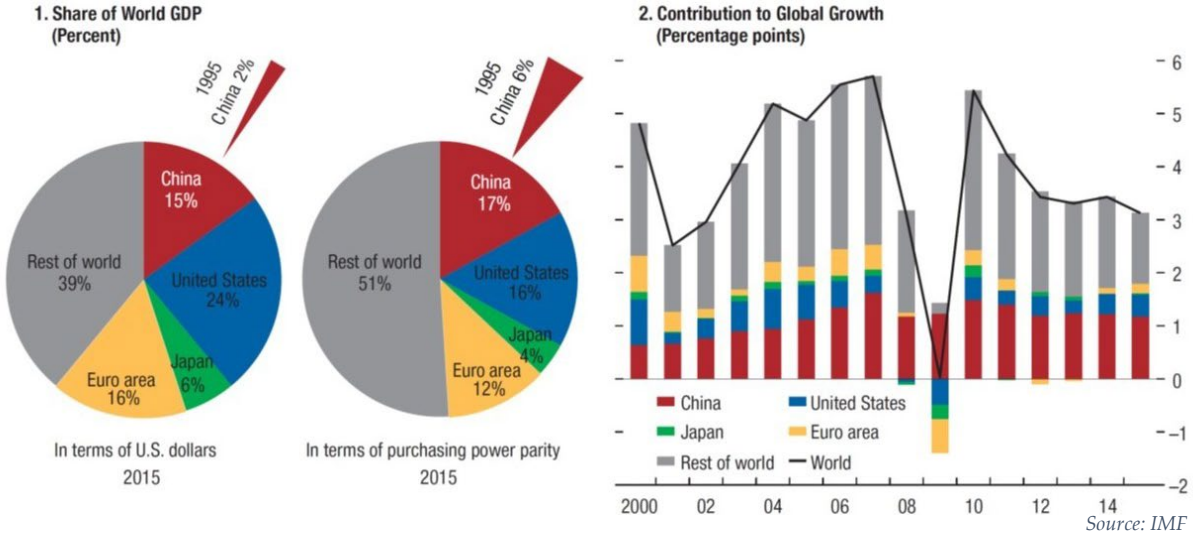
Figure 4 % Share of the Global Economy

The 173 countries outside the top 20 make up less than a fourth of the total global economy.



Source: IMF, Published in 2019

Figure 5 Share of world GDP & Contribution to Global growth (2015)



Source: IMF

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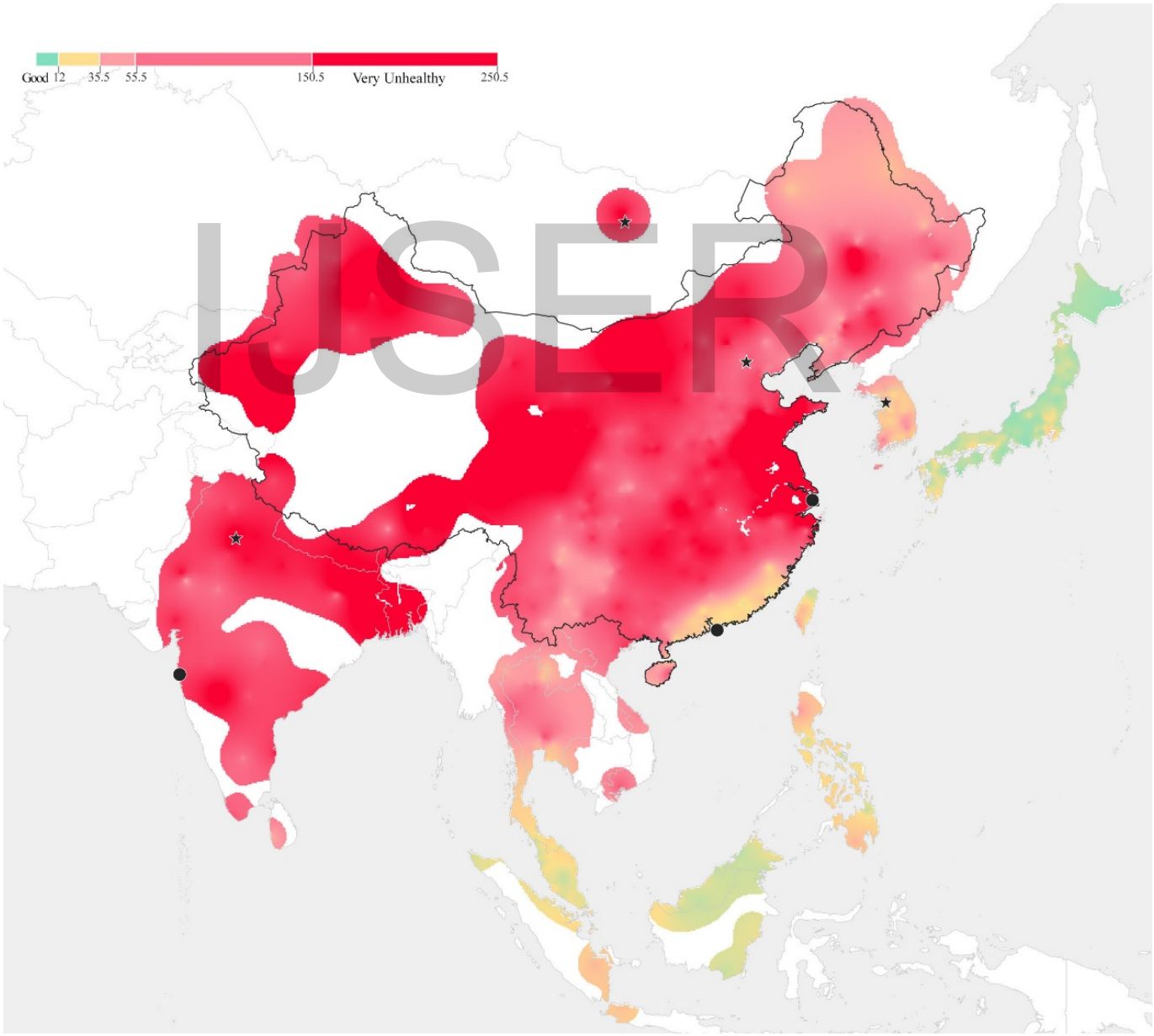
6.2. China's contribution to climate change & environmental degradation

As China rose to dominate global exports over the decades, it lacked environmental regulations. It also depends highly on coal as a major energy resource. In 2001, with the World Trade Organization entry, the production and economic growth witnessed a hike within years. However there have been concerns on what it has cost the environment and public health. With extensive rate of manufacturing, increased transportation, construction and commercial activities the effects on the environment has been enormous. Air pollution, water pollution, high rate of energy consumption, carbon emissions are to name a few. Air pollution is one of the major threats to environment and health contributing about 1.6 million deaths per year in the country alone as per Berkeley Earth, an independent research group in 2015[4]. China has become the World's No.1 Carbon Dioxide emitter. In 2015, the total global CO_2 emissions stood at a massive 36,061,710 kilotons. And China produced the highest carbon dioxide emission, around 10,641,789 kilotons, which was about 29.51% of total global emissions, followed by the United States with 5,172,336 kilotons.

Figure 6 A bad winter day (PM 2.5 Concentration Estimate (µg/m3) as of January 31, 2018)



Source: Berkeley Earth (2018)

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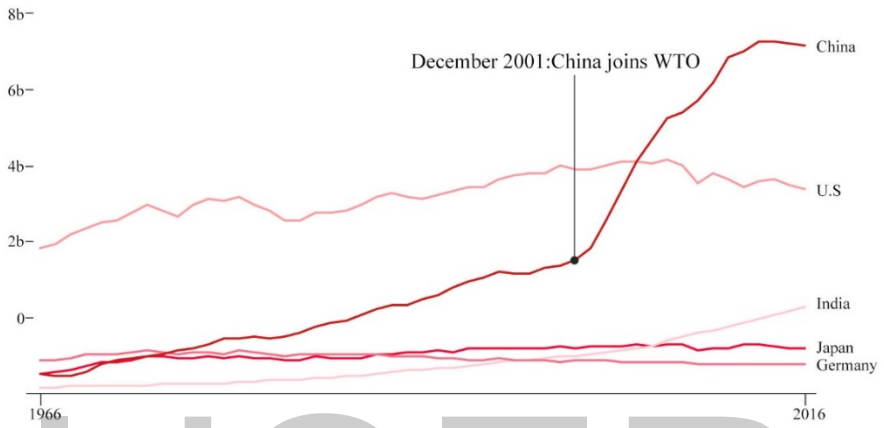
The country has become the world's No.1carbon dioxide emitter with 29.51% of total global CO2 emissions in 2015.

Figure 7 Carbon Dioxide Emissions (in Tons) 1966-2016



Source: BP Statistical Review of World Energy

7. IMPACT OF COVID-19 (IN CHINA)

China, the epicentre of the Covid-19 pandemic started its battle against the virus on 31st December 2019 after informing the WHO of the newly identified type of corona virus causing cases of pneumonia. Understanding the contagious character of the virus and possible chances of a widespread infection, the Chinese authorities took up harsh measures to contain the virus. Wuhan City of Hubei Province in China where the virus is believed to have originated from was put under a lockdown since January 23, 2020. Wuhan City, home to about 11 million people also hosts a number of tourists and students, and also has Wuhan Tianhe International Airport. Creating more windows for the spread of the virus across countries through travelling tourists who are infected. Foreseeing the impact, the airport was shut down and the whole province was put under a strict lockdown. Unfortunately, the virus had already caught up with people outside the Hubei province before the lockdown itself. This triggered the mass community outbreak in the country, forcing the Country itself to be under a lockdown to prevent any more spread and contain the virus. A lockdown of the country resulted in halt in manufacturing and production, transportation, halt to tourism, industrial and commercial activities and even day to day activities of all citizens. This lockdown proved to be a devastating threat to not only China's economy but also the global economy.

7.1. Global economy

China will account for $103 billion of the $347 billion in financial losses to be experienced due to COVID-19 (Coronavirus) globally, according to the Asian Development Bank (ADB).

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COVID-19 has resulted in sharp decline in the demand as well as supply of merchandise, lower tourism and business tour, trade and manufacturing linkages, deliver disruptions and health consequences. Asian Development Bank, have considered three case scenarios on the estimated global and regional impact of COVID 19, focussing on the impact on China, other developing countries within Asia and rest of the World. According to this in a moderate case scenario, in which precautionary behaviour and regulations on travel bans begin easing 3 months after the outbreak intensified and restrictions have been imposed in the past due January, worldwide losses may reach $156 million, or 0.2% of world GDP. And China would account for $103 million of these losses (or 0.8% of its GDP) at the same time as the rest of developing Asia could lose $22 million, or 0.2% of its GDP. And in a worst case scenario the world wide losses may reach $ 346 million (0.4% of world GDP) and China would account for $ 236 million (1.74% of its GDP).

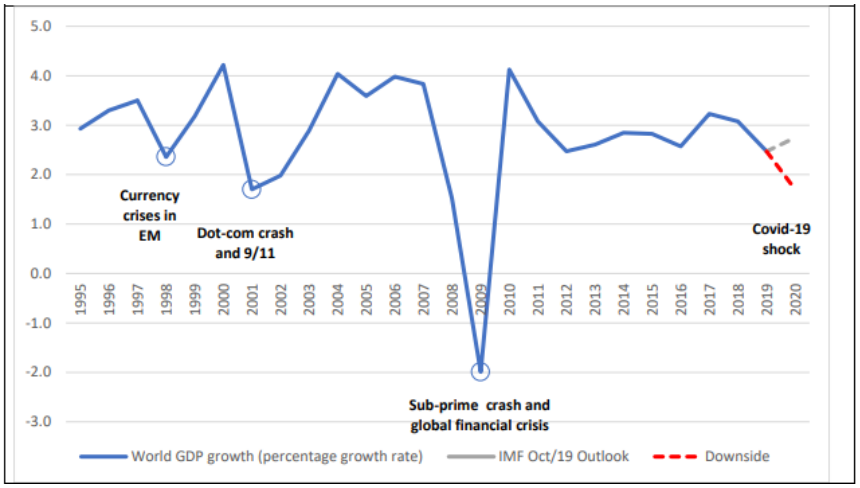
Figure 5 Estimated global and regional impact of COVID-19, under different scenarios

	Best case		Moderate case		Worse case	
	as % of GDP	losses in $ millions	as % of GDP	losses in $ millions	as % of GDP	losses in $ millions
World	-0.089	$76,693	-0.182	$155,948	-0.404	$346,975
People's Republic of China	-0.323	$43,890	-0.757	$103,056	-1.740	$236,793
Developing Asia excluding the People's Republic of China	-0.171	$15,658	-0.244	$22,284	-0.463	$42,243
Rest of the World	-0.011	$17,145	-0.020	$30,608	-0.044	$67,938

Source: Asian Development Bank (Published in March 2020)

In another report by the United Nations Conference on Trade and Development (UNCTAD), the steady growth rate of 6% in China was expected to push global growth in 2020 up to 2.7%. Instead, the virus outbreak has changed the scenario of the forecasts for 2020 downward. With a percentage point drop in global growth costing some $900bn in lost income, most forecasts have wiped a trillion dollars of global income for the year 2020. And if growth comes in at 1.7 per cent the cost of the virus will be closer to 2 trillion dollars.

Figure 8 Global GDP Growth, 1995-2020



Source: UNCTAD Calculations based on IMF, WEO, October 2019

7.1.1.Production

Indeed, most recent data from China indicate a substantial decline in output. China Manufacturing Purchasing Managers Index (PMI), a critical production index, fell by about 22 points in February (Figure 1a). This index is highly correlated with exports and such a decline implies a reduction in exports of about 2 percent on an annualized basis. In other words, the drop observed in February spread over the year is equivalent to -2 percent of the supply of intermediate goods.

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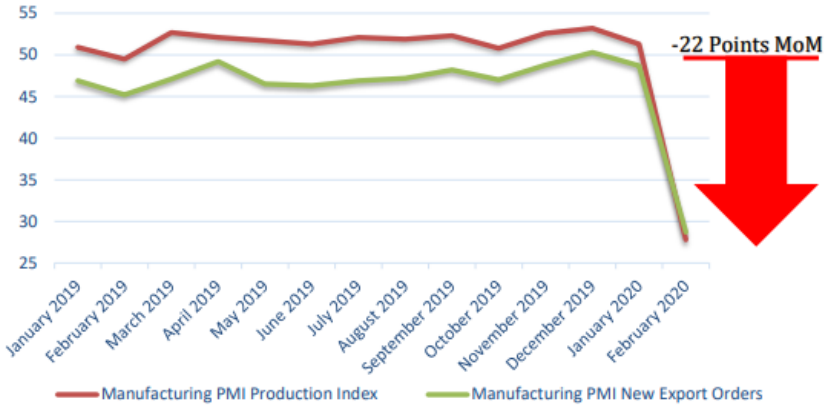
Figure 7 China's purchasing Managers Indices



Source: National Bureau of Statistics of China

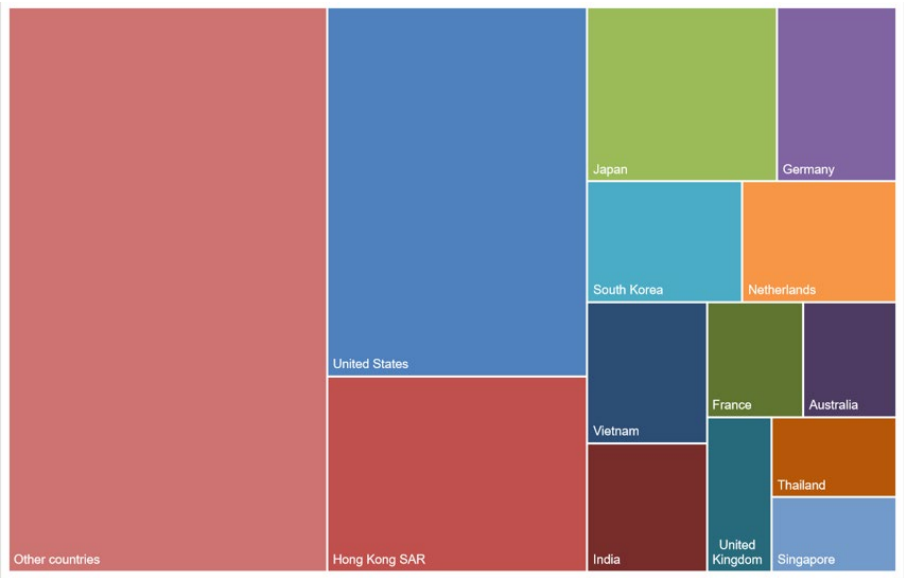
7.1.2.Trade (Export and import)

As per the estimates published by the United Nations Conference on Trade and Development (UNCTAD) the slowdown of manufacturing in China due to the COVID-19 outbreak, disrupting world trade and resulting in a 50 billion dollar in exports across global value chains. Machinery, precision instruments, automotive and communication equipment are some of the many affected sectors.

Within a span of just a few decades the World had become highly dependent on China as its trading and manufacturing epicentre. By 2011, 91% of all personal computers, 80% of all air conditioners, 74% of global solar cells, 71% of cell phones, and 60% of all cement were manufactured in China. A large number of the world's biggest companies own their major supplier factories, warehouses and other facilities in China. Thus a slowdown in Chinese production, trade and transport has repercussions for any given country depending on how reliant its industries are on Chinese suppliers.

Among the most affected economies are the European Union (USD 15.6 billion), the United States (USD 5.8 billion), Japan (USD 5.2 billion), South Korea (USD 3.8 billion), Taiwan Province of China (USD 2.6 billion) and Vietnam (USD 2.3 billion). Beijing reported a 17% drop in exports (including a 28% drop in exports to the U.S.), a 4% drop in imports, and a trade deficit of $7.1 billion just in the first two months of the year 2020.

Figure 8 China's major partners in exports in 2019 (in % real value)



Source: IHS Market

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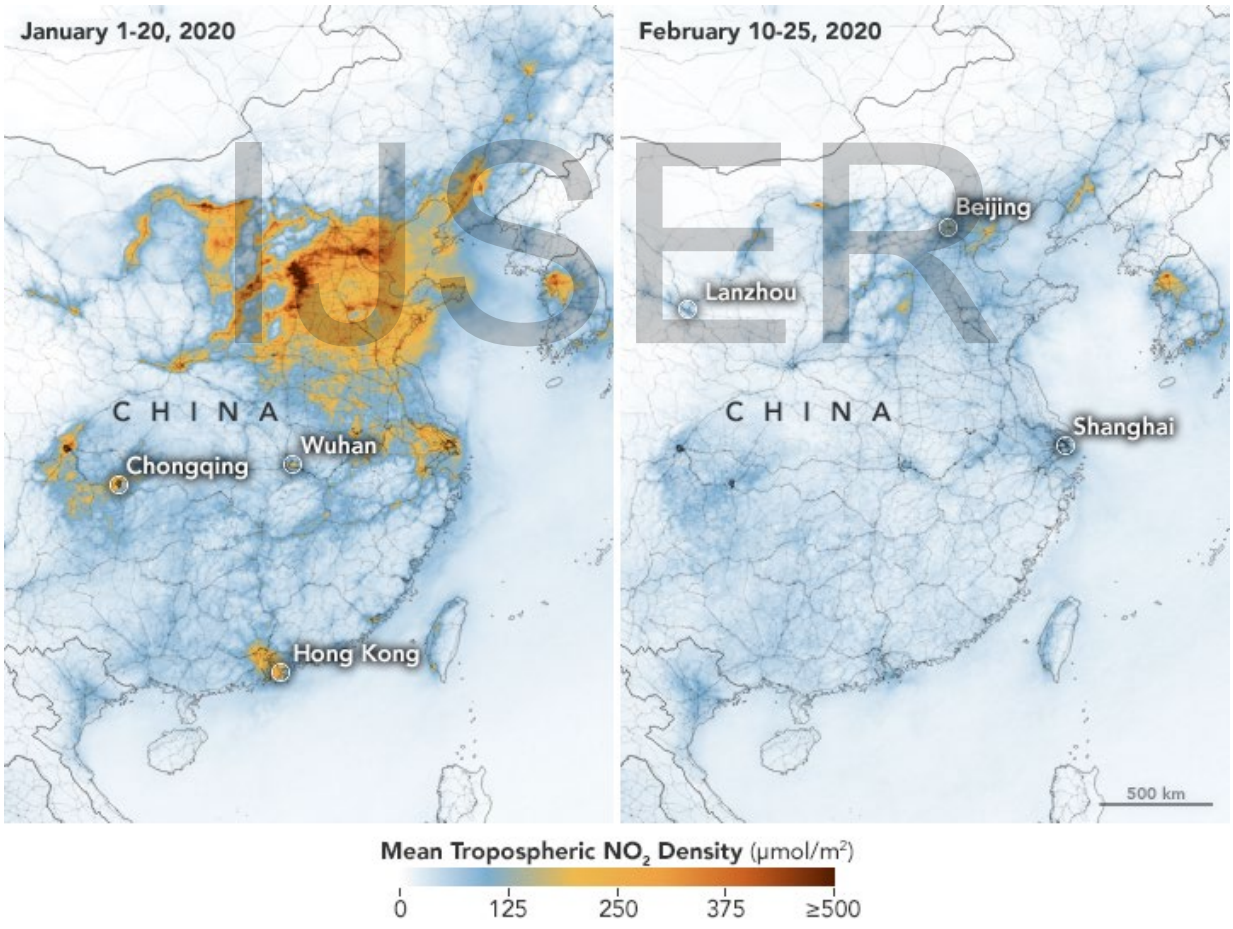
7.1.3. Oil Market

The Oil Market has a big influence on both the economy as well as environment. In 2003, China's oil demand was about 5.7 million barrels per day and by 2019 it had gone upto 13.7 mb/d (14% of the global total). Moreover, China accounted for more than three-quarters of global oil demand growth in 2019. The disrupted travel, trade, industrial and commercial activity has had a major impact on the oil demand. A report by the International Energy Agency mentions that in a worst-case scenario of the pandemic outbreak, the global oil demand could fall by 730,000 barrels a day in 2020. The drop in oil demand, low oil prices can adversely affect the oil producing economies.

7.2. Environment

China has a high energy consumption rate also with being a major Greenhouse gas polluter. The production shutdown, travel restrictions, and confinement brought the major Chinese province of Hubei to a standstill with very minimum human activities. There has been a drastic decrease in the levels of pollution over the province as compared to the previous years along the same time and days before the occurrence of the outbreak as well.

Figure 9 Concentrations of Nitrogen dioxide in China (2020)



Source: NASA, Data collected by TROPOMI

"This is the first time I have seen such a dramatic drop-off over such a wide area for a specific event, "said Fei Liu, an air quality researcher at NASA's Goddard Space Flight Centre[4].

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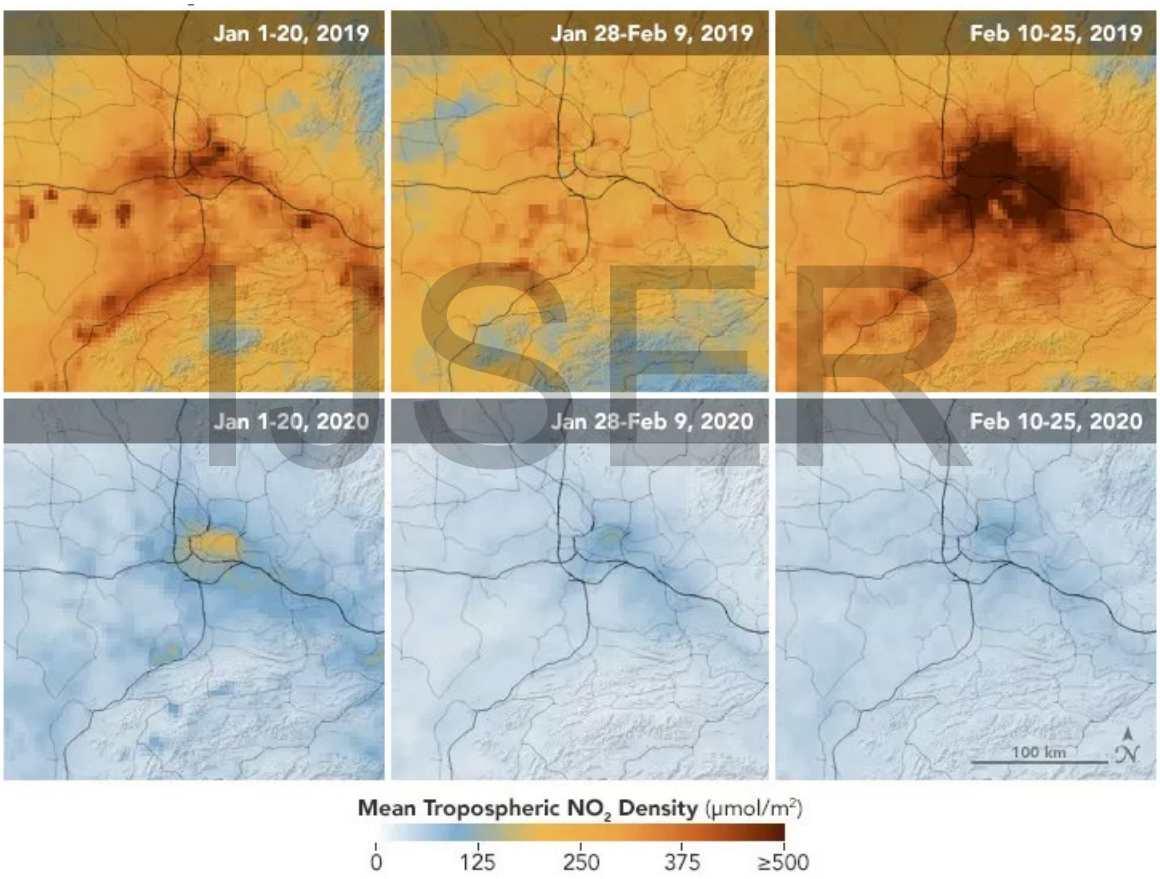
The maps in Figure 7 shows the N0₂ values across China from January 1-20, 2020 (before the quarantine) and February 10-25 (during the quarantine). The data was collected by the Tropospheric Monitoring Instrument (TROPOMI) on ESA's Sentinel-5 satellite. The reduction in nitrogen dioxide in 2020 also coincided with Lunar New Year celebrations in China. Such reduction in the N0₂ levels were generally observed during the New Year period, when shops and factories shut down from the last week in January into early February to celebrate the festival. But this is usually followed by an increase right after the celebration is over. But this time the N0₂ levels have dropped on a larger scale compared to the levels in 2019, mainly due to the isolation of the entire nation for a period of 4 months approximately, owing to the outbreak of the COVID-19. Figure 8 shows the N0₂ value drops in Wuhan, which was the epicentre of the outbreak and was completely under lockdown for about 9-10 weeks.

Figure 10 Pollutant drops in Wuhan - and does not rebound
Unlike 2019, NO2 levels in 2020 did not rise after the Chinese New Year



Source: NASA, Data collected by TROPOMI

Such reduction in emission levels are a big win in the fight against climate change and environmental degradation. But often such patterns show a striking increase in uncontrolled production, manufacturing and economic activities following the slowdown[3]. And this hikes the pollution and degradation levels at a higher rate, as economies struggle to stabilize. A similar drop was observed over several countries during the economic recession that began in 2008, but the decrease was gradual. And also around Beijing during the 2008 Olympics, but the pollution levels were seen to rise again once the Olympics ended. This brings us to the challenge that if it is possible to bring upon a sustainable approach towards a better economy. Countries could deliberate on measures to overcome the crisis by keeping in light the economic and

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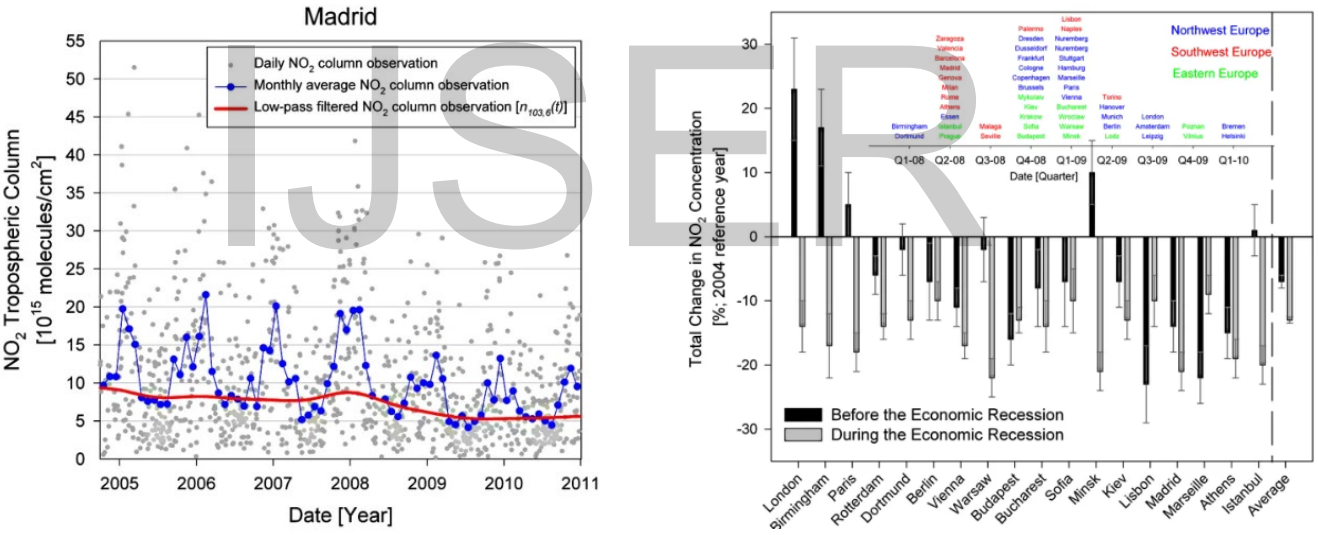
environmental balance. The environmental effects that the pandemic outbreak has brought upon can be a jump start towards a sustainable economy.

8. CASE STUDY- (RECESSION OF 2009)

The prolonged financial crisis of 2009 began in 2008 and some reports evaluate its effects on the environment. There were positive as well as negative impacts of the economic downturn. **Though the economic slowdown reduced the use of natural resources and eased the burdens on the environment, at the same time it also slowed various environmental policy processes and even international action on climate issues as economies struggled rigorously to bounce back to stability.**

The figure 11A shows the trends in NO2 concentrations over the city of Madrid measured with the Ozone Monitoring Instrument (OMI) 19 between October 2004 and December 2010. It indicates the distinct reduction in NO2 emissions during 2008-2009, the time period of economic recession. It also indicates the sharp downturn in the gross domestic product (GDP), industrial production and construction.

Figure 11A: 2004–2010 NO2 column observations over the city of Madrid& Figure 11B :NO2 concentration before(2004) and during (2009) the economic recession



Source: Reductions in nitrogen oxides over Europe driven by environmental policy and economic recession, Science Report, 2012

The figure 11B shows the calculated total relative change in NO 2 concentration before and during the economic recession for 18 large European cities with more than 500,000 inhabitants. This period of reduction in GHG emissions and considerable environmental benefits was short-lived as it was followed by a rigorous action towards economic boost and development, with climate action side-lined or even neglected.

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9. LOW CARBON DEVELOPMENT- A PLAUSIBLE SOLUTION

9.1. Dangers of fossil fuels

More than 5 million human beings in the world already die every 12 months due to air pollution. Two-thirds of air pollution deaths are because of fossil fuels emitted from assets including power generation, motors and factories. Experts estimate that premature and untimely mortality due to air pollutants from streets cost OECD countries $1.7 trillion in 2010. Air pollutants and corona virus both pose highest risks on humans with already existing respiratory conditions like asthma, so this risk already a burden, ought to exacerbate the corona virus's overall contribution to illnesses and deaths[1].

During preceding economic crises, a number of countries became fast adapted to applications that included investments in infrastructure projects. In many cases, this covered building more coal or different fossil fuel power plants, upgrading roads, investing in heavy industries which includes car production, etc. Following the same old system to respond to the COVID-19 pandemic could be a terrible mistake, as it would increase the air pollution health crisis.

1. As nations appear to give their economies a much-needed jolt in the wake of the COVID-19 outbreak, governments and businesses thinking about stimulus packages essentially have alternatives: They can opt for a long term of polluting, inefficient, excessive-carbon and unsustainable development, or they can use this as an opportunity to boost up the inevitable shift to low-carbon and increasingly cheap power and transport structures so as to carry long-term economic benefits. This will target & fight 2 major crises head-on: air pollution and climate emergency.

9.2. Economic benefits of low carbon development

A mounting frame of proof demonstrates that pursuing low-carbon and climate-resilient growth is the best way to achieve lasting economic and social benefits. Bold climate action ought to supply at the least $26 trillion in net international economic benefits between 2020-2030 in comparison with enterprise-as-usual according to the New Climate Economy[5, 6]. This includes developing more than 65 million new low-carbon jobs in 2030, equivalent to the combined work forces of the U.K. And Egypt together at present.

Sustainable, low-carbon infrastructure should be central to any government-led stimulus in reaction to the COVID-19 outbreak. Governments have a critical function to play in setting out robust, properly-articulated and sustainable funding techniques. Investment in sustainable infrastructure creates jobs nowadays and lots of greater social and financial benefits tomorrow.

According to the Global Commission on Adaptation, the net benefit of investing in resilient infrastructure over the next 10 years, majorly in developing countries would be about 4.2 trillion dollars over the entire lifetime of the infrastructure, with a benefit of 4$ each for 1$ invested.

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10. BEST PRACTISES

10.1. Case of Indonesia

In October 2017, the Government of Indonesia declared its goal of integrating climate action into the country's development agenda. **The Low Carbon Development Initiative (LCDI)** was launched at Indonesia's **Ministry of National Development Planning** (BAPPENAS). It aims to explicitly incorporate greenhouse gas (GHG) emissions reduction targets into the policy planning exercise, along with other interventions for preserving and restoring natural resources[7].

The LCDI is a process **for identifying development policies that maintain economic growth, alleviate poverty, and help meet sector-level development targets, while simultaneously helping Indonesia achieve its climate objectives**, and preserve and improve the country's natural resources. It is coordinated by BAPPENAS and brings together several institutions from the Government of Indonesia, the international donor community, local and international partners, distinguished experts, and civil society.

Fewer than twenty years ago, nearly one fifth of Indonesian people lived in extreme poverty. Today, that figure has fallen to less than 10%. Such remarkable progress does not happen by accident. Indonesia's economic and social progress has been driven by a vision and made real by tangible policy decisions that have improved lives and livelihoods for millions of people.

Figure 12Paradigm Change: The benefits of Indonesia's New Low Carbon Growth Path

Source: BAPPENAS analysis.

Between 2000 and 2018 the country had an average GDP growth rate of 5.6% per year. The report on Low carbon Development: A Paradigm Shift towards a Green Economy in Indonesia claims that a low carbon growth path would deliver an average 6% GDP growth rate annually until 2045. And this would open up

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multiple economic, social as well as environmental benefits, including reducing extreme poverty, generating additional jobs with better pay, and avoiding air pollution related deaths and health issues. And by 2045, Indonesia aims at achieving a 42 times higher per capita income.

The benefits of Indonesia's low carbon development are not only local but global as well. Indonesia aims at bringing down its total Greenhouse Gas emission by 43% by 2030, through sustainable use of natural resources, and by reduction of carbon and energy intensity.

A low carbon development pathway is not just an option, but a pressing need of the hour to not only achieve economic growth but also to curb climate change. By Indonesia adopting this measure it's a total win not just for its economy but also its people, local and global environment as well. Its benefits include the following among others:

- An efficient economic growth
- Enhanced incomes, labour employment, and wages
- Higher economic participation for people in the islands, and for more of the country's population
- Higher availability and better quality of environmental goods and services
- More inclusive development
- Improved living conditions.

An economic modelling exercise was undertaken by the BAPPENAS to measure the impacts of different development paths on the country's economy, society and the environment. Four scenarios were considered:

1. **The Base Case**:
   No new policies but reflects environmental degradation — This scenario reflects a continuation of historical trends for the economy, society, climate, and the environment. No new policies are introduced under this scenario. The Base Case does reflect the impacts that environmental degradation, including pollution and increased scarcity of environmental good and services, has on people and the economy.

2. **The LCDI Moderate Scenario**:
   Includes new low-carbon policy measures for 2020-45; achieves the unconditional NDC target — This scenario is consistent with Indonesia meeting its unconditional nationally determined climate target (NDC) of 29% less emissions in 2030 compared with baseline.

3. **The LCDI High Scenario:**
   Includes more ambitious policy measures than LCDI-Moderate for 2020–45; achieves the conditional NDC target — This scenario leads to 43% less emissions in 2030 compared with baseline, consistent with Indonesia meeting its conditional national climate target (NDC) of a 41% reduction in emissions by 2030.

4. **The LCDI Plus Scenario**:
   Reflects LCDI-High for 2020–24, and additional, more ambitious policy measures thereafter— was also produced. It incorporates an extra level of effort in low carbon policymaking starting at around 2025, so that emissions continue falling through 2045 and beyond. This is not currently under consideration.

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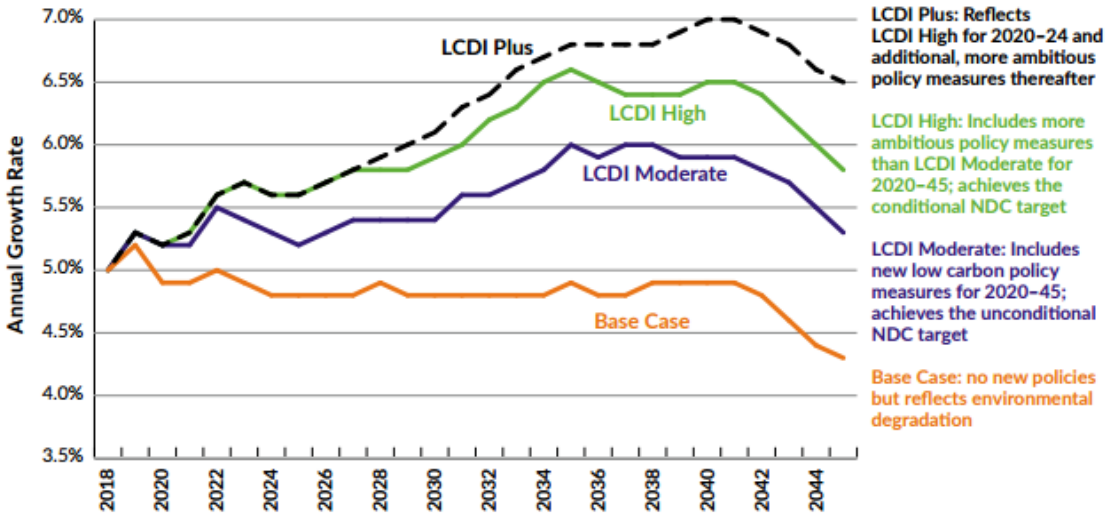
Figure 14 : Growth Trajectories for Scenari os Modeled for This Report (2018–2045)



Source: BAPPENAS Environment Directorate, based on results from Indonesia Vision 2045 Model –IV2045.

This model outcome shows the benefits that a sustainable economic development could bring over the current irresponsible path of development. Low Carbon Development thus can be considered as one way of tackling the present state of pandemic driven economic slowdown, while also contributing towards climate action.

10.2. Case of Brazil

Brazil is the largest tropical country, with agriculture and livestock production as its 2 major sectors contributing to its economic growth. It accounts for about 25 percent of the Country's National GDP. Availability of large volumes of land suitable for crop production and pasture have contributed to these sectors. The expansion of crop and pasture land by converting more native land has resulted in changing the land use of the country. This has contributed a great deal towards GHG emissions in the country. Deforestation is the country's largest source of carbon emissions. It accounts for about two fifth the national gross emission in 2008. Apart from this other agricultural and livestock activities also contribute towards direct emission. The use of fertilizer and mineralization of nitrogen (N) in the soil for increased productivity, the burning of sugar cane, cultivation of wetland irrigated rice, and use of fossil fuel as energy source for agricultural equipment, etc are to name a few. Livestock emissions result mainly from the digestive process of beef cattle, releasing methane into the atmosphere. To increase production and boost economic growth without any action towards sustainability would be to escalate the carbon emissions and cause major environmental degradation. Hence, Brazil faces the dilemma of encouraging development and economic growth and reducing GHG emissions.

In 2008, a National Plan on climate Change (PNMC) was launched in Brazil based on work of the Interministerial Committee on Climate Change, in collaboration with Brazilian Forum on Climate Change and several civil society organizations[8]. As a measure towards climate action, Brazil developed certain forest protection policies and projects to reduce deforestation and to subdue the increasing pressure for economic growth.

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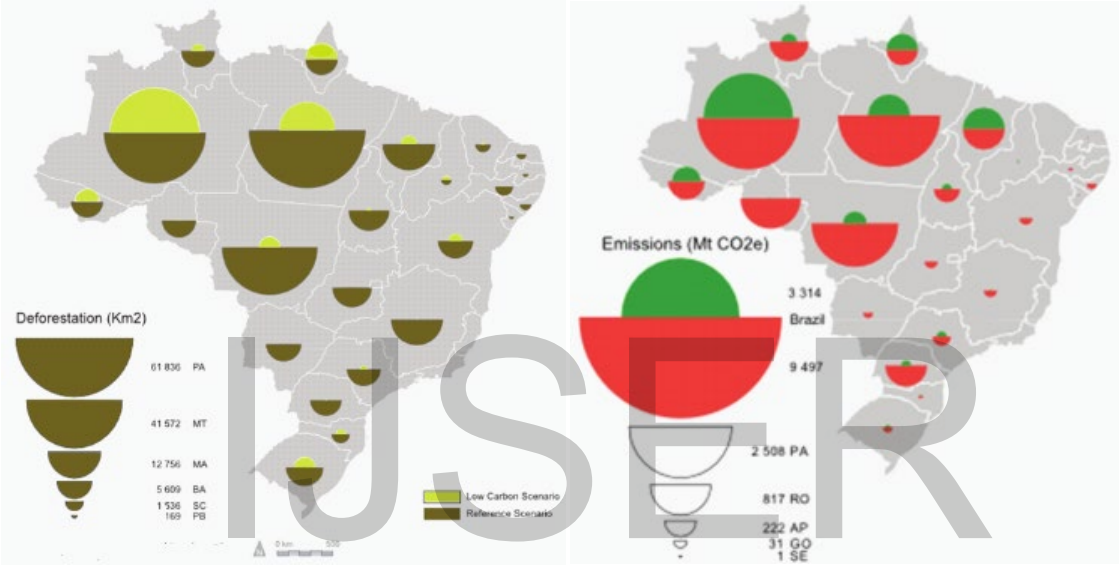
A **dual strategy** was proposed:

(i) To eliminate the **structural causes of deforestation** by **increasing the productivity by hectare**
(ii) **Protect the forest from illegal attempts to cut**. Use of more intensive production systems to enhance economic returns and net economic gain. Model-based projections indicate a reduction in deforestation to about 68% by 2030. Thus reducing the annual emissions from deforestation by 63% by 2030. Further, to reduce direct emissions from agriculture activities, an accelerated dissemination of zero-tillage cultivation was proposed. The zero-tillage cultivation involves far fewer operations, thus reducing emissions caused due to altering soil carbon stock and use of equipment powered by fossil fuels.

Figure 15: Total Area Deforested in Brazil, 2010-2030 and Figure 16: Total Cumulative Emissions from Deforestation, 2010-030



Source: EMBRAPA/ICONE, World Bank Brazil, Low Carbon Case study

Four key areas with large potential **for low-carbon options** were selected:

(i) Land use, land-use change, and forestry (LULUCF), deforestation;
(ii) Transport systems;
(iii) Energy production and use, particularly electricity and oil and gas; and
(iv) Solid and liquid urban waste. To estimate the emissions Brazil would generate over the study period, the scenarios were considered: A "reference scenario" and a projected "low-carbon scenario". The two scenarios are compared to assess the environmental and economic benefits of the latter.

11. CONCLUSION

This paper focuses on the environmental benefits brought in by the pandemic COVID-19, and how it has given a jump start to the fight against environmental degradation and climate change. The need for a shift to low carbon based sustainable development and other measures are as high as the need to contain the pandemic, but is often side-lined. There lies an opportunity for Economies to break the pattern of

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uncontrolled and unregulated measures towards a stable economy. And deliberate on low carbon investments, thus securing tomorrow not just with a stable economy but a balanced environment as well. This is a window open towards a long term plan rather than a short term remedy.

The paper evaluates the case of China, the largest Carbon Emitter in the World among others. China came to a standstill due to the pandemic, and the measures taken to contain the outbreak have indirectly benefited the environment in multiple ways. Within the span of just weeks, the emission levels have come down by 25%. But studies show how such reductions are often followed by a hike when the economy tries to bounce back. And it is here that we can bring a transformation [1] [2] [3].

Best practises such as the ones adopted in Indonesia and Brazil can be taken as a good source of example towards climate action with economic stability. Indonesia, the country that comprised a majority of poor population, through sheer determination and good governance came up with a good action plan to not just improve the economic conditions of the country but also fight climate change. They came up with a solid LCDI plan that focuses on achieving NDC (National Determined Climate target) by 2030 on the basis of the 3 types of growth plans. Similarly, Brazil utilises its natural resources in sustainable ways to minimise the GHG emissions but also increasing their production and economic growth [4].

The global outbreak of COVID-19 has shown how the governments have the ability to take urgent and radical action towards containing crises. However, while attempting to emerge from these crises, we have the choices of bad long term investments to curb the short term economic downturn or the opportunity to use stimulus measures to boost up the economic growth following the pandemic health crises by also addressing air pollution and climate crises.

Though COVID-19 and its economic impacts are the primary focus of governments today, as they look forward to boost their economies, it is important to ponder upon long term measures for tomorrow. Climate action offers a compelling opportunity to countries to achieve a long term sustainable growth post the pandemic crisis.

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