

JIGNASA STUDENT STUDY PROJECT
ON
“ IMPACT OF COVID-19 IN INDIA “



Submitted to

COMMISSIONER OF COLLEGIATE EDUCATION
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CERTIFICATE

This is to certify that the work incorporated in this project entitled “ IMPACT OF COVID – 19 IN INDIA “has been carried out by B.Sc. Life Sciences students under the guidance of Dr.K.Ganesh Asst. Prof. of Zoology.

I further certify that the project work done by the students is original, the assistance and help taken during the project work and source of literature is fully acknowledged.

In charge

Dept.of Zoology

PRINCIPAL



ACKNOWLEDGEMENTS

1. It is our immense pressure to acknowledge the deep personal interest, invaluable guidance of our teacher Dr.K.Ganesh Assistant Professor of Zoology, Kakatiya Government College, Hanamkonda in completion of the study project.

2. We also acknowledge the constant support of our Principal Dr.P.Raja Reddy during the completion of the project.

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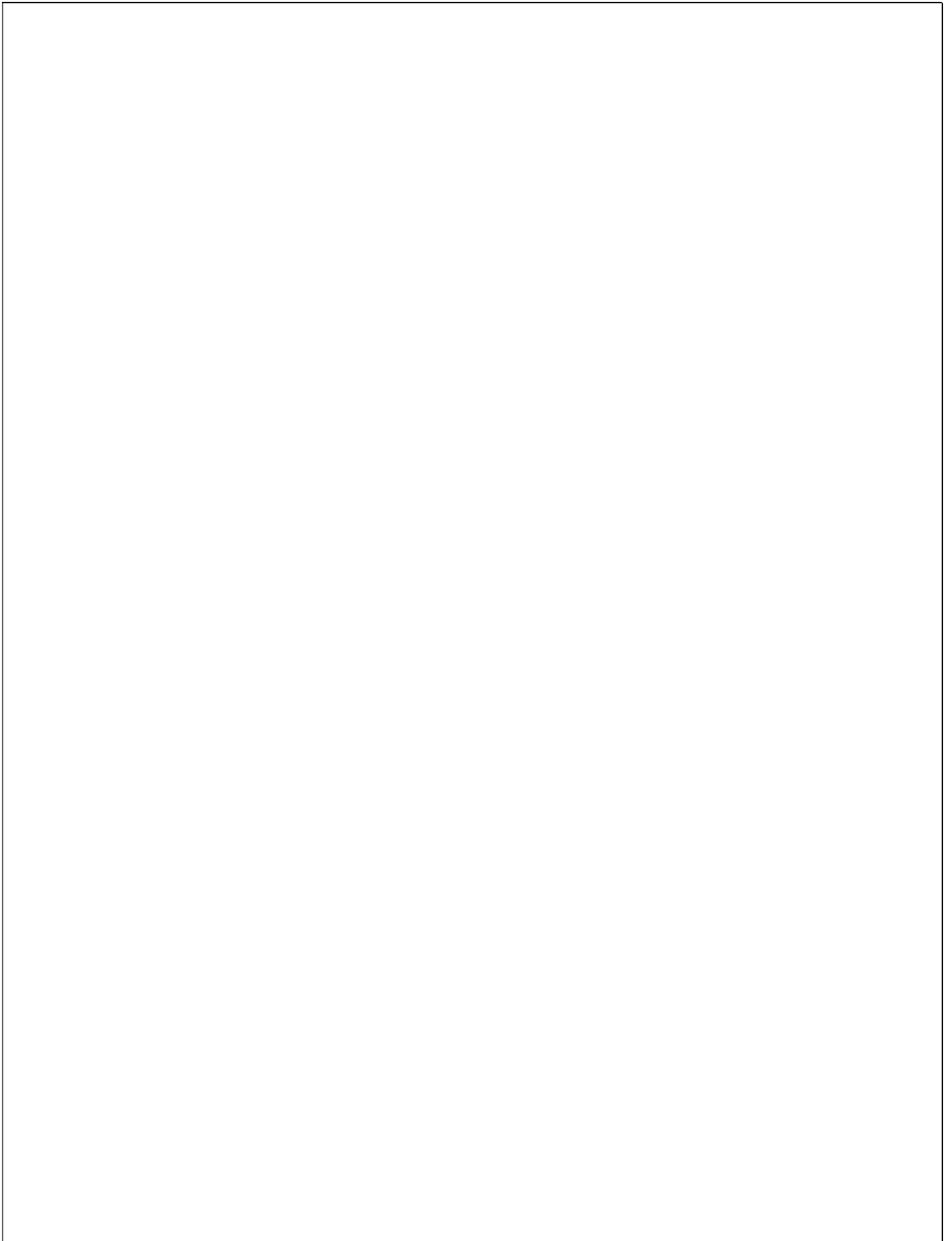
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INTRODUCTION

World Bank and rating agencies had initially revised India's growth for FY2021 with the lowest figures. The COVID-19 pandemic in India is a part of the worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of 27 September 2021, according to official figures, India has the second-highest number of confirmed cases in the world. With 33,678,786 reported cases of COVID-19 infection and the third-highest number of COVID-19 deaths at 480,592 deaths. However these figures exhibit severe under-reporting

The first cases of COVID-19 in India were reported on 30 January 2020 in three towns of Kerala, among three Indian medical students who had returned from Wuhan, the epicenter of the pandemic. Lockdowns were announced in Kerala on 23 March, and in the rest of the country on 25 March. On 10 June, India's recoveries exceeded active cases for the first time. Infection rates started to drop in September, along with the number of new and active cases. Daily cases peaked mid-September with over 90,000 cases reported per-day, dropping to below 15,000 in January 2021. A second wave beginning in March 2021 was much more devastating than the first, with shortages of vaccines, hospital beds, oxygen cylinders and other medical supplies in parts of the country. By late April, India led the world in new and active cases. On 30 April 2021, it became the first country to report over 400,000 new cases in a 24-hour period. Experts stated that the virus *may* reach an endemic stage in India rather than completely disappear; in late August 2021, Soumya Swaminathan said India may be in some stage of endemicity where the country learns to live with the virus.

The economic impact of the COVID-19 pandemic in India has been largely disruptive, India's growth in the fourth quarter of the fiscal year 2020 went down to 3.1% according to the Ministry of Statistics. The Chief Economic Adviser to the Government of India said that this drop is mainly due to the coronavirus pandemic effect on the Indian economy. Notably India had also been witnessing a pre-pandemic slowdown, and according to the World Bank, the current pandemic has "magnified pre-existing risks to India's economic outlook. The India has seen in three decades since India's economic liberalization in the 1990s. However, after the announcement of the economic package in mid-May, India's GDP estimates were downgraded

even more to negative figures, signaling a deep recession. (The ratings of over 30 countries have been downgraded during this period.) On 26 May, CRISIL. Announced that this will perhaps be India's worst recession since independence. State Bank of India research estimates a contraction of over 40% in the GDP in Q1. The contraction will not be uniform. rather it will differ according to various parameters such as state and sector. On 1 September 2020, the Ministry of Statistics released the GDP, which showed a contraction of 24% as compared to the same period the year before.

According to Nomura India Business Resumption Index economic activity fell from 82.9 on 22 March to 44.7 on 26 April. By 13 September 2020 economic activity was nearly back to pre lockdown. Unemployment rose from 6.7% on 15 March to 26% on 19 April and then back down to pre-lockdown levels by mid-June. During the lockdown, an estimated 140 million people lost employment while salaries were cut for many others. More than 45% of households across the nation have reported an income drop as compared to the previous year. The Indian economy was expected to lose over 32,000 crores every day during the first 21-days of complete lockdown, which was declared following the coronavirus outbreak. Under complete lockdown, less than a quarter of India's \$2.8 trillion economic movement was functional. Up to 53% of businesses in the country were projected to be significantly affected. Supply chains have been put under stress with the lockdown restrictions in place: initially, there was a lack of clarity in streamlining what an "essential" is and what is not. Those in the informal sectors and daily wage groups have been at the most risk. A large number of farmers around the country who grow perishables also faced uncertainty.

Major companies in India such as Larsen & Toubro, Bharat Forge, UltraTech Cement, Grasim Industries, Aditya Birla Group, BHEL and Tata Motors temporarily suspended or significantly reduced operations. Young startups have been impacted as funding has fallen. Fast-moving consumer goods companies in the country have significantly reduced operations and are focusing on essentials. Stock markets in India posted their worst losses in history on 23 March 2020. However, on 25 March, one day after a complete 21-day lockdown was announced by the Prime Minister, SENSEX and NIETTY posted their biggest gains in 11 years.

Indices: S&P BSE 500 (January 2015 to November 2020). Blue highlight reflects COVID-19 period S (taken to start from March 2020 as per first lockdown). - Tackling...

The Government of India announced a variety of measures to tackle the situation, from food Security and extra funds for healthcare and for the states, to sector related incentives and tax deadline extensions. On 26 March a number of economic relief measures for the poor were announced totaling over 170,000 crore. The next day the Reserve Bank of India also announced a number of measures which would make available 374,000 crore to the country's financial system.

The World Bank and Asian Development Bank approved support to India to tackle the coronavirus pandemic.

The different phases of India's lockdown up to the first unlock" on 1 June had varying degrees of the opening of the economy. On 17 April, the RBI Governor announced more measures to counter the economic impact of the pandemic including 50,000 crore special finance to NABARD, SIDBI, and NHB. On 18 April, to protect Indian companies during the pandemic, the government changed India's foreign direct investment policy. The Department of Military Affairs put on hold all capital acquisitions for the beginning of the financial year. The Chief of Defence Staff has announced that India should minimize costly defense imports and give a chance to domestic production; also making sure not to "misrepresent operational requirements

On 12 May the Prime Minister announced an overall economic stimulus package worth lakh crore. Two days later the Cabinet cleared a number of proposals in the economic package including a free food grains package. In December 2012, a Right to Information petition revealed that less than 10% of this stimulus had been actually disbursed. By July 2020, a number of economic indicators showed signs of rebound and recovery. On 12 October and 12 November, the government announced two more economic stimulus packages, bringing the total economic stimulus to 29.87 lakh crore by December 2021. India was back to pre-COVID 19 growth.

While the direct impact of COVID-19 has already been substantial additional layers of delayed or indirect impact have the potential to dwarf the immediate effects these additional layers of impact related to COVID-19 could result in S125 billion to \$200 billion in incremental annual PS health system cost.

AIMS AND OBJECTIVES

To study the impact on

1. Education
2. Food system
3. Health
4. Economy
5. Environment

To portrait the covid-19 causes and losses

To collect the data of various loss

To bring in awareness of covid-19

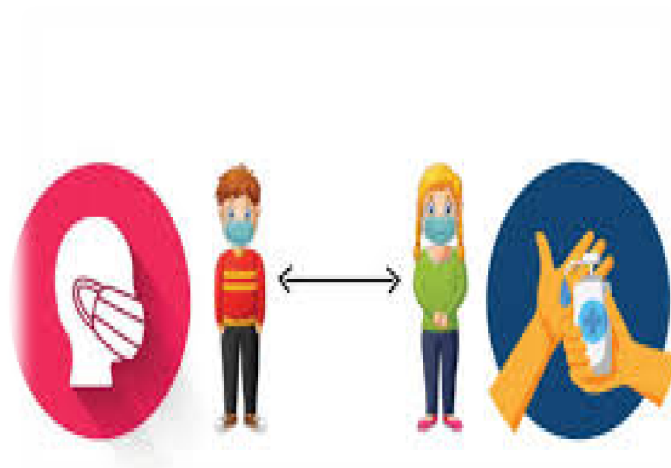
Encourage to change the environment for people

REVIEW OF LITERATURE

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shortages of vaccines, hospital beds, oxygen cylinders and other medical supplies in parts of the country. By late April, India led the world in new and active cases. On 30 April 2021, it became the first country to report over 400,000 new cases in a 24-hour period. Experts stated that the virus may reach an endemic stage in India rather than completely disappear in late August 2021, Soumya Swaminathan said India may be in some stage of endemicity where the country learns to live with the virus. Economic impact of the COVID-19 pandemic in India has been largely disruptive, India's growth in the fourth quarter of the fiscal year 2020 went down to 3.1% according to the Ministry of Statistics. The Chief Economic Adviser to the Government of India said that this drop is mainly due to the coronavirus pandemic effect on the Indian economy. Notably India had also been witnessing a pre-pandemic slowdown, and according to the World Bank, the current pandemic has "magnified pre-existing risks to India's economic outlook The World Bank and rating agencies had initially revised India's growth with the lowest figures India has seen in three decades since India's economic liberalization in the 1990s. However, after the announcement of the economic package in mid-May, India's GDP estimates were downgraded even more to negative figures, signalling a deep recession. (The ratings of over 30 countries have been downgraded during this period.) On 26 May, CRISIL. Announced that this will perhaps be India's worst recession since independence. State Bank of India research estimates a contraction of over 40% in the GDP. The contraction will not be uniform. rather it will differ according to various parameters such as state and sector. On 1 September 2020, the Ministry of Statistics released the GDP (April to June), which showed a contraction of 24% as compared to the same period the year before.

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METHODOLOGY

- The study was conducted based on both primary information and secondary information. These are given below:
 - **Primary Sources:**
 - Face to Face interaction with 50 families belonging to various sectors and through questionnaires.
 - **Secondary Sources:**
 - Different articles, research about Covid-19 impact Websites, Journals Search in Google.

This study uses the Current Population Survey (CPS) data between May 2020 and December 2020. The CPS is a monthly survey of over 60,000 households administered by the Census Bureau. The CPS is designed to represent the civilian non-institutional population of each state.



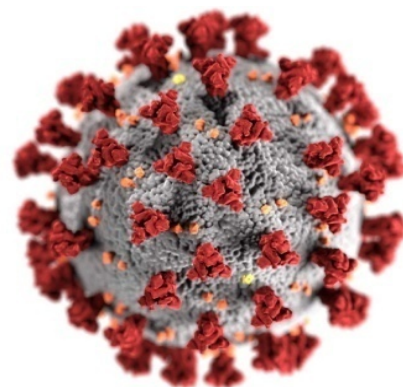




IMPACT OF COVID-19 ON FOOD SYSTEM

The globally fast-spreading novel coronavirus disease (COVID-19) is now testing the abilities of all countries to manage its widespread implications on public health. To effectively contain its impacts, a nation-wide temporary lockdown was enforced in India. The resultant panic buying and stockpiling incidents together with spread of misinformation created a sense of food insecurity at local level. This paper discusses a specific case of Nagpur from the worst affected Maharashtra state of India, wherein the urban– rural food supply chains were reportedly disrupted. Based on formal interviews with local government officials, a month-long timeline of COVID-19 outbreak in Nagpur was studied along with the consequent government initiatives for maintaining

public health and food supply. While the city residents were confined to their homes, this study then assessed their perceived food security at household level, along with their “Immediate Concerns” and “Key



Information Sources”. Through online surveys at two different time intervals, the concerns of “Food and Grocery” were found to be rising, and “Government Apps and Websites” were identified as the most reliable source of information. Based on the research findings, the authors further suggest specific policy recommendations for addressing the immediate and long-term concerns related to food systems in Nagpur.

Coronavirus disease 2019 (COVID-19) is a respiratory illness caused by the novel coronavirus, officially referred to as Severe Acute Respiratory Syndrome coronavirus (SARS-COV-2), which was first detected in China, in December 2019. There is currently no evidence if food is a likely source or route of transmission of this virus, but it has been reported to originate from the world-famous Huanan seafood market in Wuhan city. Four months later on 11 March 2020, the World Health Organization (WHO) declared the coronavirus outbreak a pandemic, after it spread over several countries affecting a large number of people. As per the global tally kept by the Johns Hopkins University, until 1 August 2020, the virus has already killed 675,213 people worldwide and more than 17.40 million cases have been confirmed in 188 out of 195 countries. The resultant panic situation due to COVID-19 outbreak is also being associated with the term “Infodemic”, as huge amount of information and misinformation is flowing through different channels, including social media. In the wake of COVID-19 global health emergency, terms such as “Quarantine”, “Social distancing” and “Lockdown” have today become the buzz words. A lockdown in this context mainly refers to the restrictions being imposed by the governments on movement of people and goods to prevent the spread of infections. Although COVID-19 is reported to be not as deadly in comparison to past pandemics such as Ebola virus disease, SARS and Middle East Respiratory Syndrome (MERS) its high transmissibility and rapid speed of spread have become a matter of serious concern for governments around the world. It is discussed several international response measures, which are implemented to break the chain of virus transmission such as reduction in transportation (through all ground, ocean and air means), tightened border controls, travel bans, lockdowns, advanced surveillance, etc. While the pandemic is still unfolding, global agencies including WHO, the World Bank, the International Monetary Fund (IMF), the Food and Agriculture Organization of the United Nations (FAO) and the World Trade Organization (WTO) have projected its drastic impacts on global economy and food systems, unless fast measures are taken to contain the spread of infections. Even before the

outbreak of COVID-19, the global food systems were already at a critical juncture, as also discussed in the 2020 Global Food Policy Report. As of 2018, more than 820 million people worldwide did not have secure access to food. Other widespread concerns of climate change, natural disasters, high population growth, poverty, malnourishment, changing consumption patterns, obesity, etc. have also been posing serious challenges for sustainable development, particularly in fast growing cities of Asia. The sudden emergence of COVID-19 pandemic has currently overshadowed or rather aggravated the already existing concerns of food insecurity. According to a recent projection by the United Nations World Food Programme, COVID-19 may aggravate the risks of acute food major signs of global food shortages. However, demand-side contractions have recently been witnessed due to the largescale closure of restaurants and other commercial food services. As most countries are now under strict lockdowns or in similar situations, Petetin uncovered that the majority of the food consumption is presently concentrated at the household level. Further, food prices are also reported to be increasing in cities around the world, as food supply from rural areas is disrupted due to the mobility restrictions. Cities have traditionally been dependent on areas outside their physical boundaries mostly surrounding rural and peri-urban areas to meet their food demands, but the sudden transport restrictions and shortage of manpower have presently disrupted the urban–rural food supply chains (from harvesting crops to food distribution) worldwide. While the jobs and livelihoods of food supply chain actors are at significant risk, the government mandated lockdowns are also found to be influencing the consumer behavior towards food along with their food priorities and lifestyles. In a bid to contain the impacts of COVID-19 at an early stage, the Government of India (GoI) enforced a temporary nation-wide lockdown (the world’s largest) from 24 March 2020, by confining more than 1.3 billion people to their homes. Despite the fragile economy, the country’s timely decision was highly appreciated by global agencies including WHO and IMF, mainly in consideration to their huge population and limited healthcare capacities. Although comprehensive protection measures were put in place at various administrative levels, GoI also announced a huge stimulus package of 20 lakh crore Indian Rupees ‘INR’. To alleviate the economic impacts of COVID-19. Nevertheless, the negative implications of enforced lockdown in India have surfaced in form of a serious economic slowdown, panic-stricken migrant crisis, panic buying, etc.. With around 195 million undernourished people, India already shares a quarter of the global hunger burden and also performs poorly on indicators of child wasting,

stunting and mortality, as per the Global Hunger Index 2016. In the lockdown phase, the situation is therefore particularly critical in Indian cities, where majority of fresh food supply is dominated by the unorganized retail market. The wide-ranging implications of COVID-19 on local food systems are yet to be understood clearly, as very few evidence-based studies have emerged thus far. In the context of India, the media reports have however covered several issues. Mishra and Rampal underlined that there is still a lack of rigorous academic studies that examine the impacts of COVID-19 on food insecurity. With an aim to bridge this gap, this paper discusses a specific case of Nagpur from the worst affected Indian state of Maharashtra. As of 1 August 2020, the state of Maharashtra has reported more than 420,000 confirmed cases out of the total 1.64 million cases reported in India. To control the spread of coronavirus infections in Nagpur in parallel to maintaining the local food systems, a range of government initiatives has been taken by the local authorities. At the same time, the incidents of panic-buying, spread of misinformation, etc. have raised food security related concerns among the city residents, as they stayed confined to their homes under the enforced lockdown. In regards to that, the three key objectives of this study were:

(1) To firmly understand the chronology of COVID-19 outbreak in Nagpur and its implications on local food systems;

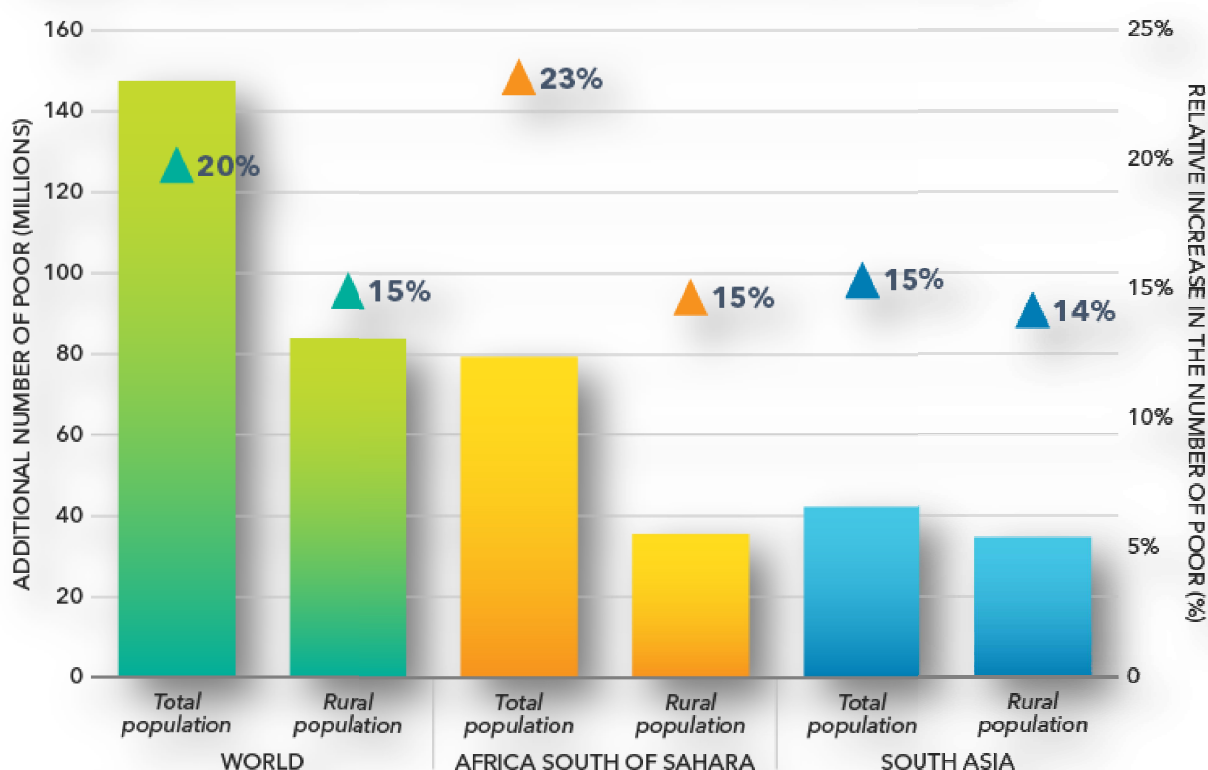
(2) To understand the perceived food security of Nagpur city residents at household level during the lockdown phase and assess their perception regarding their “Immediate Concerns” and “Key Information Sources”; and

(3) To suggest feasible recommendations for addressing the immediate and long-term concerns related to food systems in Nagpur. The food security assessment at household level is mainly intended to assess the effectiveness of local government initiatives in providing a secure food environment, as the city residents stayed confined to their homes under the enforced COVID-19 lockdown. While the food supply chains are widely disrupted due to the enforced mobility restrictions, the urban areas have adversely been affected due to their predominant dependence on rural areas for meeting their fresh food demands. In that context, the study also aimed to highlight the importance of urban–rural partnerships for strengthening local food systems.

IMPACT OF COVID-19 ON FOOD SYSTEM

Systems are basically defined as the sum of actors (farmers, traders, consumers, etc.) and their interactions along the various stages of food value chain such as production, storage, processing, transport, distribution, etc. As the COVID-19 pandemic continues to be a major concern for the government agencies, only a handful of studies have so far been conducted to assess its impacts on local food systems and related factors. Company synthesized the wide-ranging adverse effects of COVID-19 on various factors involved in food systems, ranging from food producers to consumers. The study stressed that the COVID-19 impacts on food security are further worsened by the government mandated lockdowns and business closures, as they consequently lead to loss of income and purchasing power. These restrictions also pose detrimental effects on the food supply, as they not only cause labor shortage but also hinder the flow of agricultural goods and services. On the demand side, it leads to panic buying amongst the consumers and stockpiling. Further, based on a preliminary analysis of 31 European countries, After produced reliable empirical evidence that reveals the increase in overall food prices due to stay-at-home restrictions. Galanakis also discussed the food systems in the coronavirus era and raised an alert for global food security as billions of people are currently living under temporary lockdown or in similar situation.

FIGURE 1 Impact of COVID-19 Global Economic Crisis on Extreme Poverty



■ Increase in number of poor people (millions; PPP\$1.90 poverty line)

▲ Relative increase in the number of poor (%)

Source: Authors based on simulations with MIRAGRODEP model.

Emerging Food Security Challenges and Assessment Methods

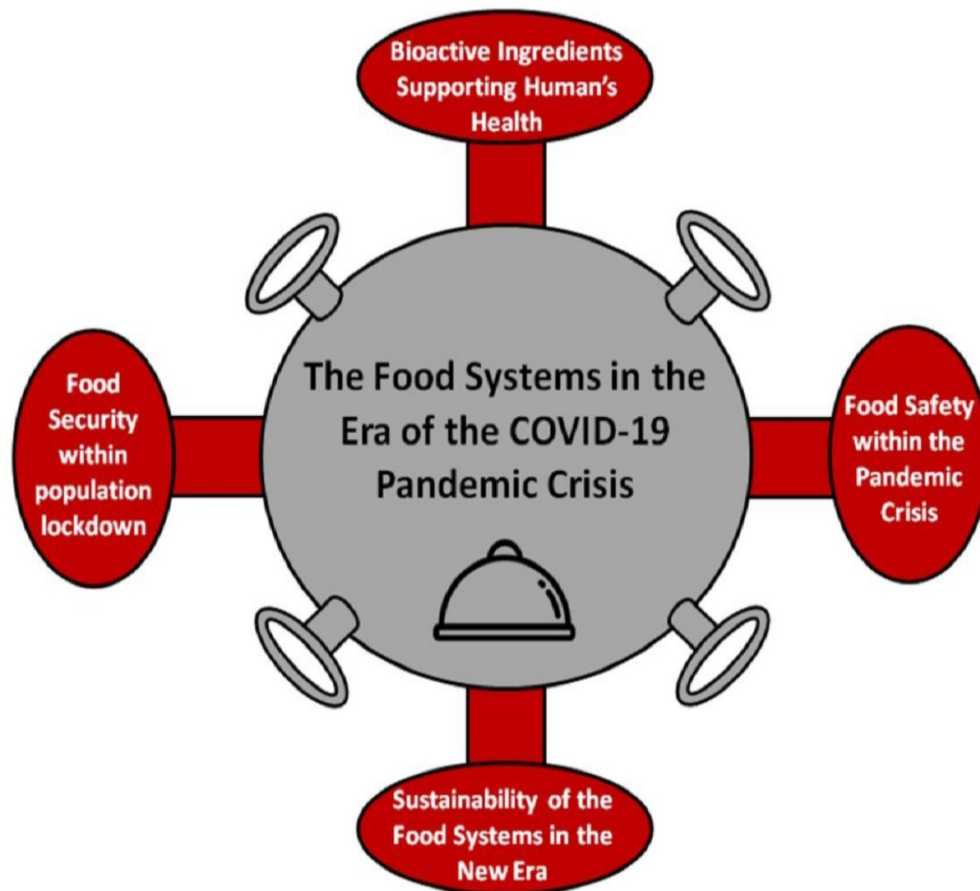
Food security is a multidimensional concept that conventionally stresses on food availability and accessibility at individual level, along with food quality and cultural preferences. As per the definition established by World Food Summit 1996, “food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. In the present context, COVID-19 is directly undermining the food security through disrupted supply chains, and it is also causing indirect impacts due to lockdowns in terms of reduced household incomes, restricted physical access to food, etc. further stressed that the ongoing COVID-19 pandemic affects all the four dimensions of food security, defined by the United Nations ,namely availability, accessibility, utilization and stability. The changing consumer behavior linked to the panic buying and stockpiling incidents are already affecting the food availability in the short

term, but in the long term other challenges in terms of food import–export, etc. may unfold. The relative increase in food prices due to COVID-19 lockdowns, the shortage of preferred products, etc. are also impacting the food accessibility in the recent times. For poor people specifically, the increased food costs and closure of informal food markets may impact their food utilization in terms of reduced diet quality and nutrition intake. Lastly, the stability of food supply is also threatened by COVID-19 due to varied reasons, as already discussed. The 2008 global food crisis had earlier mainstreamed the importance of food security in the global policy agenda. Since then, numerous efforts have been made to establish measures for understanding this multifaceted concept. A variety of research frameworks and indicator sets have also been developed for the assessment of food security at different levels such as individual, household, community, national, regional and global. The wide-ranging indicator sets have focused on variety of dimensions (availability, access, utilization, consumption, stability, sustainability, etc.) and components (quality, quantity, local preferences, cultural acceptability, etc. Particularly at the household level, various indicators are presently being employed for evaluation, monitoring, analysis, etc. However, food security assessments at household level remain a challenge as the term “household” is still subjected to varying interpretations and its composition also varies. Selecting appropriate indicators for analyzing different dimensions of food security at different scales is also recognized as a serious challenge. Also, food insecurity has for long been viewed from the perspective of rural population only. However, in the recent years, there has been a growing recognition for this issue in context of urban population.

Importance of Urban–Rural Partnerships for Enhancing Food Security in Context of India

Fostering partnerships between urban and rural areas is important for sustainable development, as they are closely linked through a range of spatial and sectoral linkages, including food supply. Urban areas have traditionally been reliant on surrounding peri-urban and rural areas to meet their fresh food demands. However, the conventional urban–rural food linkages are increasingly stressed due to the fast-growing urban population, rapid urbanization, industrialization, etc. Lately, the industrial supply chains have started to dominate the food markets by maintaining a steady supply of processed food with higher standards. In the present context of COVID-19 in India, the GoI has assured a wide distribution of food grains at affordable prices. Through the

established Public Distribution System (PDS) and large buffer stocks maintained under the National Food Security Act 2013 (explained by Pillay and Kumar). However, it is important to note that the PDS system is supplemental in nature, and there are already substantial challenges related to food supply and distribution in India. Pointed that the PDS system caters to only 5% of all purchased food in India, and the remaining 95% of purchased food is sold by private sector. The study also indicated that 60% of the food consumption in India is centered in urban areas, and the growing food demands are increasingly being met by long urban–rural supply chains. Following the enforced mobility restrictions and disrupted food supply chains, the ongoing COVID-19 pandemic has therefore created a sense of food insecurity in urban centers. However, very limited research has thus far been done to understand the food insecurity issues in context of urban areas in India. Recently, the importance of urban–rural partnerships has gained high prominence, especially after the global policy agreements, namely Sustainable Development Goals “SDG” and The New Urban Agenda .Goal 11 of the SDGs specifically emphasizes on strengthening the urban–rural linkages from a regional planning perspective. The United Nations Human Settlement Programme (UN-Habitat) also defined key entry points to foster urban–rural linkages for implementing The New Urban Agenda through integrated development planning.



COVID-19 IMPACT ON EDUCATION IN INDIA

The spread of COVID-19 has sent shockwaves across the globe. The public health crisis, unprecedented in our lifetimes, has caused severe human suffering and loss of life. The exponential rise in infected patients and the dramatic consequences of serious cases of the disease have overwhelmed hospitals and health professionals and put significant strain on the health sector. As governments grappled with the spread of the disease by closing down entire economic sectors and imposing widespread restrictions on mobility, the sanitary crisis evolved into a major economic crisis which is expected to burden societies for years to come. According to the OECD's latest Economic Outlook, even the most optimistic scenarios predict a brutal

recession. Even if a second wave of infections is avoided, global economic activity is expected to fall by 6% in 2020, with average unemployment in OECD countries climbing to 9.2%, from 5.4% in 2019. In the event of a second large-scale outbreak triggering a return to lockdown, the situation would be worse (OECD, 2020). All this has implications for education, which depends on tax money but which is also the key to tomorrow's tax income. Decisions concerning budget allocations to various sectors (including education, healthcare, social security and defence) depend on countries' priorities and the prevalence of private provision of these services. Education is an area in which all governments intervene to fund, direct or regulate the provision of services. As there is no guarantee that markets will provide equitable access to educational opportunities, government funding of educational services is needed to ensure that education is not beyond the reach of some members of society. In 2017, total public expenditure on primary to tertiary education as a percentage of total government expenditure was 11% on average across OECD countries. However, this share varies across OECD and partner countries, ranging from around 7% in Greece to around 17% in Chile. However, government funding on education often fluctuates in response to external shocks, as governments reprioritise investments. The slowdown of economic growth associated with the spread of the virus may affect the availability of public funding for education in OECD and partner countries, as tax income declines and emergency funds are funnelled into supporting increasing healthcare and welfare costs.

However, the current crisis may affect education budgets more quickly as public revenues decline sharply and governments review the prioritisation of education in national budgets. Forecasts predict that the pandemic will lead to slower growth in government spending in the coming year, and that if the share of government spending devoted to education were to remain unchanged, education spending would continue to grow but at significantly lower rates than before the pandemic. In the short term some countries have implemented immediate financial measures to support students and education systems in coping with the disruptions and economic impact of school and university closures. Examples include: • The Higher Education Relief Package, launched in April 2020 by the Australian government, which provided funding to Australians who have been displaced as a result of the COVID-19 crisis and who were looking to improve their skills or retrain. This package reduced the cost of taking short online courses, provided exemptions from loan fees for domestic students for a

period of six months starting in May and guaranteed funding for domestic students, even if enrollments dropped.

- The launch of the Canada Emergency Student Benefit announced in April 2020 which seeks to provide financial support to post-secondary students and recent highschool graduates who are unable to find work due to COVID-19 over the summer months. The Student Service Grant will also provide financial support to students who do national service and serve their communities during the pandemic crisis. The government has also announced plans to double student grants and broaden the eligibility for financial assistance, as well as additional support in the form of scholarship funding extensions for students and postdoctoral researchers affected by the COVID-19 pandemic (Ministry of Education, 2020).

- Distance learning support measures announced by the Italian government in March 2020 to equip schools with digital platforms and tools for distance learning, lend digital devices to less well-off students, and train school staff in methodologies and techniques for distance learning (Republic of Italy, 2020). In May 2020 Italy announced new measures which seek to provide extra funding to cover costs arising from responses to the pandemic crisis at the school and university level (Republic of Italy, 2020). This extra funding will cover the costs associated with special services, safety equipment and cleaning material needed in schools and universities for the next academic year, among other things. Additional financial resources were approved to recruit new teachers for primary to secondary level for the next school year. Emergency financial grants to cover partial or total course-related costs were announced for less well-off tertiary students.

- Support packages for tertiary students announced by the New Zealand government in April 2020 to help students continue their studies after the crisis. Measures include increasing the amount of student loans and providing additional support to students to cover extra course related costs (Ministry of Education, 2020).

- England's (United Kingdom) financial support for schools launched in April 2020, which provides additional funding to schools to support them with costs associated with the coronavirus. The additional costs covered by the fund include utilities and resources needed to keep the school open during holidays for priority groups of children, support for free school meals for eligible children attending school, as well as additional cleaning costs, where schools have suspected or confirmed cases of the virus (Department for Education, 2020).

- The announcement of the CARES Act Higher Education Emergency Relief Fund by the education authorities in the United States which provides funding to institutions to One of the aspects of tertiary education which Education at a Glance tracks each year is international student flows. This is an area where future editions of this publication may reveal a sharp reversal of trends in the year that COVID-19 struck. The global spread of the COVID-19 pandemic severely affected higher education as universities closed their premises and countries shut their borders in response to lockdown measures. The crisis has affected the continuity of learning and the delivery of course material, the safety and legal status provide emergency financial aid grants to students whose lives have been disrupted (U.S. Department of Education, 2020). The CARES Act Elementary and Secondary School Emergency Relief Fund aims to provide financial support to school districts affected by the disruption and closure of schools from COVID-19.

The current worldwide epidemic has wreaked havoc on one of the most important systems: education. Education is undeniably crucial in contributing to a country's welfare and an individual's growth, but it has been jeopardized by the emergence of Covid -19. It has had a huge impact on the lives of millions of kids. There have been a number of severe targets that have had to be met since the lockdown was implemented. Education was also hampered by the economic crisis, which reduced its output. According to studies, the epidemic has denied almost 32 crore students of an education. This is being referred to as a national crisis, with an increase in unemployment as a result.

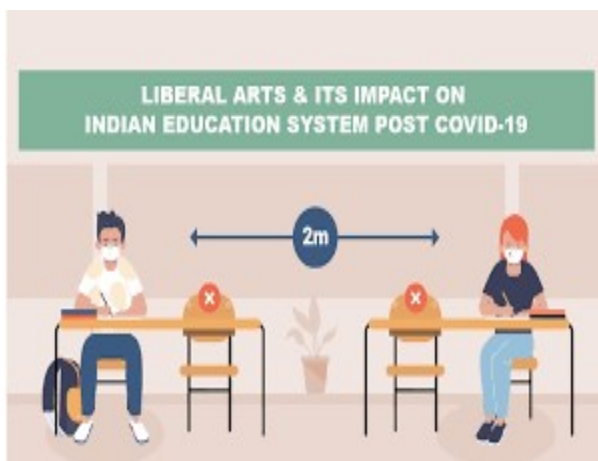
In March 2020, a nationwide lockdown was imposed, forcing some schools and colleges to close and instructing students to abandon the usual classroom teaching style. This resulted in an immediate increase in innovation and technology, which the teachers used to finish the curriculum. However, due to a lack of infrastructure, productivity suffered. Remote learning was not available in every family; according to the Global internet network research, just 24% of households had a consistent internet connection, while other remote areas remained unreachable. As a result, the government was forced to ensure that sufficient benefits and monetary funds were provided.

Let us not ignore the impact on girls, who have recently begun to defy educational conventions and have been seen dropping out of schools in large numbers. In extreme circumstances, the fall

rate of poverty was recorded at 8% of GDP, resulting in additional reasons such as unemployed families who couldn't afford fees and resources being forced to stop their children's education due to debts, and so on. Boys were requested to work as daily wage employees, while girls were assigned to home chores, prompting the government to ask a series of questions in order to stimulate emergence.

In response other financial aid were all incorporated in the majority of the amended schemes. Similarly, several sections of India have received support from the government as well as non-governmental organizations to the situation in Karnataka, chief minister B.S. Yeddyurappa established government-sponsored funds to assist low-income students and their families. Early pension benefit, lunch facility, fee processing, and funds.

According to ASER (Annual Status of Education Report), they have demonstrated with verifiable data that parents, even in rural areas, have showed full interest in their children's education despite the minimal resources available to them. As a result, this demonstrates a promising aspect of the educational system in terms of raising government awareness in order to meet their demands. On the plus side, with the increased use of webinars, conferences, and financial aid through volunteer organizations, things have definitely improved over time. The goal was to create a traditional educational environment using digital technology. To get pupils' attention, teachers started creating modules, frameworks, and explanations on whiteboards, similar to how a classroom is set up. One of the sole tasks in the next years will be to take



necessary safeguards to safeguard children while also affiliating them with teaching aids, as this creates the groundwork for an upcoming mode of educational growth.

The education sector in India, which was hitherto slow to change, has been witnessing a massive transformation recently with changing job landscape, technological disruptions, demand for quality education and the implementation of

National Education Policy (NEP) 2020. The pandemic caused further shocks to the system with schools forced to shut down during the lockdown period, and the transition of students and

teachers to online teaching-learning. In India, around 250 million students were affected due to school closures at the onset of lockdown induced by COVID-19. The pandemic posed several challenges in public and private schools which included an expected rise in dropouts, learning losses, and increase in digital divide. The pandemic also called into question the readiness of the systems, including teachers to address such a crisis and sustainability of private schools. However, COVID-19 also acted as a catalyst for digital adoption in school education. With schools reopening in many states, it is important that a careful strategy is built in to smoothen the transition of children back to school after more than 15 months of home-based learning. This transition has to consider the learning losses which had happened over the previous year as well take a futuristic approach to build a resilient system which can withstand any future shocks. NEP 2020, and subsequent government initiatives such as National Digital Education Architecture (NDEAR) and National Initiative for Proficiency in Reading with Understanding and Numeracy (NIPUN Bharat) are expected to provide a blueprint for this transformation. The paper is a culmination of CII School Summit 2021 which brought together policy makers, industry heads, and service providers together on a platform to deliberate on the road to recovery for schools post the pandemic. It analyses the impact of the pandemic across five themes and maps the various initiatives undertaken by governments and civil society organizations to address the challenges:

1. Curtailing dropouts during and post pandemic
2. Decline in learning outcomes and well-being
3. Integration of digital based learning
4. The role and capacity of teachers and
5. Sustainability of private schools.

It further draws a roadmap to recovery for the school education system across these five themes centered around the vision laid down by NEP 2020 as well as drawing from best practices across the globe in the form of 13 recommendations. The paper unfolds discussions on some important thematic between student and educator, systemic interventions redefining the role of teachers as ‘edupreneurs’, role of digital technology in impacting teaching-learning process, solutions bridging the learning gaps in curriculum, pedagogy and assessments and strategies for ensuring sustainability of private schools. The paper may act as a reference for all concerned stakeholders

on post pandemic recovery of the schools with a focus on building an equitable, inclusive, and holistic education system for the country.

IMPACT ON – HEALTH BY COVID -19

The COVID-19 pandemic has led to a dramatic loss of human life worldwide and presents an unprecedented challenge to public health, food systems and the world of work. The economic and social disruption caused by the pandemic is devastating: tens of millions of people are at risk of falling into extreme poverty, while the number of undernourished people, currently estimated at nearly 690 million, could increase by up to 132 million by the end of the year.

Millions of enterprises face an existential threat. Nearly half of the world's 3.3 billion global workforce are at risk of losing their livelihoods. Informal economy workers are particularly vulnerable because the majority lacks social protection and access to quality health care and have lost access to productive assets. Without the means to earn an income during lockdowns, many are unable to feed themselves and their families. For most, no income means no food, or, at best, less food and less nutritious food.

The pandemic has been affecting the entire food system and has laid bare its fragility. Border closures, trade restrictions and confinement measures have been preventing farmers from accessing markets, including for buying inputs and selling their produce, and agricultural workers from harvesting crops, thus disrupting domestic and international food supply chains and reducing access to healthy, safe and diverse diets. The pandemic has decimated jobs and placed millions of livelihoods at risk. As breadwinners lose jobs, fall ill and die, the food security and nutrition of millions of women and men are under threat, with those in low-income countries, particularly the most marginalized populations, which include small-scale farmers and indigenous peoples, being hardest hit.

Millions of agricultural workers – waged and self-employed – while feeding the world, regularly face high levels of working poverty, malnutrition and poor health, and suffer from a lack of safety and labour protection as well as other types of abuse. With low and irregular incomes and a lack of social support, many of them are spurred to continue working, often in unsafe

conditions, thus exposing themselves and their families to additional risks. Further, when experiencing income losses, they may resort to negative coping strategies, such as distress sale of assets, predatory loans or child labour. Migrant agricultural workers are particularly vulnerable, because they face risks in their transport, working and living conditions and struggle to access support measures put in place by governments. Guaranteeing the safety and health of all agri-food workers – from primary producers to those involved in food processing, transport and retail, including street food vendors – as well as better incomes and protection, will be critical to saving lives and protecting public health, people's livelihoods and food security.

In the COVID-19 crisis food security, public health, and employment and labour issues, in particular workers' health and safety, converge. Adhering to workplace safety and health practices and ensuring access to decent work and the protection of labour rights in all industries will be crucial in addressing the human dimension of the crisis. Immediate and purposeful action to save lives and livelihoods should include extending social protection towards universal health coverage and income support for those most affected. These include workers in the informal economy and in poorly protected and low-paid jobs, including youth, older workers, and migrants. Particular attention must be paid to the situation of women, who are over-represented in low-paid jobs and care roles. Different forms of support are key, including cash transfers, child allowances and healthy school meals, shelter and food relief initiatives, support for employment retention and recovery, and financial relief for businesses, including micro, small and medium-sized enterprises. In designing and implementing such measures it is essential that governments work closely with employers and workers.

Countries dealing with existing humanitarian crises or emergencies are particularly exposed to the effects of COVID-19. Responding swiftly to the pandemic, while ensuring that humanitarian and recovery assistance reaches those most in need, is critical.

Now is the time for global solidarity and support, especially with the most vulnerable in our societies, particularly in the emerging and developing world. Only together can we overcome the intertwined health and social and economic impacts of the pandemic and prevent its escalation into a protracted humanitarian and food security catastrophe, with the potential loss of already achieved development gains.

We must recognize this opportunity to build back better, as noted in the Policy Brief issued by the United Nations Secretary-General. We are committed to pooling our expertise and experience to support countries in their crisis response measures and efforts to achieve the Sustainable Development Goals. We need to develop long-term sustainable strategies to address the challenges facing the health and agri-food sectors. Priority should be given to addressing underlying food security and malnutrition challenges, tackling rural poverty, in particular through more and better jobs in the rural economy, extending social protection to all, facilitating safe migration pathways and promoting the formalization of the informal economy.

We must rethink the future of our environment and tackle climate change and environmental degradation with ambition and urgency. Only then can we protect the health, livelihoods, food security and nutrition of all people, and ensure that our ‘new normal’ is a better one.

To fully realise the mental health crisis that India faces in relation to COVID-19, one has to begin with recognising the very serious situation that existed even before the pandemic. The government’s National Mental Health Survey reported that about 10 percent of adults meet diagnostic criteria for a mental health condition (ranging from mood and anxiety disorders to severe mental illness). The Global Burden of Disease study estimated that nearly 200 million people in India have experienced a mental disorder, nearly half of whom suffer from depressive or anxiety disorders. India accounts for more than a third of the female suicides globally, nearly a fourth of all male suicides, and suicide has been the leading cause of death in young Indians. Yet, the government has spent very little on mental healthcare (estimated at less than one percent of the health budget), and this expenditure has been almost entirely on doctors, drugs, and hospitals in urban areas. There is little community-oriented mental healthcare anywhere in the country. Unsurprisingly, between 70 to 92 percent of affected individuals have received no care from any source, of any kind, for their mental health conditions.

COVID-19 will impact mental health in two phases

One can consider the impact of the pandemic on mental health in two phases: The first is the acute phase, which coincided with the lockdown—the period when the pandemic surged through the country. The second phase will unfold in the months ahead, as the virus starts to get contained, but the economic fallout of the pandemic begins to bite deeper.

Right now, people are terrified of the virus, of dying, or of loved ones contracting this disease.

Right now, in the midst of the acute phase, people are terrified of the virus, of dying, or of loved ones contracting this disease. They are also scared of being quarantined, maintaining physical distancing, being isolated, and breaking the constantly changing rules. For millions, these fears only add to the already daunting apprehensions about their livelihoods. These are not abstract anxieties; these are real, everyday worries. If one considers all these factors, and adds to them the increase in domestic violence, the disruption of public transportation, the lack of access to routine health services, and the shortage of medical supplies, it seems almost normative that people are going to be very distressed during this period.

Indeed, there is already evidence in support of this distress. Internet-based surveys conducted between March-May 2020 show high rates of depression and anxiety in the general population. For example, the ‘FEEL-COVID’ survey conducted in February-March 2020 with 1,106 people across 64 cities reported that a third of respondents faced significant ‘psychological impact’ because of COVID-19. A number of other surveys indicate that such impact may be related to preoccupations with, or anxieties about contracting the virus, depression, sleeping difficulties, irritability, and loneliness.

Related article: But, what about mental health?

The pandemic is affecting different groups in specific ways

- **Women:** In general, studies report many women suffering from anxiety and depression; this may be due to them facing the brunt of increased household responsibilities and domestic violence during the lockdown.
- **Children:** After speaking with 1,102 parents and primary caregivers, it was found that more than 50 percent of children had experienced agitation and anxiety during the lockdown. Media reports indicate that they may be experiencing fears about the virus, worries over access to online classes, and stress and irritability from being unable to go out. Many have faced violence in their homes or have been victims of cyber bullying.
- **Young people:** One survey reported that 65 percent of nearly 6,000 youth aged 18-32 years felt lonely during the lockdown, and 37 percent felt that their mental health had been ‘strongly impacted’. This is not surprising given that twenty-seven million young

people lost their jobs in April 2020 alone, and 320 million students have been affected by the closing of educational institutions, and the postponement of exams.

- **Migrant workers and daily wage laborers:** Although there are no studies specifically with migrant workers, panic reactions have been observed in the millions who lost their livelihood and made desperate attempts to return to their rural homes. Daily wage laborers have also been heavily affected; a study of 1,200 auto drivers found that 75 percent were anxious about their work and finances.
- **Doctors and frontline workers:** A survey with 152 doctors found that more than a third of them are experiencing depression and anxiety due to the pandemic. Frontline workers are reportedly burdened by over-work, and anxious about contracting the virus.
- **Sexual minority groups:** A study of 282 people reported higher anxiety among sexual minority groups, and called for the attention of policymakers to take sensitive and inclusive health decisions for marginalized communities.
- **People with pre-existing mental health conditions:** The anxieties described earlier have been overwhelming for people with pre-existing mental health conditions. Problems may also have worsened for individuals because of the disruption of mental health services and the difficulty of travel, which led to people reducing doses of prescribed medication.
- **People with substance use disorders:** The sudden closure of all liquor shops in the country and the cutting off drug supplies has resulted in withdrawal symptoms in many people with alcohol and substance use dependence, for example, delirium and seizures. Many alcohol ‘addicts’ distressed by their craving have also consumed poisonous substances such as hand sanitizers as substitutes and died, or died by suicide.

It is important to note that the surveys conducted were not entirely representative, as they focused primarily on English-speaking, urban adults with access to the internet. Nevertheless, the prevalence of anxiety and depression reported are uniformly high—up to 20 percent higher than previously reported data.

We must go beyond the narrow, disease-based models of mental healthcare and embrace the diversity and the pluralism of mental health in our communities.

Responding to the crisis

There has been a flourishing of initiatives to address this rising tide of mental health problems.

Some of these include:

- **Telemedicine platforms** such as the Brihanmumbai Municipal Corporation and Mpower helpline, for example, received about 750 calls a day, and a total of 45,000 calls in just two months. E-platforms such as Lybate and Practo, have reported over 180 percent increase in tele-psychiatry consultations.
- **Central government initiatives** include a telemedicine system whereby persons with mental illness can be provided with electronic medical prescriptions. However, this has not been very effective for poor persons in rural areas, or for obtaining medicines that cannot be sold over the counter without a hard copy prescription. The government has also issued a resource package that details guidelines for management of mental health problems, for use in primary and specialised health settings.
- **At the state level**, noteworthy responses include the ‘psychological support team’ constituted by the Kerala government, the reviving of the ‘Happiness Department’ in hospitals set up by the Madhya Pradesh government, and the initiatives at the Outpatient Opioid Assisted Treatment (OOAT) and de-addiction centres by the Punjab government.
- **Several nonprofits, private hospitals, and universities** have set up helplines and e-counselling—for example, the Neptune Foundation, Trijog, Mastermind Foundation, Samaritans, Jamia Millia Islamia, and others. Additionally, nonprofits such as CRY, The Banyan, Sangath, and others have hosted webinars on mental health, and/or are providing free tele-counselling services.



IMPACT OF THE COVID - 19 ON THE TRANSPORTATION

The COVID-19 (also known as SARS-CoV-2 or coronavirus) pandemic upended the global economy. In the United States (U.S.) alone between March 21st and April 25th of 2020, the total number of initial unemployment claims filed reached 30.3 million people, and the unemployment rate for May was projected to reach 16% compared to 4.4% in March. These pandemic related job losses exceed those lost from the Great Recession. The impacts of the pandemic were also noticeable from changes in consumer spending. In the early portion of the pandemic (February 26-March 10), consumer spending increased by over 40% in efforts to stockpile goods and in anticipation of an inability to visit retailers. Consumers also spent between 25% and 30% less on restaurant, entertainment and travel related expenses during this period retailers. Perhaps most visible were the reductions in mobility across multiple sectors of the transportation industry, as a variety of global restrictions (e.g., border restrictions, travel bans, quarantines and curfews, stay-

at-home orders, closure of various amenities and services) reduced demand in the transportation sector.

This reduction in mobility had impacts on the transportation industry. Globally, direct aviation jobs potentially fell by 43% and total aviation supported jobs fell by 52.5% from pre-COVID levels (Air Transport Action Group, 2020). In the U.S., the number of total commercial flights fell from a total of 218,346 on March 8 to 58,113 on April 19, 2020; a reduction of 73% (U.S. Bureau of Transportation, 2020). Truck tonnage in the U.S. fell by 9.18% between March and April 2020 (U.S. Bureau of Transportation, 2020b). On March 13, 2020 the U.S. government declared a state of emergency in response to the pandemic (The White House, 2020). Highway congestion in major cities dropped substantially in 2020 compared to the previous year: 36% in Los Angeles, 30% in New York and 25% in Miami.

Given the magnitude of economic and social impacts associated with the COVID-19 pandemic, the research community is beginning to disentangle these impacts to determine who, when, and where people and industries are most intensively impacted. To this end, studies are looking at job losses. As well as the ability of people to work from home during the pandemic. Reported that 39% of the annual household survey data respondents in the Netherlands worked almost all of their hours from home in 2020, compared to only 6% in 2019. They are also beginning to look at impacts on various industries hit hardest by the pandemic. For example, studies highlight that workers in non-essential industries (e.g., leisure and hospitality) were significantly more likely to be unemployed during the pandemic. In contrast, workers in essential industries were less likely to be unemployed but were also at higher risk of exposure to the virus due to the nature of their jobs.

This study will conduct an industry-level analysis of unemployment trends as a result of the COVID-19 pandemic, with a focus on the transportation industry. To do this, the study leverages monthly survey data from the Current Population Survey which contains information about people prevented from working during the pandemic, as well as associated demographic and socio-economic information between May 2020 and December 2020. These data are incorporated within a random effects panel legit model to determine the impacts of the pandemic on workers in the transportation industry compared to other essential and non-essential industries. Results of the analysis of these survey data indicate that workers in the transportation industry were about 20% more likely to be unemployed due to COVID-19 compared to workers

in other (non-transportation) industries. They also show that several sociodemographic groups, including older workers, non-Whites or Hispanics, immigrants, less educated people, and unmarried people were more likely to be prevented from working during the pandemic. In addition, the results illustrate a decreasing likelihood of being unemployed due to COVID-19 over time. They also uncover heterogeneous impacts within the transportation industry. Workers in customer-oriented transportation sectors (e.g., taxi, scenic, water, bus, and air) were more likely to be unemployed compared to workers in other transportation sectors and essential non-transportation industries.

The present study will examine the employment impacts on the transportation industry of the COVID-19 pandemic. To do so, we draw on two bodies of related work which inform our model specification and results in later sections of the paper. One, work on the employment impacts of the pandemic. Two, work on COVID-19 impacts on the transportation industry related to changes in mobility patterns, transit ridership, and social equity issues pertaining to both industry workers and riders.

Employment impacts of COVID-19

A review of work on the economics of COVID-19 notes that by June of 2020 there were 160 working papers from the National Bureau of Economic Research. A large segment of this work analyzes how many and what types of workers were affected by the pandemic. One study of employment impacts in the first few months of the pandemic (April and May) found that a large proportion of losses were in jobs that could not be conducted remotely and that required a lot of interpersonal contacts. The same study found that even after accounting for job sorting, or how market forces partition people into jobs, demographic characteristics including gender, race, and age were statistically significant explanatory factors of unemployment due to the pandemic. Specifically, model results highlight that single parents (who are overwhelmingly females), Blacks, Hispanics, and younger workers have been disproportionately impacted by pandemic-related employment losses.

Related research found that racial/ethnic minorities, particularly African Americans and Latin workers, had the largest spikes in unemployment in the early months of the pandemic. Of these two groups, Latin workers experienced the largest spikes in unemployment because of their concentration in particular industries. These higher levels of unemployment among Latin workers are likely explained by an overrepresentation in industries most heavily impacted by the pandemic (e.g., Leisure and Hospitality, Wholesale and Retail Trade, Construction, and Services) and underrepresentation in industries less intensively impacted by the pandemic (e.g., Management, Business, and Financial Occupations, Professional and Related Occupations).

Pandemic-related employment studies have also examined unemployment trends related to stay at home orders and the ability to telework. Dingel and Neiman (2020) estimated that in the United States, 37% of jobs can be performed entirely from home. They also estimated the share of jobs that can be done at home by industry; their results showed that the share of transportation-related jobs such as transportation and material moving occupations was only 0.03, which indicated a low telework ability for these jobs. Results of the Dingel and Neiman (2020) study also found that “remote jobs” pay more and make up a substantial percentage of wages earned in the United States (46%). This same study also found regional variations in the percentage of jobs with remote work capabilities. Metropolitan areas including San Jose-Sunnyvale-Santa Clara, CA (Silicon Valley) and Washington-Arlington-Alexandria, DC have at least 50% of jobs that can be done entirely remotely while other metropolitan areas such as Baton Rouge, LA, Las Vegas-Henderson-Paradise, NV, and Scranton-Wilkes-Barre-Hazleton, PA only have 30% of remote jobs.

Research on stay-at-home orders and employment trends found that these orders raised the unemployment rate but that the unemployed were concentrated in particular segments of the population. They found that the people most likely to be unemployed from stay-at-home orders were racial/ethnic minorities, younger workers, people that were not married, and the less educated. A study of essential workers, defined as those with an inability to telework, found that they are disproportionately non-White, make lower earnings, are male, and have lower levels of educational attainment. The Kearney and Pardue (2020) study also found that Blacks are more likely to be essential workers. A related study of the impacts of the pandemic on immigrant workers found that, within this group, men and undocumented workers were hit hardest by the pandemic due to their inability to telework . Analyzed the impact of social distancing policies on

workers that were not able to work from home and required close physical proximity to others. They produced similar findings to these workers made lower incomes and are less educated. A new insight was that those unable to work from home and that work in close physical proximity to others had lower financial liquidity and were more likely to rent their homes.

Gezici and Ozay (2020) took a slightly different approach from the previous studies. They incorporated data from the April 2020 Current Population Survey into probit regression models to estimate the probability of unemployment during this period of the pandemic. They found racial/ethnic and gender differences in the probability of being unemployed, even after controlling for the ability to telework. Specifically, Black and Hispanic women were more likely to be unemployed even if they were able to telework, which suggests discrimination may be behind higher instances of unemployment in these groups.

COVID-19 IMPACTS ON THE TRANSPORTATION INDUSTRY

Transportation-related research work on COVID-19 impacts is focused in three areas: trends in mobility, usage of different transportation modes, and equity impacts of changes in transportation. Several studies have analyzed mobility patterns during the pandemic. In a study in Colombia analyzed the short-term impacts of the pandemic on air, freight and urban transport. They found that government policies, which included a ban on air passenger travel, reduced mobility, transit ridership, and congestion. Within the U.S., Riggs and Appleyard (2020) analyzed shifts in travel behavior due to telework during the pandemic by using survey data collected in the initial months of the pandemic (March and April of 2020). Interestingly, many of the increased foot and bike trips for recreational purposes were induced by telework (i.e., additional trips generated while working from home).

About and Heydari (2021) analyzed Google data on daily location trends for two time periods, a pre-pandemic period (January 3-February 6) and a post-pandemic period (February 15-April 25). They found that mobility in the following locations declined during the pandemic: transit stations, pharmacies, retail, grocery stores, and recreation. In an Australian survey-based study in March of 2020, estimated the number of days people work from home based on the characteristics of their jobs and employers, and investigated its subsequent impacts on their commuting trips. Their study found that low-income group workers were less likely to be able to work from home, while females and younger workers were more likely to be able to work

from home. Used county-level data from the COVID-19 Impact Analysis Platform at the University of Maryland to compare the mobility of low-income and high-income groups after the implementation of stay-at-home orders. Their trip dataset included information about the total number of trips and trips for work and non-work purposes. Based on these data, the study found heterogeneous impacts across income groups of stay-at-home orders on the number of trips taken. Specifically, stay-at-home orders did not reduce trips for either work or non-work purposes for the lowest income group in the study (<\$30,000). However, these orders did significantly decrease work and non-work trips (with the exception of park visits) for middle- and higher-income groups in the study. From a policy perspective, investigated the time lag effects of pandemic-related policies on transportation systems in the U.S cities of New York and Seattle. They reported that vehicular traffic and transit ridership in both cities dropped significantly after the implementation of social distancing restrictions. They also found a faster recovery in vehicular traffic prior to reopening, but did not observe a recovery in transit system usage, which highlights important differences in impacts by transportation mode of COVID-19 restrictions.

Another facet of transportation research related to the pandemic examined trends in the use of transportation modes. Air transportation was one of the most affected sectors during the COVID-19 pandemic, exhibited by a substantial reduction of air passengers and a large number of flight cancellations worldwide. Using Flightradar24 data that covered 150 airlines between 2,751 airports globally, Sun et al. (2020) examined the changes in global passenger flights from December 16th, 2019, to May 15th, 2020. They found that starting from mid-March of 2020, the number of served origin–destination airport pairs dropped by about 75%, and the number of active aircraft decreased by two-thirds. In a related paper, Sun et al. (2021) investigated the influence of COVID-19 on air transportation systems, air passenger experience, and the long-term effects on aviation by reviewing 110 research papers. This review uncovered several important trends that are likely to occur in the aviation industry post-COVID including: the emergence of hub-operation reducing super long-haul flights, the application of a worldwide immunity license, and the development of competing and substitute transportation modes (e.g., high-speed rail and connected and automated vehicles).

Long-distance railway transportation was another sector hit hard COVID-19, especially in Asia and Europe. The two biggest rail companies in Europe, Deutsche Bahn (Germany) and SNCF

(France), both reported significant passenger and financial losses for their rail lines in the first half of 2020. Similarly, major intercity railway companies in Japan experienced a more than 30% decrease in either ridership or revenue. In July 2020, the International Union of Railways (UIC, 2020) estimated an econometric model based on data obtained from various sources, including railway revenue data and economic forecast scenarios. According to their prediction, the missed revenues for the global passenger railway industry would reach \$22 billion under a slow recovery scenario and \$6.2 billion under a quick recovery scenario for the year 2021 (UIC, 2020).

Road transportation displayed divergent patterns for different transportation modes. Islam (2020) found that vehicle usage declined in the U.S. during the pandemic in terms of total hours of use and total number of vehicle miles traveled. A case study indicated that the demand for taxis in Shenzhen, China shrank by more than 85% during the lockdown period and experienced a delayed recovery in demand, compared to overall vehicle travel in the city. In the Riggs and Appleyard (2020) found a reduction in vehicle miles driven but an increase in foot and bike trips for recreational purposes. Buehler and Pucher (2021) found that 11 European countries experienced an 8% increase in biking on average, and weekends had a much larger increase than weekdays. Recreational cycling in the U.S. and Canada also increased significantly during the pandemic. Another study in the U.S. used data from New York City Bike Share and the Metro Transit Authority to compare bike sharing system and subway system use between February and March of 2020. It reported that although subway ridership dropped by 90% and bike sharing use dropped by 71%, the comparatively muted decline in bike sharing use suggests that this system perhaps provided a critical lifeline to low-income groups in need of public transit. This result provides support for prior work finding that bike sharing systems are critical to low-income groups as a means of transit.

Water transportation also exhibited notable impacts influenced by the COVID-19 pandemic. Based on panel data for 14 major ports in China between January to October 2020, found that the severity of the pandemic, measured by the cumulative number of confirmed cases, had a significant negative effect on both import and export cargo throughputs due to the large-scale shutdown of factories. An Australian study based on information from numerous sources including but not limited to Google, Apple, Moovit, and interviews with transportation stakeholders predicted that water-based freight transportation declined by 9.5% as a result of the

pandemic. At the global level, Cullinane and Haralambides (2021) revealed that many major ports with a strong gateway function experienced a container throughput plunge in the first half of 2020, but also experienced a large rebound in activity in the second half of 2020. The fast transition in demand resulted in shortages in equipment, truck drivers and dock labor, and congestion and long turnaround times in these ports.

Trends in urban public transit are of concern because of the increased risk of transmission due to the large number of touch surfaces on which the virus can survive for several days, and also the close proximity of people in a confined, closed environment. A longer-term concern about transit systems is the financial impact of reduced ridership on systems that are already challenged fiscally. Overwhelmingly, this group of studies find that public transit ridership decreased during the pandemic with understandable variations across study regions and type of system in question. In South Korea, for example, Park (2020) examined the impact of the pandemic on subway ridership between the third week of January and the first week of March and found a reduction of 40.6% in the average daily number of passengers. A study of rail transit in China used survey data to understand the likelihood that commuters would use this form of transit during the pandemic. They found several factors that impacted the probability of taking rail transit during the pandemic, including occupation, pre-pandemic mode of transport, and possibility of infection in a private car and on rail transit. In particular, self-employed or free-lance people were more likely to take public transit as were people that commuted via rail transit prior to the pandemic. In the U.S., Islam (2020) utilized data from the National Transit Database between 2012 and 2020 to examine the impacts of the COVID-19 pandemic on public transit ridership. The study found declines in travel via public transit. Stay-at-home policies did not explain these declines in public transit usage.

Social equity impacts of COVID-19 related changes in transportation

Social equity issues are a well-noted issue in public transit research and several studies have examined the extent that the pandemic exacerbated already inequitable access to public transit. In a study of King County, Washington, used a combination of mobile phone data, sensor data collected from county buses, transit fare card data, and surveys to assess mode substitution and travel intensity during the initial months of the pandemic (February, March, and April of 2020). They found that in the early stages of the shutdown, higher socio-economic status individuals

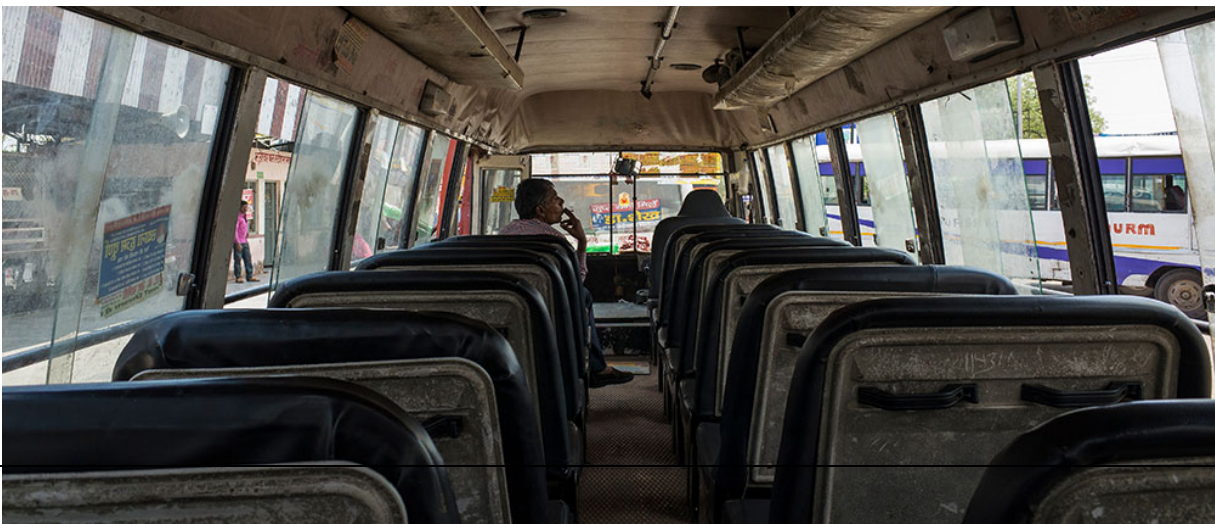
used public transit less than their counterparts. As the pandemic wore on, however, this difference disappeared. The same study also found differences in travel intensity across individuals of varied levels of educational attainment and socio-economic status. Specifically, they found that individuals with less education and lower incomes had higher travel intensities than individuals with more education and higher incomes. Suggest that this difference in mobility responses is explained by an inability of lower income and less educated individuals to work from home, and a greater need to travel to work for essential jobs. A study of COVID-related impacts on service adjustments (i.e., change in the number of unique trips) in North America, using Census block group level data from the General Transit Feed Specification (GTFS), found that reduced trip frequency has disproportionately affected low income and vulnerable populations in 30 U.S. and 10 Canadian cities. In their analysis of changes in public transit ridership in Nashville, Tennessee during the pandemic between January 1, 2019 and July 1, 2020. Found a higher incidence of reduced ridership in higher income areas relative to lower income areas; ridership was 19% lower in higher income areas as compared to lower income areas. Emerging research suggests this increased reliance on public transport may disproportionately expose low-income and racial/ethnic minorities, who are more likely to be essential workers, to COVID-19.

While there is a large and growing body of work on the employment impacts and transportation trends/impacts associated with COVID-19, there is little work at the intersection of these two research strands. It is important to fill this research gap because anecdotal evidence suggests that transportation workers have been hit hard by the pandemic in terms of COVID-19 cases and deaths. Research notes about the early months of the pandemic projected negative impacts on commercial truck drivers' health, safety, and stress exacerbated by the older age of drivers, and unhealthy aspects of this line of work (e.g., poor diet and sleep, lack of physical activity, smoking). Aside from these potential impacts on truck driving occupations, we know little about the employment impacts within the transportation industry and the profiles of transportation workers most and least affected by the pandemic. We also do not know how employment trends among transportation workers compares to workers in other industries. This is important to ascertain given the heterogeneity of essential and non-essential occupations in the transportation industry. Given this heterogeneity, we propose three hypotheses. First, the transportation industry experienced a greater incidence of unemployment than other industries. Second, there is

heterogeneity in employment impacts within the transportation sector. Third, specific sectors within the transportation industry experienced more employment impacts than essential non-transportation industries.

To test the aforementioned hypotheses, this study uses the Current Population Survey (CPS) data between May 2020 and December 2020. The CPS is a monthly survey of over 60,000 households administered by the United States Census Bureau (Bureau of Labor Statistics, 2021). The CPS is designed to represent the civilian non-institutional population of each state based on a scientifically selected multistage probability-based sample of households. The CPS data has a panel structure with multiple responses from the same households and individuals over consecutive months (a maximum of eight times). These data are well suited for comparing unemployment impacts related to COVID because it contains a survey question that asks respondents whether they were unable to work because of the pandemic. The survey also collects demographic and socio-economic information that prior studies have noted to explain employment impacts related to the pandemic (e.g., age, marital status, race/ethnicity, gender). Data presents the code and description of the variables from the CPS data used in this study, as well as their recoding for analyses.

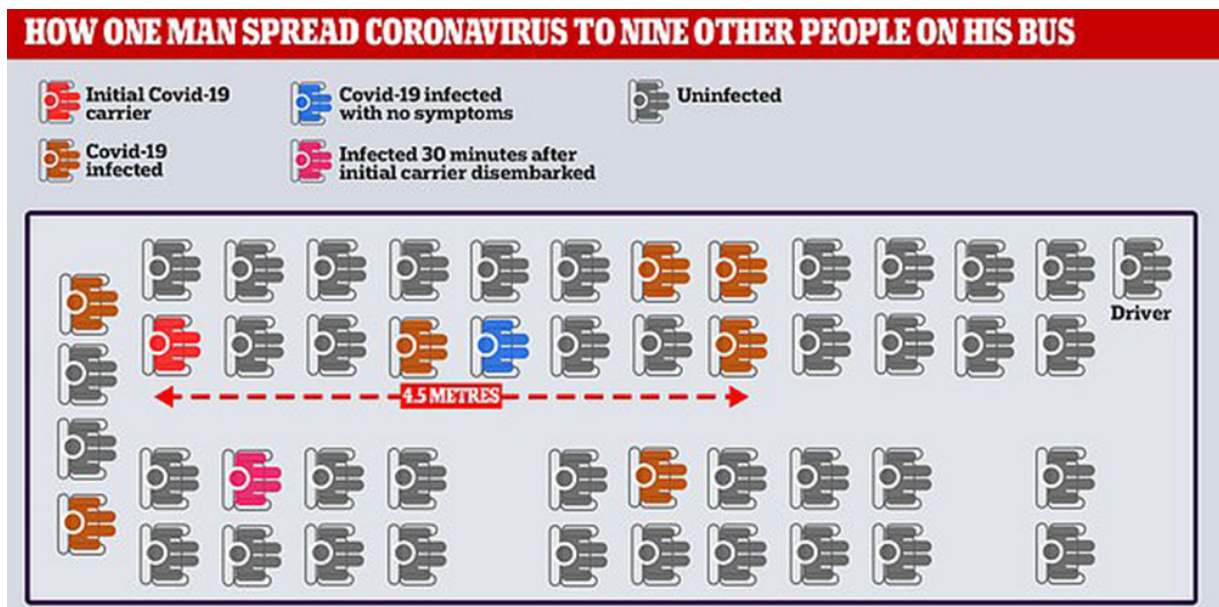
Transportation sector has been one of the primary victims of COVID-19. From rickshaw pullers to airlines, all have been affected economically by the pandemic. India's overall energy demand fell by 11% in March 2020. Due to lockdown in many countries, the demand for passenger transport has been adversely hit. The freight segment has had a mixed short-term effect in terms of transportation demand. There is a surge in demand for truck drivers in transportation of essential goods. For instance, there is 40% to 60% increase of product being moved into grocery stores and warehouses in US. Since COVID spread started². However, the supply chain disruption and slowdown caused by COVID is expected to pull down freight demand in the



medium-term. Urban freight segments in India have also had a mixed short-term effect in terms of transportation demand. Since February, the online food orders have dropped by 20% whereas online grocery orders are overflowing³. It is to yet to be seen whether these acquired habits of online grocery shopping will sustain after the pandemic passes.

Even though the fall in passenger transport demand is pushed by social distancing restrictions, COVID-19 may have a long-term effect on people's travel behaviour. The following figure shows the image from a retracted epidemiological study from Wuhan. The researchers show through CCTV evidence on how one individual infected nine others in a public bus on January 22nd.

Even after the situation normalises, the perception of risk associated with crowded areas could lead to shift in preferences towards personal travel modes. That is, people may avoid using public transport modes to avoid crowds. People may also avoid shared mobility modes like auto-rickshaws, micro-transit vans, e-rickshaws etc. The drivers employed in app-based taxi services are economically suffering in the short term due to the COVID lockdown. However, it cannot be said if these modes may face long term economic effects in terms of reduced travel demand.



Many players in the transportation sector are adapting to these changing demands. For instance, American Airlines and some of its peers have converted many of the passenger flights to carry goods. These idle airplanes have been assigned to carry e-commerce, medical supplies and office cargo. In China, autonomous vehicles were piloted to provide 'touchless' service to provide delivery issues while reducing the risk of spread of the disease⁸. Indian Railways have simultaneously cancelled passenger trains and ramped up parcel services and other freight services for essential commodities. In Bengaluru, Three Wheels United (TWU), a city-based social enterprise, launched a program for auto drivers to deliver medicines, groceries and other essential goods to the residents. Unfortunately, this program hit a roadblock regarding permissions from the authorities to operate during the 21-day lockdown in India.

During the lockdown, only essential people and commodities are permitted by the authorities. The list of essential people and commodities must be continuously revised to minimise the adverse impact on people's lives and the spread of the pandemic. Considering this lockdown as a large travel demand experiment, organisations have much to gain from optimising transportation of employees in the future, in terms of productivity and costs. Also, during this period, due to no transport modes, people have been exposed to walking in roads with neither pollution nor congestion. Hence authorities may expect better results in future policies aimed at nudging short trips into pedestrianised modes. However, as the transportation sector employs millions, in the long run, it is necessary to understand the pandemic's impact on consumer preference and the subsequent transportation demand for passengers and goods.

Industry information in the CPS is based on the Survey of Income and Program Participation (SIPP) public use industry code list and the 2017 North Industry Classification System (NAICS) codes (Census Bureau, 2020). Using these codes, it was possible to identify and classify respondents into two mutually exclusive categories, those working in the transportation industry and those not working in the transportation industry. It was also possible to further segment respondents into the following mutually exclusive categories: transportation industries, essential non-transportation industries (or 'other essential industries'), and non-essential non-transportation industries (or 'other non-essential industries'). Essential and non-essential industries were identified based on the recommended essential industry classification for phased allocation of COVID-19 vaccines in the U.S. (Centers for Disease Control and

Prevention, 2021). There were three phases of vaccine allocation: 1a, 1b, and 1c. In this study, industries that were included in Phase 1a are considered to be essential industries, and the rest as non-essential industries. See Appendix A for a comprehensive list of transportation, essential non-transportation, and non-essential non-transportation industries.

Data preprocessing revealed apparent inconsistencies (e.g., change in age by more than a year in consecutive months) for a small proportion of CPS respondents with multiple observations (0.5% of responses). These data were not included in our 401,794 samples from 169,713 respondents for analysis.

Statistical modeling

Random effects panel logit models were estimated to investigate the disproportionate impacts of the COVID-19 pandemic on survey respondents' inability to work because of closed or lost business at their employer. A random effects specification was selected over a fixed effects specification because we are interested in modeling unemployment variability between individuals over time rather than the variation in employment status within individuals over time. Above and beyond its relevance to our primary research question, a random effects specification allows for the inclusion of time-invariant characteristics while a fixed-effects specification does not.

In these logit models, our dependent variable, COVIDUNAW, has a binary outcome: the respondent was able to work, or the respondent was unable to work. The modeling structure of the estimated random effects logit models is illustrated as follows. Let denote the binary outcome of the dependent variable COVIDUNAW for observation j of respondent i , where n_i is the number of observations for the respondent. Then, the probability that the respondent i was unable to work due to the COVID-19 pandemic during observation j for a given vector of explanatory variables X_{ij} and the respondent-specific random effect parameter u_i is given by Equation In Equation (2), β_0 denotes the model intercept and β denotes the vector of coefficients for the explanatory variables. The random effects parameter is assumed to be normally distributed with mean 0 and variance σ_u^2 ; $u_i \sim N(0, \sigma_u^2)$. This is a common assumption in the literature for such models made for computational convenience. Since y_{ij} is binary, the probability of $y_{ij}=0$ can be calculated by Equation (2).
$$\Pr(y_{ij}=0|X_{ij}, u_i) = \frac{1}{1 + e^{\beta_0 + X_{ij}T\beta + u_i}}$$

Then, the panel-level likelihood l_i of all observations for respondent i is given by Equation (3).

$$l_i = \prod_{j=1}^{n_i} \text{Pr}(y_{ij} | x_{ij}, \beta_0 + X_{ij}T\beta + u_i)$$

Since l_i has the form $\int_{-\infty}^{\infty} e^{-x^2} h(x) dx$, it can be approximated with M -point Gauss-Hermite quadrature (Naylor and Smith, 1982). The log likelihood L , which is the sum of the logs of the l_i for all respondents, can be approximated by adaptive Gauss-Hermite quadrature. We used the 'xtlogit' command with 'mvaghermite' integration method in STATA 15.0 to estimate the random effects logit model. The number of integration points in 'mvaghermite' were set to 12.

Model fitness for the fixed effects was assessed using Wald chi-square test, with p -value less than 0.05 indicating a good model fit. The suitability of panel structure (i.e., random effects model) was tested using intra-class correlation coefficient (ρ), which examines the proportion of panel-level or random effects variance component (σ_u^2) and unit-level variance component, as illustrated in Equation . A higher value of ρ favors the random effects model. Note that the unit-level variance component is not identifiable for the random effects logit model, and it is assumed to follow standard logistic distribution, which is equals to $\pi^2/3$, instead of 1 to avoid overestimation of ρ .

$$\rho = \frac{\sigma_u^2}{\sigma_u^2 + \pi^2/3}$$

All models incorporated sociodemographic covariates (including age, sex, race/ethnicity, citizenship status, education level, veteran status, and marital status). They also include time fixed effects (i.e., monthly dummy variables) to capture unemployment trends related to the public response to the pandemic as well as the implementation of various safety measures (e.g., stay-at-home orders) which were implemented at different times across the United States.

Two separate specifications of our model are used to test the three hypotheses proposed in this study. The main source of variation in these models is the dummy variable that compares the transportation industry to other industries. In the first model, we use a dummy variable that compares the transportation industry to all other industries. This variable is used to test our hypothesis that workers in the transportation industry experienced a greater incidence of unemployment than other industries. In the second model, we use a different dummy variable that segments industries into thirteen categories as transportation sub-industries, essential industries, and non-essential industries. This classification enables us to test our hypothesis that there is heterogeneity in employment impacts within the transportation industry. It also enables us to compare each transportation sub-industry to essential and non-essential industries and test

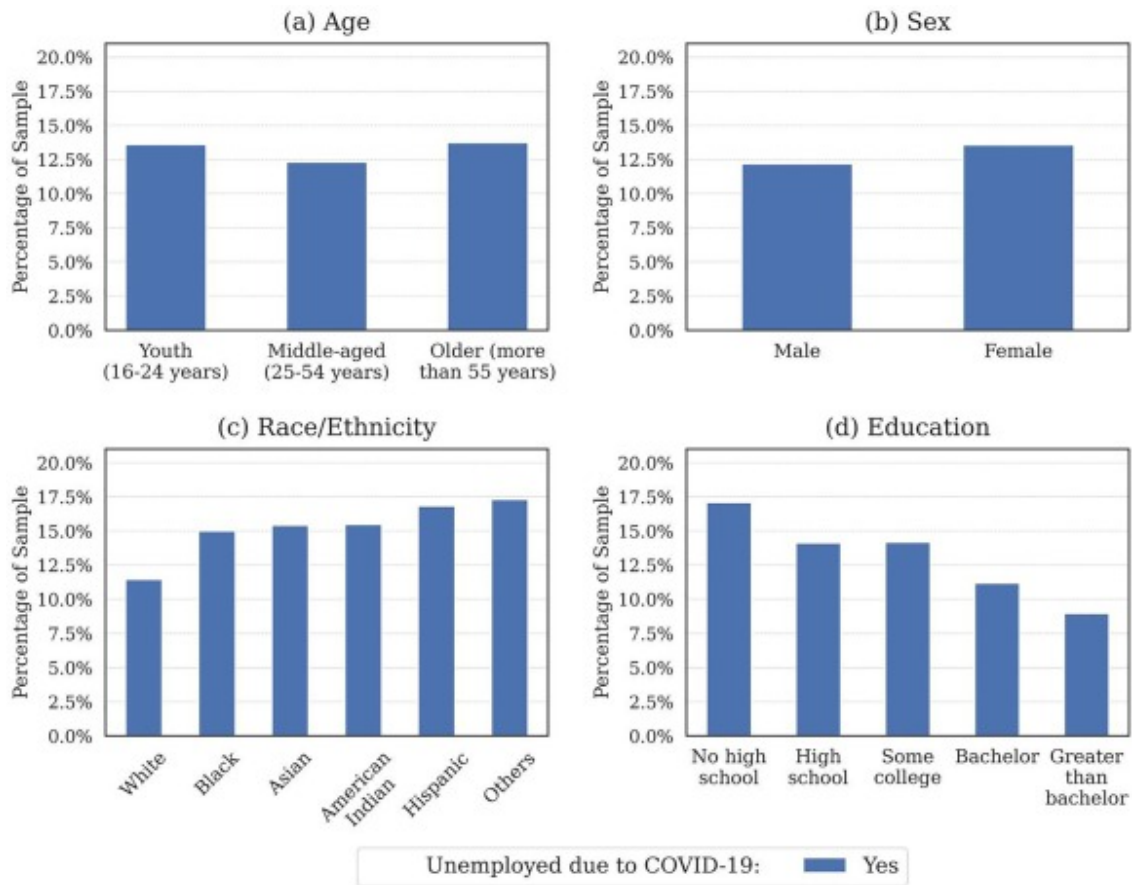
our third hypothesis: specific sectors within the transportation industry experienced more employment impacts than other essential industries.

RESULTS AND DISCUSSION

Descriptive Statistics

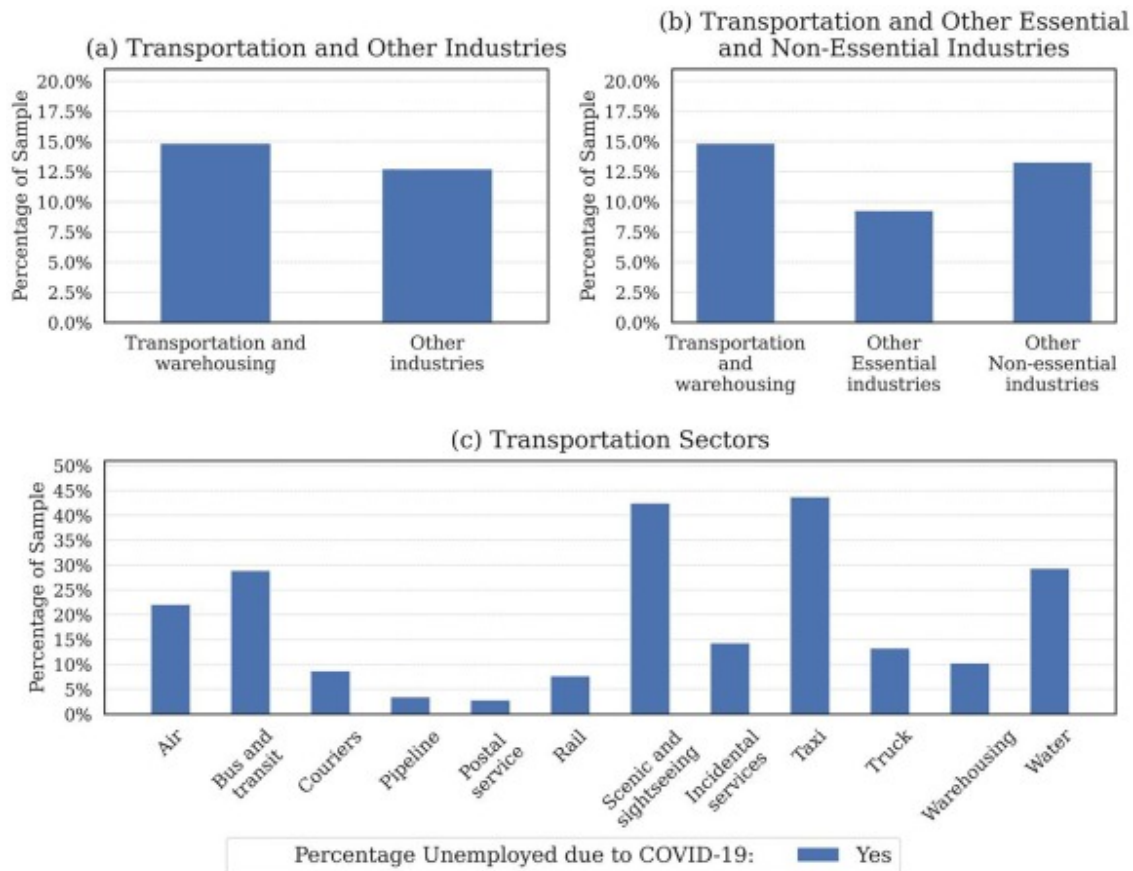
The final data contained 401,794 samples from 169,713 respondents. The inability to work due to COVID-19 by month for the full CPS sample, the transportation and warehousing industries, the essential non-transportation industries, and the non-essential non-transportation industries between May and December of 2020, compared to the number of newly confirmed cases by month in the U.S. during the same period. The number of new COVID-19 cases were obtained from Trading Economics, which reorganizes data from the World Health Organization. It demonstrates that the unemployment rate for workers in the transportation and warehousing industries was higher than the other two categories and the full sample throughout the study period. The unemployment rates for all categories showed a downward trend and reached the bottom around October, whereas the number of new cases kept increasing. The percentage of people unable to work due to the pandemic for multiple sociodemographic characteristics. Provides more detailed descriptive statistics of our study sample for the explanatory variables (sociodemographic characteristics) used in estimating the model. It also shows the number of respondents that were either unable to work due to the COVID-19 pandemic ('Yes') or were not affected ('No') for each subcategory, along with their corresponding percentage split. It indicates that although the pandemic did not affect the ability to work for most people, workers belonging to certain minority groups (e.g., females, non-White or Hispanic, non-citizens, and people with lower level of education) were disproportionately more affected compared to their counterparts

Monthly Inability to Work Due to COVID-19 and Number of New COVID-19 Cases.



Unemployment Distribution by Sociodemographic Characteristics.

shows the distribution of workers who were unable to work due to the pandemic in the transportation industry and other essential and non-essential industries. It also shows this distribution for different sectors within the transportation industry. If one computes the average across all sub-industries within the transportation sector, about 14.9% of respondents indicated they were unable to work because of the pandemic. This is certainly higher than 9.3% of workers in essential industries (e.g., Health Care and Social Assistance) and 13.3% of workers in non-essential industries (e.g., Accommodation and Food Services). Within the transportation sector, there is a great deal of heterogeneity in COVID-19 impacts. For example, only 2.9% of postal service workers were unable to work while 43.8% of taxi and limousine service workers were unable to work. Other transportation industries where workers were heavily impacted include scenic and sightseeing transportation (42.5%), water transportation (29.4%), and bus service and urban transit (29.0%).



The odds ratios presented in the table indicate how a unit change in each explanatory variable is associated with the changes in the odds of being able to work during the pandemic, compared to the odds of not being able to work. If setting p as the odds of being able to work, then the odds ratio can be expressed as $p/(1-p)$. For an explanatory variable X with a regression coefficient β , its odds ratio is calculated through the exponential function of the regression coefficient (e^β). An odds ratio equal to 1 indicates that the variable does not affect the odds of being able to work; an odds ratio that is greater than 1 indicates that the variable is positively associated with the odds, and an odds ratio that is smaller than 1 indicates a negative association with the odds. In the discussion that follows we will use the phrase “unemployed” as shorthand to refer to the “inability of people to work due to the COVID-19 pandemic.”

Model Comparing Transportation and Other Industries.

Variable	Odds Ratio	Std. Err.	z	Significance Level
MIDDLE-AGED	1.168	0.041	4.410	***

Variable	Odds Ratio	Std. Err.	z	Significance Level
OLDER	1.573	0.061	11.630	***
FEMALE	1.292	0.028	11.820	***
BLACK	1.600	0.058	13.070	***
ASIAN	1.940	0.090	14.220	***
AMERICAN INDIAN	1.684	0.182	4.830	***
HISPANIC	1.861	0.061	18.940	***
OTHER RACE	2.241	0.168	10.780	***
CITIZEN	0.579	0.025	-12.410	***
HIGH-SCHOOL	0.832	0.034	-4.440	***
COLLEGE	0.833	0.035	-4.340	***
BACHELOR	0.521	0.023	-14.760	***
GRADUATE	0.337	0.017	-22.100	***
VETERAN	0.823	0.041	-3.930	***
MARRIED	0.679	0.016	-16.960	***
TRANSPORTATION	1.206	0.055	4.080	***
JUNE	0.568	0.013	-23.890	***
JULY	0.290	0.008	-46.910	***
AUGUST	0.172	0.005	-61.160	***
SEPTEMBER	0.108	0.003	-72.410	***
OCTOBER	0.071	0.002	-80.410	***
NOVEMBER	0.069	0.002	-79.370	***

Variable	Odds Ratio	Std. Err.	z	Significance Level
DECEMBER	0.070	0.002	-76.940	***
CONSTANT	0.250	0.016	-22.000	***
Log likelihood	-129054.360			
Wald chi-square test statistic	11029.870			
df for Wald test	23			
p-value for Wald test	0.000			
Σu	2.696	0.020		
P	0.688	0.003		

Note: * 95% confidence level; ** 99% confidence level, *** 99.9% confidence level

These results indicate that workers in the transportation sector were 20.6% more likely to be unemployed because of the pandemic than workers in non-transportation industries. Relative to younger workers, middle-aged and older workers were more likely to be unemployed during the pandemic. That said, older workers (ages 55 and older) were 57.3% more likely to be unemployed compared to young workers. This likelihood is greater than middle-aged workers (ages 25–54) who were 16.8% more likely to be unemployed compared to young workers. This result is different from prior work suggesting younger workers were more likely to be impacted by the pandemic, but is in line with some research and news sources suggesting older workers were more likely to be unemployed during the pandemic. Females were 29.2% more likely to be unemployed during the pandemic, which is consistent with prior research, and news reports related to the pandemic.

Compared to White workers, racial and ethnic minorities were more likely to be unemployed, which is consistent with prior research. Among racial and ethnic minorities, our model results indicate that survey respondents identifying as part of our other race group (e.g., multiracial people) were over two times more likely to be unemployed compared to Whites. Hispanic respondents were also more likely to be unemployed. However, U.S. citizens and married people

were less likely to be unemployed. These results are consistent with prior work noting that foreign-born people are more likely to be unemployed, as are unmarried people. Work on immigrants in particular notes that this community has been particularly hard hit by the pandemic due to their inability to telework. Educational attainment is also linked to the inability to work and prior work notes that people with lower levels of educational attainment experienced the greatest employment impacts. These studies reported a monotonic decrease in unemployment likelihood with higher education levels. Our results are consistent with this emerging body of work. People with higher levels of educational attainment are less likely to be unemployed during the pandemic. For example, people with a bachelor's degree are 48% less likely to be unemployed, compared to people without a high school diploma. People with a graduate degree are 66% less likely to be unemployed, compared to people without a high school diploma. These results may be linked to the ability of people with more education to work remotely and remain employed during the pandemic.

A final noteworthy aspect of model results are the fixed effects for time, which indicate a reduced likelihood of inability to work due to COVID-19. In May of 2020, the CPS data indicate that 26.5% of workers were unable to work due to the pandemic, and by December of 2020, this rate decreased to 8.1%. This decline in the inability to work is reflected in the odds ratios. The odds ratio for June for example, indicates people were 43% less likely to be unable to work compared to May. By December, they were 93% less likely to be unable to work.

Given the heterogeneity of employment impacts on the transportation industry, an additional model was estimated to obtain odds ratios for sub-sectors within the transportation industry, and compare these sub-industries to essential and non-essential industries, as designed by the Centers for Disease Control and Prevention (CDC) Phase 1a vaccination guidelines. By and large, the odds ratios for the socio-demographic variables are consistent with those, as are the monthly time dummy variables. The odds ratios for the transportation sectors do indicate heterogeneities in impacts within the industry, and the value of analyzing this industry from a more fine-grained perspective. During the 2020 months of the pandemic, taxi and limousine drivers were 28 times more likely to be unemployed compared to essential workers. Scenic and sightseeing transportation workers were 23.8 times more likely to be unemployed compared to essential workers. Notably, both these industries rely heavily on traveling customers for revenue, which

was adversely affected by social distancing guidelines. Workers in other customer-oriented sectors (e.g., water, bus, and air) were more likely to be unemployed compared to workers in other essential and non-essential industries. The results also show that truck drivers and workers in services incidental to transportation were also more likely to be unemployed compared to essential workers. On the other end of the spectrum however, postal service workers were 84% less likely to be unemployed compared to essential workers. The likelihood of unemployment for workers in other transportation sectors did not show statistically significant differences (at 95% confidence level) compared to essential workers. Non-essential workers were about two times more likely to be unemployed compared to essential workers.

Model Comparing Sub-Sectors Within Transportation and Other Essential and Non-Essential Industries.

Variable	Odds Ratio	Std. Err.	z	Significance Level
MIDDLE-AGED	1.180	0.041	4.730	***
OLDER	1.565	0.061	11.540	***
FEMALE	1.418	0.031	15.860	***
BLACK	1.643	0.059	13.830	***
ASIAN	1.925	0.089	14.110	***
AMERICAN INDIAN	1.676	0.180	4.820	***
HISPANIC	2.214	0.165	10.670	***
OTHER RACE	1.860	0.061	19.020	***
CITIZEN	0.605	0.026	-11.500	***
HIGH-SCHOOL	0.850	0.035	-3.960	***
COLLEGE	0.872	0.037	-3.260	**
BACHELOR	0.533	0.023	-14.320	***

Variable	Odds Ratio	Std. Err.	z	Significance Level
GRADUATE	0.361	0.018	-20.780	***
VETERAN	0.828	0.041	-3.830	***
MARRIED	0.684	0.016	-16.720	***
AIR	6.431	0.948	12.630	***
BUS	9.295	1.573	13.180	***
COURIER	0.885	0.112	-0.960	
PIPELINE	0.329	0.233	-1.570	
POSTAL	0.161	0.037	-7.900	***
RAIL	0.974	0.285	-0.090	
SCENIC	23.814	10.187	7.410	***
INCIDENTAL	2.449	0.326	6.730	***
TAXI	28.130	4.393	21.370	***
TRUCK	1.828	0.169	6.540	***
WAREHOUSING	1.037	0.152	0.250	
WATER	12.692	4.563	7.070	***
NON-ESSENTIAL	1.991	0.066	20.780	***
JUNE	0.569	0.013	-23.870	***
JULY	0.290	0.008	-46.890	***
AUGUST	0.173	0.005	-61.070	***
SEPTEMBER	0.108	0.003	-72.340	***
OCTOBER	0.071	0.002	-80.380	***

Variable	Odds Ratio	Std. Err.	z	Significance Level
NOVEMBER	0.069	0.002	-79.260	***
DECEMBER	0.071	0.002	-76.800	***
CONSTANT	0.123	0.009	-29.150	***
Log likelihood	-128463.360			
Wald chi-square test statistic	11610.690			
df for Wald test	35			
p-value for Wald test	0.000			
Σu	2.663	0.020		
P	0.683	0.003		

Note: * 95% confidence level; ** 99% confidence level, *** 99.9% confidence level

Discussion

The economic impacts associated with the pandemic produced unemployment rates exceeded Great Recession of 2008 in the first three months of the pandemic. These unprecedented impacts, research has investigated who was more likely to be unemployed during the pandemic and found particular populations including racial/minorities, women, immigrants, and the less educated were disproportionately impacted (Studies suggest these impacts are related to work in jobs with an inability to telework.. Due to these impacts, a parallel line of inquiry has transportation impacts in three areas: trends in mobility, public transit usage, and equity impacts of changes in transportation. These studies found declines in the availability and usage of many transportation modes, including air, long-distance rail, road, water, and public transit. They also found changes in public transit availability negatively impacted low income and vulnerable populations. In addition, previous studies also revealed that transportation-related jobs had a low telework ability, which indicated greater economic and health risks. To this point

in time. However, research has not connected these strands of inquiry to investigate and compare the impact of COVID on employment in the transportation industry.

To fill this gap in our knowledge, this study estimated random effects logit models using panel survey data from the CPS. Two models were estimated to test three hypotheses. One, the transportation industry experienced a greater incidence of unemployment than other industries. Two, there is heterogeneity in employment impacts within the transportation sector. Three, specific sectors within the transportation industry experienced more employment impacts than other essential industries. Model results indicate that the transportation industry experienced a greater incidence of unemployment than other industries. They also provided evidence of heterogeneity in the likelihood of being unemployed within the transportation industry. Transportation workers in tourism-related sub-sectors (e.g., taxi, scenic, air) were more likely to be unemployed as travel around the world plummeted during the pandemic. Transportation workers in public transit (e.g., bus) and cargo shipping related industries (e.g., water) were also more likely to be unemployed due to shutdowns of nearly all activity in the beginning months of the pandemic. These results suggest that workers in affected occupations lost income and experienced financial hardship because of the pandemic. Other industries were far less likely to be unemployed (e.g., postal) than essential workers because work in these transportation sub-sectors continued throughout the pandemic. These results suggest greater exposure to COVID-19 for workers that remained employed in transportation during the pandemic.

From a policy perspective, these results suggest that attention to several aspects of transportation work are needed in the coming years to prepare for future interruptions to the transportation industry. One, cross-training in work activities that could be conducted remotely or moved to remote work may alleviate some of the employment impacts. Two, provision of health care for workers that must work and cannot work remotely, above and beyond the provision of personal protective equipment (PPE), is critical. Three, although the U.S. government provided payroll assistance to some transportation sectors (i.e., air, rail, and transit) to cope up with lost business due to COVID-19, such financial assistance programs also need to target workers in sub-sectors (e.g., taxi and scenic) that experienced significantly more adverse impacts of the pandemic in terms of employment. Lastly, for future crises, short-term emergency measures such as the Coronavirus, Aid, Relief and Economic Security, which provided funding to transit systems to

keep them running. Longer term financial solutions are also needed to make up fare shortfalls from the pandemic to keep already financially strained transit systems running particularly for populations that rely on public transit as their only means of transportation.

Despite the insights and contributions, this study has a few limitations. One, although the CPS data provides a representative sample, some industry sectors (e.g., pipeline transportation) have a small sample size. This may have led to a large variance for those subsamples that affected the model estimation. Two, while our analysis illustrates the employment impact of the pandemic on transportation workers, the underlying causes of the impact remain unknown due to the limited information provided by the data. To inform effective policymaking, more in-depth explorations are needed in the future, including qualitative and survey research targeting this specific worker group. Three, the CPS data does not specify some emerging transportation-related jobs, such as ride-hailing drivers, e-scooter allocators, and app-based delivery drivers. These workers may have distinct employment patterns compared to those in traditional transportation sectors, which need further investigations in the future. Finally, this analysis is specific to unemployment trends in the United States. While transportation workers around the world, particularly in the airline industry, were undoubtedly affected by the pandemic, these results may not translate to other countries for a variety of reasons including but not limited to: widely varying policy responses related to the pandemic, the elevated presence of transportation workers involved in the informal economy in the developing world, variations in demand across transportation modes, and variations in rates of personal car ownership. Given these sources of variation, future work should examine the impact of the COVID-19 pandemic on transportation workers around the globe to understand how these varying contexts may have translated to higher or lower unemployment rates for this segment of workers as compared to the United States.

The COVID-19 pandemic is the latest disruption to global transportation systems, and it will not be the last. This piece demonstrated the impact of the most recent pandemic on transportation employees and highlighted their unemployment vulnerability relative to other workers, including essential workers. As the world becomes increasingly integrated, the likelihood of disruptions to transportation systems from pandemics, terrorism and climate change is highly likely. Proactive planning for future disruptions to transportation systems is needed to

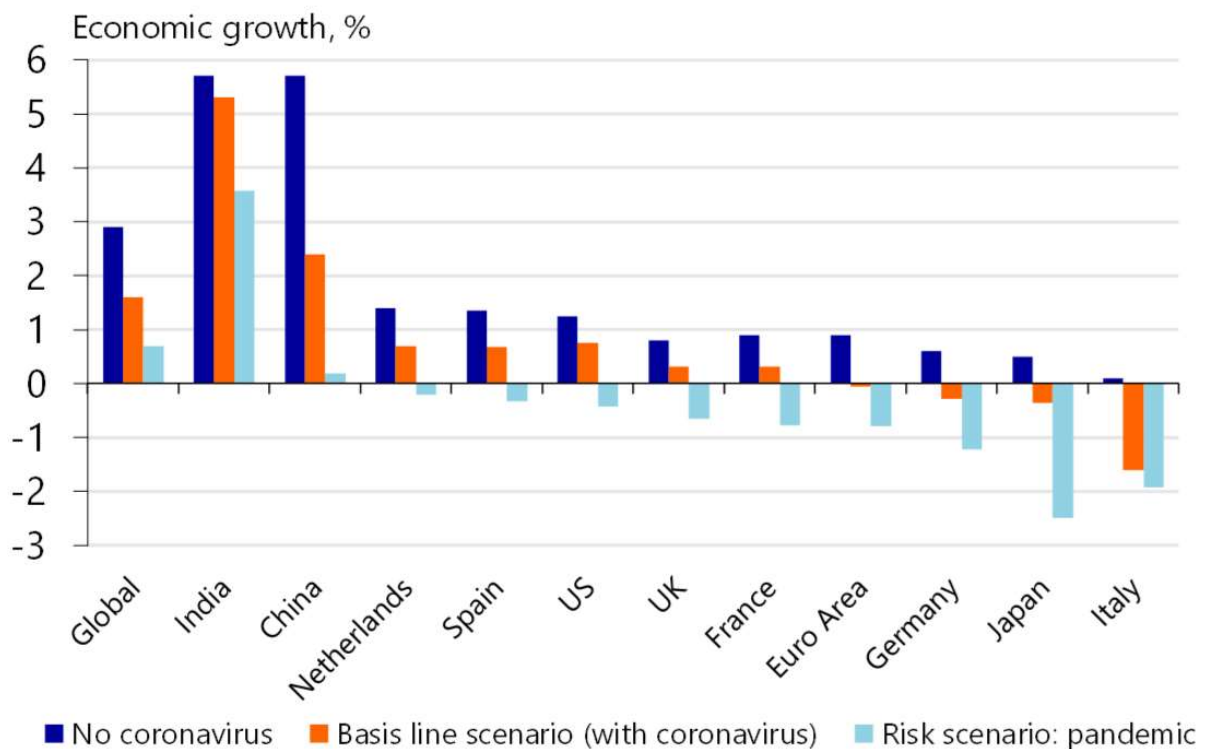
protect the health and economic livelihoods of the people that keep this critical infrastructure running.

Industry segments

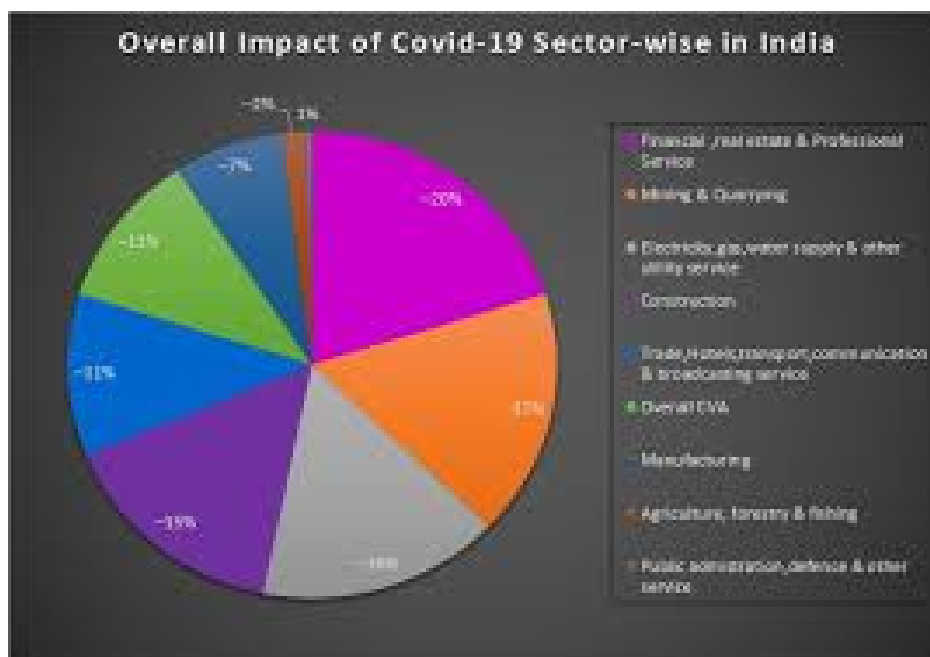
Industry Segment	NAICS Level 2 and Level 3 Industries
Transportation and warehousing industries	Transportation and warehousing industries (Air transportation; Bus service and urban transit; Couriers and messengers; Pipeline transportation; Postal Service; Rail transportation; Scenic and sightseeing transportation; Services incidental to transportation; Taxi and limousine service; Truck transportation; Warehousing and storage; Water transportation)
Essential non-transportation industries	Health Care and Social Assistance (except, Community food and housing, and emergency services; Child day care services; Vocational rehabilitation services); Retail trade (Pharmacies and drug stores); Other Services, Except Public Administration (Funeral homes, and cemeteries and crematories)
Non-essential non-transportation industries	Accommodation and Food Services; Administrative and support and waste management services; Agriculture, Forestry, Fishing, and Hunting; Arts, Entertainment, and Recreation; Construction; Educational Services; Finance and Insurance; Health Care and Social Assistance (Community food and housing, and emergency services; Child day care services; Vocational rehabilitation services); Information; Manufacturing; Military; Mining, Quarrying, and Oil and Gas Extraction; Other Services, Except Public Administration (except, Funeral homes, and cemeteries and crematories); Professional, Scientific, and Technical Services; Public Administration; Real Estate and Rental and Leasing; Retail Trade (except, Pharmacies and drug stores); Utilities; Wholesale Trade

The Impact of Covid-19 on Indian Economy

As per the official data released by the ministry of statistics and program implementation, the Indian economy contracted by 7.3% in the April-June quarter of this fiscal year. This is the worst decline ever observed since the ministry had started compiling GDP stats quarterly in 1996. In 2020, an estimated 10 million migrant workers returned to their native places after the imposition of the lockdown. But what was surprising was the fact that neither the state government nor the central government had any data regarding the migrant workers who lost their jobs and their lives during the lockdown. The government extended their help to migrant workers who returned to their native places during the second wave of the corona, apart from just setting up a digital-centralized database system. The second wave of Covid-19 has brutally exposed and worsened existing vulnerabilities in the Indian economy. India's \$2.9 trillion economy remains shuttered during the lockdown period, except for some essential services and activities. As shops, eateries, factories, transport services, business establishments were shuttered, the lockdown had a devastating impact on slowing down the economy. The informal sectors of the economy have been worst hit by the global epidemic. India's GDP contraction during April-June could well be above 8% if the informal sectors are considered. Private consumption.



And investments are the two biggest engines of India's economic growth. All the major sectors of the economy were badly hit except agriculture. The Indian economy was facing headwinds much before the arrival of the second wave. Coupled with the humanitarian crisis and silent treatment of the government, the covid-19 has exposed and worsened existing inequalities in the Indian economy. The contraction of the economy would continue in the next 4 quarters and a recession is inevitable. Everyone agrees that the Indian economy is heading for its full-year contraction. The surveys conducted by the Centre for Monitoring Indian Economy shows a steep rise in unemployment rates, in the range of 7.9% to 12% during the April-June quarter of 2021. The economy is having a knock-on effect with MSMEs shutting their businesses. Millions of jobs have been lost permanently and have dampened consumption. The government should be ready to spend billions of dollars to fight the health crisis and fast-track the economic recovery from the covid-19 instigated recession. The most effective way out of this emergency is that the government should inject billions of dollars into the economy.



The GDP growth had crashed 23.9% in response to the centre's no notice lockdown. India's GDP shrank 7.3% in 2020-21. This was the worst performance of the Indian economy in any year since independence. As of now, India's GDP growth rate is likely to be below 10 per cent.

The Controller General of Accounts Data for the centre's fiscal collection indicates a gross-tax revenue (GTR) of rupees 20 lakh crore and the net tax revenue of rupees 14 lakh crore for 2020-21. The tax revenue growth will be 12 per cent, which would mean the projected gross and the net tax revenues for 2020-21 would be rupees 22.7 lakh crore and 15.8 lakh crore respectively.

This suggests some additional net tax revenues to the centre amounting to rupees 0.35 lakh crores as compared to the budget magnitudes. The main expected shortfall may still be in the non-tax revenues and the non-debt capital receipts. If we look down in the past, the growth rate for the non-tax revenues and non-debt capital receipts have been volatile, but if we add them together, they average to a little lower than 15% during the five years preceding 2020-21.

How have different sectors been affected due to Covid-19?

Hospitality Sector:

As many states have imposed localised lockdowns, the hospitality sector is facing a repeat of 2020. The hospitality sector includes many businesses like restaurants, beds and breakfast, pubs, bars, nightclubs and more. The sector that has contributed to a large portion of India's annual GDP has been hit hard by restrictions and curfews imposed by the states.

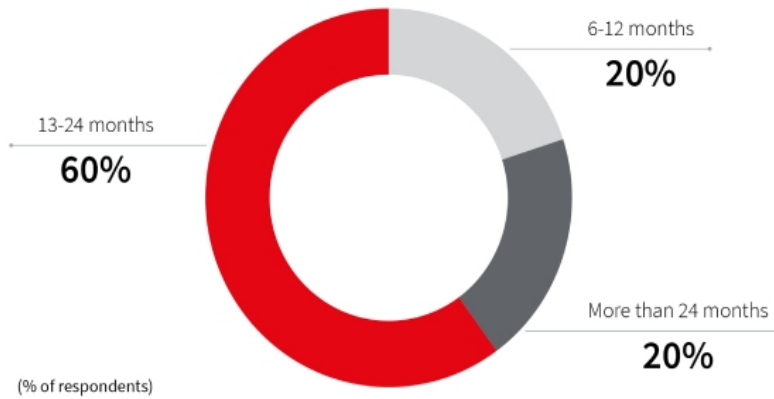
Tourism Sector:

The hospitality sector is linked to the tourism sector. The sector that employs millions of Indians started bouncing back after the first wave, but the second wave of covid was back for the devastation! The tourism sector contributes nearly 7% to India's annual GDP.

It comprises hotels, homestays, motels and more. The restrictions due to the second wave have crippled the tourism sector, which was already struggling to recover from the initial loss suffered by the businesses in 2020.

Performance outlook

Expected time for hotels to return back to 2019 RevPAR levels



Aviation and Travel sector:

Aviation and other sector establishments faced a massive struggle during the second wave of the pandemic. The larger travel sector is also taking a hit as people are scared to step out of their homes. For airlines and the broader travel sector, its recovery will depend on whether people in future will opt for such services. At present, the outlook for the aviation and broader travel sector does not look good.

Automobile sector:

The automobile sector is expected to remain under pressure in the near term due to the covid-19 situation in India.

Real Estate and Construction sector:

The real estate and construction activities have started facing a disruption during the second wave as a large number of migrant workers have left the urban areas. The situation has not been grave as of 2020 for this sector.

Fiscal Deficit:

The Covid-19 pandemic has not affected our fiscal deficit and disinvestment target much. In this year's union budget, Finance minister Nirmala Sitharaman announced a fiscal deficit target of 6.8% for 2021 to 2022. India's fiscal deficit for 2020-21 zoomed to 9.5% of GDP as against 3.5% projected earlier. Our finance minister has promised to achieve a fiscal deficit of 4.5% of GDP by 2025-26 by increasing the steaming tax revenues through increased tax compliance as

well as asset monetization over the years. According to the medium-term fiscal policy statement that the government had presented in February 2020, the fiscal deficit for 2021-22 and 2022-23 was at 3.3% and 3.1% respectively.

The impact of the lockdowns and restrictions:

The extent to which localised lockdowns and restrictions have been imposed in the past have impacted the economic recovery timeliness. There is a scope for sustained fiscal stimulus going throughout the year. To some extent, if credit is made available to businesses at low-interest rates, then monetary stimulus is also possible. The second wave has pushed back India's fragile economic recovery. Rising inequality and strained household balance sheets have constrained the recovery. From growing only 4% in 2019-20 to contracting 7-8% in 2020-21 to staring at another low economic growth recovery in 2021, India has been virtually stopped in all its tracks. Therefore, fiscal policy must lend a generous helping hand to lead vulnerable businesses and households towards economic recovery.

If the outbreak worsens over time, or if the case numbers are very high, this would elevate the risk to India's economic and fiscal recovery. The Indian economy should resume its recovery once the covid waves recede and the Indian economy will continue to grow at a faster pace than its peers at similar levels of per capita income around the world. On the downside, there will be less vigorous recoveries in the government revenues and severe downside scenarios may entail additional fiscal spending. Commodities and the automobile sector are severely affected by the initial stream of infections and associated lockdown measures. It recovered strongly in the second half of 2021.

The recovery in the global economy has made it unlikely that a sharp price decline like 2020 will happen again. The pent up demand in the automobile sector will likely drive a strong recovery when curbs are relaxed as was seen in 2020. The second wave of covid-19 has challenged an otherwise strong recovery for Indian Infrastructure. As consumers strive to maximize their utility, they will maintain earning due to regulated returns, fixed tariffs and quick recovery in demand. Airports are most at risk with international traffic recovery likely delayed by another year. This may impede a strong domestic recovery if the government increases the severity and scope of restrictions on mobility. A strong recovery is needed after a crushing 2020. As the outbreak grew worse the state governments have applied restrictive lockdown measures that halted the budding economic recovery in tracks.

Downgrades are a warning not to take economic recovery for granted. The slow pace of vaccinations is likely to be a burden on India's economic recovery. The Indian recovery has been vigorous across many sectors particularly in the last quarter of fiscal 2021. Halts to domestic air traffic and subdued international travel have dismantled recovery for airports. The covid wave has hit small and medium-size enterprises particularly hard. It has delayed recovery in banks' asset quality. Mobility has been down to 50-60% of the normal levels. Therefore, people are staying home more and spending less. Recovery will take hold later this year. India's budding economic recovery throughout March solidified government revenues.

Power Sector: The Indian power sector will generate huge revenues and it would track the recovery of the GDP of India.

Airports: The second wave has threatened India's air recovery traffic. The domestic passenger traffic has decreased by 75% of the pre-covid levels. The traffic recovery in the worst-case scenario could be 10% lower than what is predicted. Weaker traffic hits the cash flows of the airports. There will be a sharp recovery in road traffic after a short disruption. The commercial vehicle traffic will see better resilience as it supports logistics and essential services.

Ports: A modest recovery will be witnessed by import volumes. Fertilizers and containers will increase at a greater pace than crude and coal segments.

Operating cash flows will recover most infrastructure and utilities such as water, sewage, dams and natural gas segments. Credit loss will remain high in the fiscal year 2022 at 2.2% of the total loans before it recovers to 1.8% in 2023. India's strong economic recovery and the steps taken by the central governments and the state government to mitigate the effects of the economic crisis have lessened the burden on the banks. Additionally, banks have raised capitals to strengthen their balance sheets. This will smoothen the hit from covid related losses. The weak consumption accompanied by large scale job losses and the salary cuts in the formal sector may hit the banking sector's loans and 'credit card' loans. This is accompanied by lower recovery rates in the bank's non-performing assets. That could lead to a rise in weaker loans.

If we have to move towards sustained and real economic growth against v-shaped, k-shaped or w-shaped paths, the states and the centre need to work towards a cooperative strategy through their "cooperative federalism" scheme to increase the vaccination drive.

Last year, the government chose life over livelihoods. By choosing to protect the former, the covid 1.0 was delayed in September and its intensity was much lower than predicted. By January

2021, the government had declared victory over covid-19. The first threat to economic recovery is the regional cases which are resulting in further extension of lockdowns and hence they are limiting the pace of economic recovery. The second threat is the vaccination rates arising from the vaccine supply. Without inoculating a major portion of our labour force, there is a threat that viruses will disrupt our real economy. It is apparent from the worldwide cases of Covid-19.

Impact of COVID-19 on Environment

- Air quality improved to a range where thought never went.
- Low level of noise and plastic pollution.
- Flora and fauna flourished without no human interaction and freeness.
- Masks and hazmat were disposed directly into water bodies and may have an adverse effect on bio-.



Before

After

The Above picture depicts the improvement of environment due to covid-19 during pandemic.

Conclusion:

- Economic impacts of the pandemic and prevent its escalation into a protracted humanitarian and food security catastrophe, with the potential loss of already achieved development gains.
- We must rethink the future of our environment and tackle climate change and environmental degradation with ambition and urgency.
- Medical facilities and hospitals need to be risen in count to meet the need in the likewise times.
- Only then can we protect the health, livelihoods, food security and nutrition of all people, and ensure that our ‘new normal’ is a better one.
- Stopping the spread at the source remains key. Current measures to reduce transmission including frequent hand washing, wearing a mask, physical distancing, good ventilation and avoiding crowded places or closed settings continue to work against new variants by reducing the amount of viral transmission and therefore also reducing opportunities for the virus to mutate.

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