COVID-19 and Pathways to Sustainable Development

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Abstract

The pathway to sustainable development is governed by six major transformations: the digital revolution; human capacity and demography; consumption and production; decarbonization and energy; food, biosphere and water; and smart cities. The COVID-19 pandemic has altered the trajectories of each of these transformations around the world in both positive and negative ways. Countries which have successfully navigated the crisis have generally implemented policies which will accelerate these transformations in the direction of sustainability, while countries which have failed to rise to the challenge have reinforced patterns which will make sustainable development harder to achieve in the future. Following what the most successful countries have accomplished, policymakers elsewhere have at their disposal a clear set of tools for saving the lives of their citizens, preserving the health of their economy, and building the groundwork for a sustainable future.

Introduction

As of today, the COVID-19 pandemic is beginning to accelerate out of control across India. The country has logged 7.3 million confirmed cases, second in the world behind only the United States, and the third most recorded deaths in the world at over 112,000. India's massive population is largely responsible for this high number; only 8.29 out of every 100,000 Indians have been confirmed to have died from the virus so far, slightly over 12% the current rate in the United States and roughly 70% of the rate in Germany, a country deemed to have implemented one of the most successful responses to the pandemic. Some parts of India do look more like Germany than the United States: after playing host to the worst COVID-19 outbreak in the country in the month of June, Delhi has dramatically slowed its infection rate. Delhi still lies behind only Goa, Puducherry and Ladakh with a total measured infection rate of 1.9%, but out of 321,031 cases recorded overall, only 20,198 have emerged in the past seven days.[1] Elsewhere, such as in Maharashtra, the state with the highest caseload in the country with almost 1.6 million positive tests so far, no such slowdown has taken place. Maharashtra has seen 70,731 new cases in the past seven days, which remains the most in the country. Karnataka has recorded nearly as many new positive cases in the past week, despite having only half as many total cases and half the population of Maharashtra. After gaining plaudits for nearly halting the outbreak at its outset, Kerala has now run into significant trouble; 18.6% of its total case count of 317,929 has been recorded in the past seven days. States across India's south and northeast are following similar exponential trajectories and testing inconsistencies in the north hint at similar levels of infection, raising the question of just how severe the national outbreak will become before a vaccine can be developed and universally distributed. Despite the efforts of certain States and UTs which have successfully slowed their outbreaks, India as a whole continues day after day to set records for both deaths and new cases with no end in sight absent the development and distribution of a safe and effective vaccine.

India did not always find itself in such a precarious position with regards to the COVID-19 outbreak. On March 24, when the number of recorded cases in the country had hit roughly 500, the central government unveiled a lockdown policy more severe and comprehensive, on paper, than anywhere in the world outside of China, giving the population a mere four hours' notice. Acknowledging the catastrophe that could result if the coronavirus was given free reign in the dense urban areas of a country whose public healthcare system was already struggling to meet the needs of its citizens, prime minister Narendra Modi announced a universal stay-at-home order, a total ban on all public transportation, and a suspension of all services with the exception of essential businesses such as banks and grocery stores. This sweeping lockdown was initially set to last 21 days and was extended until May 4. Since then, restrictions have been steadily and gradually released over the course of the year.

Initially, Modi's sudden and harsh measures were met with soaring approval ratings and acclaim from across the political spectrum. The Prime Minister's popularity reached as high as 83% by the end of April, at the height of the national lockdown.[2] Crucially, the lockdown provided a window of opportunity to develop physical and digital infrastructure for managing the pandemic.

[1] Data from Ministry of Health and Welfare of India, tabulated at https://www.nytimes.com/interactive/2020/world/asia/india-coronavirus-cases.html
[2] https://www.nytimes.com/2020/05/16/world/asia/coronavirus-modi-india.html

With the national infection curve apparently frozen in place, lockdown bought the time for the government to shore up a public health system which had been worn threadbare even before the onset of the pandemic. Lockdown also provided time for India to develop and implement Aarogya Setu, a COVID tracking app modeled after Singapore's highly successful TraceTogether app. If a total lockdown had been sustained for a long enough period of time, suppressing the virus entirely in the fashion of Vietnam, New Zealand or Taiwan could have been within the realm of possibility. With buy-in at all levels of government from the local to the national, the nation's COVID strategy appeared set to allow India to buck the global trend by mounting one of the most successful responses of any country, developing or otherwise.

Unfortunately, however, various contradictions within this strategy and shortcomings in its implementation have conspired to cause the effective failure of this strategy. The zealous enforcement of the initial 21-day lockdown in cities was not matched with corresponding economic support to those impacted by the lockdown, particularly the large migrant populations in urban areas reliant on the informal sector. This lack of support forced many marginal workers to pack into transit centers against public health guidelines in the hopes of returning home, and eventually, to return to their home villages as a means of survival. Hundreds of thousands were forced to walk in the grueling spring heat to their home villages, often hundreds of miles away, in what has been called the greatest mass migration in India since Partition. At the time this occurred, India's testing regime was neither widespread enough nor targeted enough at high-risk individuals to estimate the exact impact of this mass exodus on nationwide infection rates. But given the surge of infections in rural areas that followed this massive population movement and has only become more serious, urban-rural migration caused by counterproductive national policies undoubtedly played a pivotal role.[3]

Nor has digital testing and tracing risen to meet the demands of the moment. While Aarogya Setu was initially declared mandatory for every working person in India by the Home Ministry, privacy concerns around the app and a series of court rulings have caused uptake to remain relatively low. As a result, the app never reached the level of market saturation that would have been necessary for it to serve as the keystone of a national testing and tracing system, as was originally envisioned. As economic reopening has continued despite mounting infection rates and runaway community spread, Aarogya Setu has increasingly slipped into irrelevance to the detriment of what remains of a national infection prevention strategy.[4]

In short, India's response to the COVID-19 pandemic was at first highlighted by lofty ambition, but has more recently been held back by a lack of resources to see this ambition through. Likewise, the contradictions and shortcomings which snowballed to undermine the national strategy have been directly related to India's challenges in adapting to a sustainable economy and society for the 21st century. Despite the robust IT-enabled services sector which has made a name for itself around the world, the broader Indian economy remains highly dependent on in-person interactions, and on the informal labor market in particular.[5] Only a select group of primarily

[3] https://www.nytimes.com/2020/10/08/world/asia/india-covid-19-rural.html
[4] https://www.financialexpress.com/industry/technology/eavesdropper-aarogya-setu-is-losing-relevance-why-the-govt-must-be-more-innovative-to-push-it-through/2014141/
[5] https://www.brookings.edu/blog/future-development/2020/07/13/the-impact-of-covid-19-and-the-policy-response-in-india/

urban employers have been able to allow their employees to work from home, and the shadowy nature of the informal sector has made it difficult to even define how economic support could even be delivered to the estimated 86% of workers operating within the informal sector.[6] On foundations such as these, it's no wonder that states and metropolitan areas have proceeded with economic reopening even as infections have skyrocketed and India has failed to meet its own infection rate benchmarks for ending lockdowns.[7] Even though the end of lockdowns has caused cases and deaths to jump sharply,[8] and a wealth of international evidence has demonstrated that reopening alone cannot revitalize depressed economies unless the virus is under control,[9] India's national and subnational governments have apparently felt that they had no other choice.

COVID-19 has presented the world with a crisis which both makes the need for sustainable development more obviously acute than ever and has itself required a response rooted in the principles of sustainable development. Similarly, the countries which have to this point mounted the most successful responses to the challenges posed by COVID-19 have done so by jumpstarting their transitions towards economies and societies defined by the principles of sustainable development. By mobilizing the potential of recent advances in technology, these countries have made their education, health, and social support systems more inclusive while reshaping economic patterns in a way which encourages the more efficient use of resources, cleaner and more accessible urban environments, and more climate-conscious outcomes.

To this point, India has lacked the foundation needed to mount a similar response to the COVID-19 pandemic which would both meet the needs of the population during this crisis and lay the groundwork for meeting the challenges India will face through the remainder of this century. But India under the Modi administration in particular has proven itself capable of national, transformative, and disruptive change. Such change is necessary immediately if India wishes to avoid becoming the worst impacted country on the planet during this crisis, yet the times call for ambition beyond just surviving the present. If India can revive its response, time still remains to reshape it in a way which both saves as many lives as possible and holistically prepares society and the economy to confront the many challenges which are yet to come.

Sustainable Development Transformations

Since 2015, international thinking around sustainable development has been dominated by the Sustainable Development Goals (SDGs). A set of 17 goals, 169 targets, and 232 indicators adopted unanimously by the UN General Assembly under the umbrella of the 2030 Agenda, the SDGs provide a detailed outline of the objectives which nations seeking to build a future defined by social equity, economic strength, and environmental protection should aim for. The SDGs are structured in an intersectional fashion which ensures that its environmental goals are economically and socially bearable, its economic goals are socially and environmentally equitable, and its social goals are economically and environmentally viable, forming a three-pillared foundation for just, broad-based, and long-term prosperity.

[6] https://www.cfr.org/in-brief/india-fighting-coronavirus-informal-economy
[7] https://www.indiatoday.in/news-analysis/story/covid-19-unlock-1-0-india-lockdown-coronavirus-cases-1687162-2020-06-09
[8] https://www.nytimes.com/2020/05/06/world/asia/india-coronavirus-lockdown-infections.html
[9] https://csd.columbia.edu/sites/default/files/content/docs/ICT%20India/Papers/ICT_India_Working_Paper_33.pdf

The 17 SDGs, summarized. Further details on SDG targets and indicators can be found at https://sdgs.un.org/goals.

What the SDGs do not necessarily provide, however, is a roadmap to achieving these ends. While the 2030 Agenda is highly ambitious, it does not identify the actual mechanisms which countries around the world would need to be aware of and mobilize in order to spark permanent, lasting transitions into sustainable development. It was out of recognition of this need, and the need to further understand synergies and tradeoffs between the different facets of sustainable development, that The World in 2050 Initiative (TWI2050) was launched as a global research initiative to understand these pathways for navigating away from the unsustainable status quo.

In its first report, published 2018, TWI2050 identified and elaborated what can be termed as an achievement framework for the SDGs. This framework revolves, in turn, around six major societal transitions nations must manage on their way to constructing a sustainable society.

Transformations to Achieve the Sustainable Development Goals. Full report found at http://pure.iiasa.ac.at/id/eprint/15347/1/TWI2050_Report081118-web-new.pdf.

Unlike the SDGs, TWI2050's six transformations present an actionable framework for policymakers and institutions to implement, coupled with a focus not on outputs and ends, but inputs and means. By accelerating certain transformations and understanding the impact of the trajectories of others, countries can use this framework as a real template for attaining a lasting sustainable future – a need which the COVID-19 pandemic has only made more obvious.

Digital Revolution

Even though the digital revolution was surprisingly almost totally excluded from the original 2030 Agenda, the accelerating development and deployment of digital technologies around the world plays perhaps the most crucial role in catalyzing the societal transformations necessary for sustainable development. Just like other General-Purpose Technologies (GPTs) such as the steam engine during the First Industrial Revolution and electricity during the Second Industrial Revolution, digital technology both affords an opportunity and poses the risk for radical transformation of existing social and economic structures. Similarly to the first two industrial revolutions, the digital revolution, sometimes termed the Third Industrial Revolution, has yielded exponential growth in productivity by accelerating the spread of information through innovations such as the introduction of digital databases, the rise of the internet, and the introduction of mobile technology. As the development of digital systems proceeds, increased capacity for automation of physical and even cognitive processes is likely to spark a Fourth Industrial Revolution, whose capacity for reinventing production and information sharing processes is only matched by its potential to shake the underpinnings of modern economies and societies. The broad spectrum of revolutionary technology which constitutes the digital revolution poses great risks to social equity and sustainability if not anticipated and managed properly, but if properly mobilized, holds the promise of accelerating growth while expanding access to prosperity and relieving pressure on planetary boundaries.

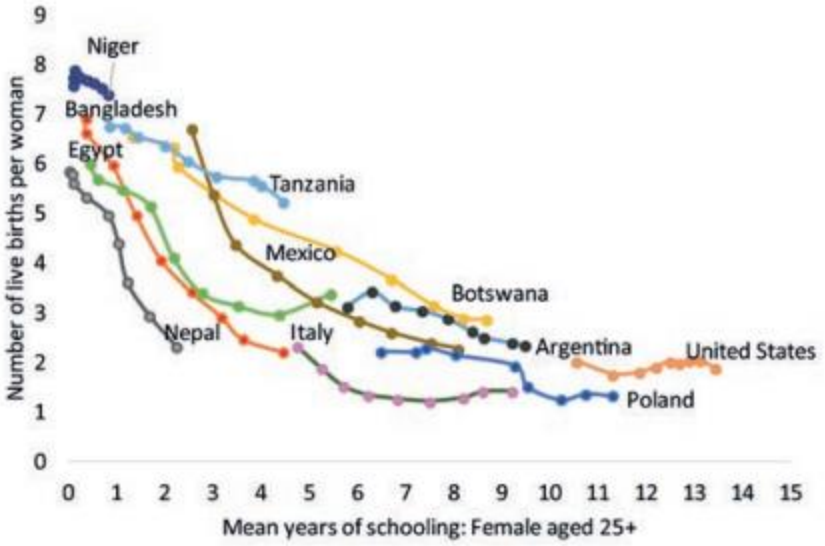
Data has been referred to as the new oil. Beyond its value on the market, though, data will also serve an integral role in building capacity for sustainable development. Where economic and social programs once hinged on the outcomes of small, controlled statistical studies, data collection and sharing has become so ubiquitous that large-scale datasets extracted directly from primary sources can now drive policy design and analytics. Advances in computing power have made more sophisticated and creative uses of this big data more possible than ever before. In the medical field, big data analytics have famously formed the core of new diagnostic engines, and big data drawn from infrastructure usage in urban areas could pave the way for more adaptive smart cities. In other fields ranging from education to public safety, information gleaned from big data analysis has the potential to redefine how resources are invested and distributed through public and private mechanisms to build wealthier, more flexible, and more just societies.

Big Data is also fueling recent advances in Artificial Intelligence (AI) which represent the first glimmers of the Fourth Industrial Revolution. With exponentially more training data on tap than ever before, AI algorithms can utilize the process of machine learning to optimize their own approaches and assume roles in cognitive computing which had previously been reserved for humans alone. With more capable computing devices available than ever before, and unprecedented connectivity between devices, these advances are paving the way for agriculture, manufacturing, and infrastructure networks to optimize the delivery of resources to distributed nodes, dramatically reducing energy and resource waste while boosting the resilience and capacity of these systems. The advances of the new digital revolution have already reshaped work, governance, and services patterns around the world. If safeguards around personal information, privacy protection, and labor rights can be erected, the digital revolution holds almost unlimited potential to advance growth, equity, and environmental sustainability.

Human Capacity and Demography

Thanks to medical advances that extended life expectancies around the world over the course of the 20th century, countries around the world experienced population booms as fewer died of childhood illnesses and more survived deeper into old age. By the late 20th and early 21st centuries, birth rates were falling in all but the poorest countries as women grew more educated and entered the workforce at a higher rate. The combination of higher life expectancies and a lower dependency ratio in many countries, including India, has resulted in what has been termed a "demographic dividend," in which development and prosperity have been powered by a disproportionately high share of working age individuals compared to the non-working-age population. East Asian societies have most dramatically benefited from the demographic dividend, but up to 2% of India's per capita GDP growth rate in recent years can be attributed to the age structure.[10]

[10] https://www.imf.org/external/pubs/ft/wp/2011/wp1138.pdf

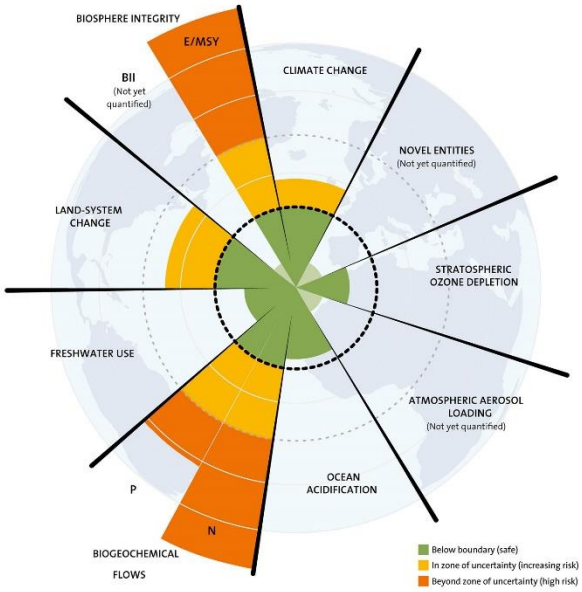


Higher education for women is strongly correlated with reduced birth rates, and labor market trends point to greater inclusion of women and higher skill requirements through the near future. Sustainable societies will need to orient their social welfare, education, and development policies around the confluence of these trends. Source: http://pure.iiasa.ac.at/id/eprint/15347/1/TWI2050_Report081118-web-new.pdf

The upshot of the demographic transition is that societies which have benefited from it will need to build more substantial social welfare systems in the near future to support rapidly aging populations as the working-age share of the population declines. At the same time, education and training programs will need to evolve alongside technology in order to include the broadest population base possible in the emerging global knowledge economy. As populations grow older and more dependent on a smaller group of earners, socially inclusive sustainable economies will need to avert rising inequality both by preparing as many as possible for the high-skill employment demands of the future and by distributing these gains to those who, either due to age or lack of education, are unable to benefit from this changing labor market. In lower-income countries, which already have large youth populations and highly stratified labor markets, such policy responses will need to be even more intentional to avoid exacerbating already-established trends.

Consumption and Production

Existing consumption and production patterns across the global economy tend to use unsustainable levels of resources and generate unsustainable levels of pollution. If Business As Usual (BAU) continue, planetary boundaries are likely to be exceeded before global needs for energy, food production, and quality living environments are met. To avoid hitting against planetary boundaries in the pursuit of necessary growth, societies will need to decouple human and economic development from these unsustainable patterns before ecological catastrophe forces their hand.



Excessive reliance on various planetary resources is likely to cause ecological catastrophe and force changes in consumption and production practices unless these practices are changed in advance. Source: Stockholm Resilience Centre.

In practice, implementing more sustainable production and consumption patterns cuts across a number of economic sectors as well as the other transitions pointing toward sustainable development. In agriculture, for example, it requires sustainable withdrawals of groundwater and limited use of fertilizer to avoid aquifer collapse and excess toxic runoff. It requires reimagining supply chains to avoid excessive pollution and intelligent infrastructure in urban environments which minimizes resource use and maximizes reuse. And, as discussed in the next section, it requires decarbonization in the energy, transportation, and all other relevant sectors.

Decarbonization and Energy

Decarbonization and climate action have been the most discussed transitions toward sustainable development in the public sphere, but less discussed is the flip side of that coin: the need to provide clean, modern energy to the entirety of the world's population. As of 2017, over a billion people remained without access to electricity and three billion lacked access to clean cooking. The health impacts of indoor air pollution alone amount to some four million premature deaths every single year, and lack of access to electricity of any kind makes economic inclusion virtually impossible. As for outdoor air pollution, the immediate health impacts of carbon-intensive activities such as automobile transportation, coal power production, and crop burning in places such as India have been extensively documented. Moving into the long term, unmitigated climate change is likely to devastate coastal regions, harm agriculture through higher incidence of drought and flooding, and permanently damaged ecosystem services. Every year, the risks of climate change and the need for immediate action becomes more and more obvious.

One essential facet of this transition will be improvements in the efficiency of energy generation, energy usage, and energy distribution. Doing so will require both advances from the digital revolution and in distributed energy. For central power grids, green or otherwise, big data concerning network usage patterns can decrease wasted distribution capacity by improving real-time information about how much power is needed in any location at any one time. Distributed renewables, on the other hand, negate the need for this by generating decarbonized energy directly at the point of need. Finally, further digital advances, particularly in semiconductor design, are likely to steadily decrease energy usage requirements in common household and industrial applications.

Food, Biosphere and Water

Much like current consumption and production practices and existing energy systems, current land use patterns undermine sustainability in a number of sectors. Modern agriculture systems, particularly livestock production, produce high levels of Greenhouse Gases (GHGs), deplete groundwater reserves, and contribute to eutrophic dead zones in rivers and coastal areas due to excessive application of fertilizer. Deforestation contributes to air and water pollution while harming biodiversity, an unheralded yet crucial contributor to agricultural production. Not only do modern land use practices undermine sustainability, they also remain vulnerable to the damage which will be wrought by unmitigated climate change. Sustainable land use systems, therefore, must deliver appropriately high intensification to meet the demands of a growing global population while building resilience to climate change and minimizing damage to auxiliary ecological systems.

In order to meet global demand for food without further degrading sensitive habitats, sustainable intensification of agriculture must undoubtedly play a major role. Digital agriculture can help fill this need to elevate agricultural outputs without further expanding land use. By using spatial mapping technologies, mobile testing kits, and big data-assisted genetic improvements, farmers can further boost yields from their land without making wasted investments on excessive inputs or cultivating more land. With information and communications technologies in play that can aid extension agents in training farmers in using the tools and techniques of this so-called “precision agriculture,” sustainable intensification can be achieved at scale and global agricultural demand can be met without undue threat to virgin ecosystems or biodiversity.

Smart Cities

More people live in cities than ever before, with 70% of the global population expected to live in cities by 2050. So far in the young 21st century, cities have served as magnets of culture and economic opportunity like never before in human history. But many urban environments have not kept pace with the unprecedented demands placed upon them. A quarter of the global urban population lives in slums and informal settlements, disproportionately so in countries which are already lower-income. Cities have struggled to build infrastructure in the realms of transportation, energy, ICT, and public sanitation adequate to meet this surging population demand, and have likewise had trouble delivering equal access to soft infrastructure, such as quality health and education services. As unmet demand for urban services accumulates,

informal settlements grow and the task of delivering the promise of the modern city to the whole population becomes exponentially more difficult.

Faced with these challenges, cities are increasingly applying recent technological advances in order to deliver essential services and amenities in an equitable and environmentally friendly manner to their exploding populations. Digital infrastructure has expanded the capacity and efficiency of public transportation systems, which has reduced urban sprawl by increasing densification around transit hubs, expanded access to affordable housing stock, and sparked the decarbonization of city infrastructure. Similar digital innovations in public sanitation systems reduce sewer overflow, flood damage, and the spread of disease. The reshaping of the urban environment prompted by these innovations creates more inclusive, healthier cities with reduced social segregation, expanded green space, and expanded opportunity for all inhabitants – essential in an era where more people will live in cities than ever before.

Sustainable Development Potential in the Age of COVID-19

Meeting the SDGs was always going to take tremendous lifestyle changes, coordinated policy actions, and cooperation at the national and international levels. The silver lining of the COVID-19 pandemic, so far, has been that facing a global crisis of this magnitude has already forced some of these changes to take place. To a certain degree, this has been because sustainable development is the *only* way to successfully manage generational challenges such as a pandemic or climate change. In this sense, taking the steps necessary to end the pandemic has also *de facto* advanced the cause of sustainable development. But room still exists to improve the national and international responses to COVID-19 by focusing them on pursuing the aims defined by the SDGs via the six fundamental transitions mentioned above. Doing so would not distract from the goal of resolving the pandemic. Far from it, such a framework would ensure all the intersectional challenges of the pandemic were being comprehensively addressed by policy while building future capacity for realizing prosperous, inclusive, and resilient societies around the world.

Vital Investments in Digital Infrastructure

Social distancing measures around the world have made the role of the internet one of the defining characteristics so far of this uniquely 21st century crisis. As public health has demanded that people maintain their economic and social relationships from their own homes, the quality of digital infrastructure has become inseparable from public safety and well-being. Service workers who have benefited from adequate public investment in digital infrastructure have been able to near-seamlessly continue working without unnecessarily risking themselves to exposure to the virus. Those who have not, in the face of inadequate public support, have been forced into an impossible choice between their own sustenance and the health of themselves and their families.

Sufficient digital infrastructure is not simply a mitigation tool for managing future outbreaks, though. It is also a vital piece for improving inclusion in the knowledge economy and for relieving heightening pressure on urbanized areas. As communication over the internet has played an ever more central role in the modern workplace, quality employment has been increasingly limited to areas where infrastructure allows for the seamless incorporation of the internet in the workplace. Simply having a connection is often no longer enough, either. Online

economic activity consumes increasingly more bandwidth year by year, requiring a level of investment in digital infrastructure sufficient to meet these escalating demands. If such investment does not take place, economic activity in the future will increasingly be limited to geographical areas which do have it. This will inevitably result in rising inequality between tier-one urban areas and outlying regions unless this infrastructure deficit is anticipated and solved.

The rapid rise of remote work around the world during the pandemic, including in India, has created the demand and the conditions that call for such unprecedented investments. In addition to normalizing conducting everyday workplace activities at home, new technologies gaining prominence during the pandemic have elevated what is possible for remote work. For instance, virtual reality could make permanent remote work feasible and sustainable by creating more comfortable and natural environments for interaction than the endless teleconferences and videoconferences workers at home must sit through now. Augmented reality technologies could even allow skilled workers, such as repairmen, to help low-skilled workers fix machines and carry out other complicated tasks without leaving the comfort of their own home.

The financial crisis of 2007-08 is remembered, among other things, for causing firms to permanently incorporate more technology in their production techniques. The COVID-19 pandemic is likely to leave an even deeper and more persistent impact on production and labor markets. On the consumer end, the pandemic has shifted consumer preferences away from physical retail and towards e-commerce and online health and education services in a way that is likely to persist well after a vaccine is distributed. On the producer end, businesses which have successfully adjusted to the new reality of working from home seem to have thrived. In May, two-thirds of US GDP was produced from people's houses, a sea change in production location never before seen outside of wartime. Meanwhile, Indian workers who have been able to work from home have apparently experienced similar success. 66% of Indian employees working from home report a considerable increase in productivity, and 55% feel positive about their ability to maintain a balance between their work and personal lives from homes.[11]

The nature of remote work will likely reduce housing shortages in cities where knowledge work is centered, while opening up opportunities for employees outside of metropolitan areas where these industries are centered. For the former group, this will expand opportunities for professional development that were formerly financially off-limits. The latter group will vastly increase the pool of talent available to employers, allowing for better matching between workers and workplaces. In both cases, remote work could indirectly play a hand in unlocking the productivity gains from digital technology which have long been predicted, but have never materialized.

Autonomous Food Systems

COVID-19 has revealed significant weaknesses in global food systems, from production along the supply chain all the way to distribution. Harvesting many crops still remains reliant on manual labor, as does meat processing, and numerous COVID outbreak clusters in the United States have been linked to groups of workers on farms or at food plants who have been

[11] https://timesofindia.indiatimes.com/life-style/relationships/work/work-from-home-survey-66-employees-feel-their-work-productivity-has-gone-up-considerably/articleshow/77649776.cms

effectively forced to work without being given reasonable options to socially distance. Aside from the lack of government support which forced these employees into the workplace in the absence of effective safety measures, these instances have pointed to how reliance on manual labor in food systems is both a source of inequality and a vulnerability during a pandemic. On the distribution side, where supply chains historically face a severe tradeoff between efficiency and resiliency, mass disruptions in the consumption destination for food products created a surge in food waste at the same time that hunger skyrocketed for marginal populations around the world. At every point, the pandemic has highlighted the ways in which modern food systems experience problems based on reliance on obsolete practices which recent technological advances can help address.

Automation was until recently limited to the performance of predictable physical tasks, such as those found on an assembly line on the factory floor. But with machine learning algorithms and exponential increases in access to training data, automating the performance of unpredictable physical tasks has become increasingly feasible. Manual farm labor largely falls into the category of unpredictable physical labor, and particularly in countries with inexpensive labor markets, the marginal cost of such technology is unlikely to fall enough to justify investing in it for quite some time. But strategic investments in automation can be made in more predictable stages of the production chain to minimize the required involvement of manual labor. On the distribution end of the supply chain, static contracts between buyers and sellers could be supplemented by live end-market demand updates based on big data drawn from consumer purchases. This would allow supply contracts to shift more smoothly between clients in times of unpredictable demand, reducing waste and improving the efficiency of food distribution during emergency situations.

Digital Health Systems

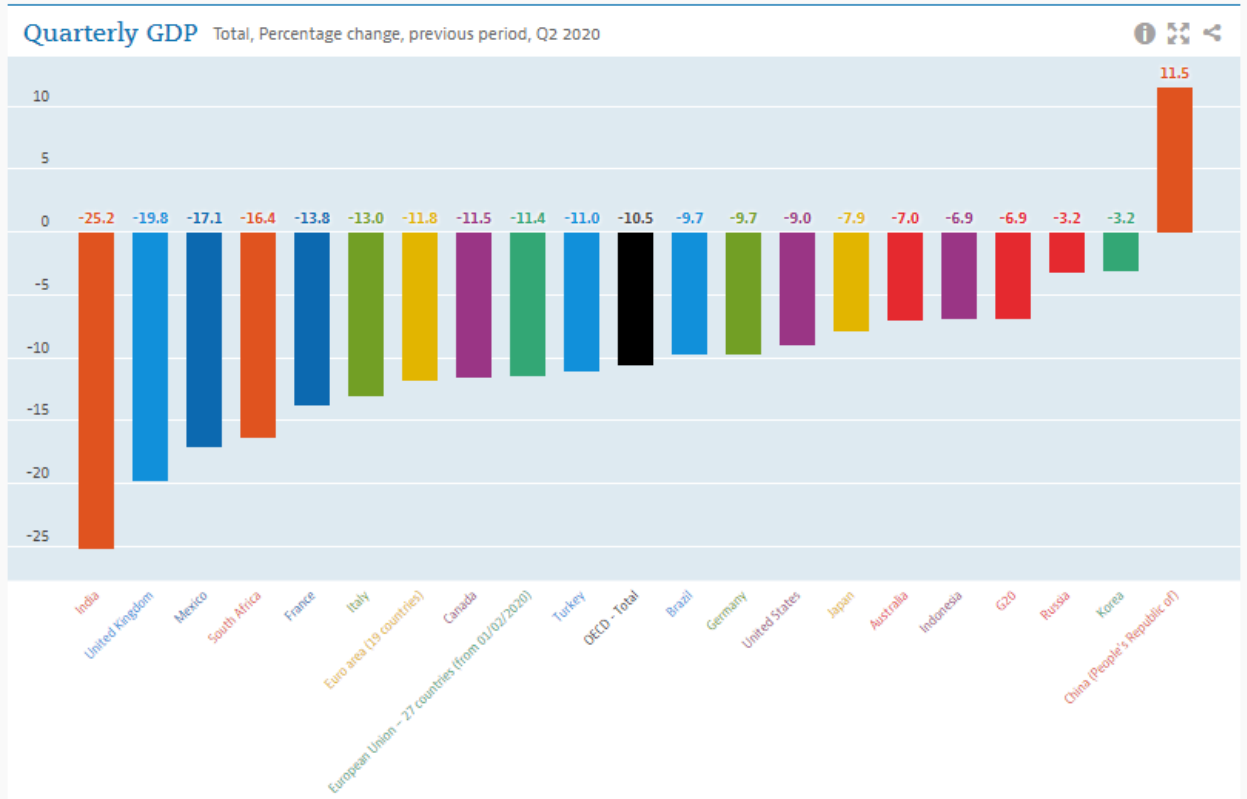
Unsurprisingly, the most significant digital advances which have emerged during the pandemic have taken place in the health sector. The popularity and capability of telemedicine has grown by leaps and bounds, and countries which have built successful testing and tracing programs have put ICT at the heart of their systems. More advanced digital technologies, such as AI, have shown great promise in predicting the timing and location of new outbreaks, developing new treatments, and contributing to the development of a vaccine.

Digitizing health systems is, first and foremost, a means of expanding access to health services, whether during a pandemic or otherwise. Recognizing the challenges faced by large swathes of its population in accessing healthcare, India has officially prioritized digitization in its healthcare sector since the publication of its National Health Policy in 2017 and formalized this commitment with the official launch of the National Digital Health Mission (NDHM) this year. Expanding access to healthcare in India has never been more important than now, in the middle of a pandemic. The NDHM, with its goal of streamlining healthcare services within a comprehensive digital health ecosystem, will make a major contribution to eliminating the vast disparities in access to healthcare that the pandemic has underlined in bold. If the system can successfully demonstrate its potential in the middle of the most severe test that can be imagined for a newly-minted national health system, then NDHM will play a major role in shaping the conditions for a just and sustainable healthcare system well into the future. If this is to happen, practitioners will need to draw upon the best practices in digital medicine which are emerging

around the world over the course of this global crisis, and the central government will need to encourage state governments and public institutions to experiment with a new and unproven system. With regard to the NDHM, for India to draw relevant lessons from the experiences of other countries, refer to Bajpai and Wadhwa 2020.

Structural Economic Reforms

The pandemic has staggered economies around the world. In the second quarter of this year, France's economy shrunk by 13.8%, Mexico's contracted by 17.1%, and India's declined by an astonishing 25.2%, the most in the world. Out of all G20 countries, only China reported economic growth in the second quarter, and while anticipated declines during the third quarter are less stark, the broader picture is no rosier.



Percentage GDP change for G20 countries during the second quarter. Source: OECD.

In the Great Recession of 2008, economic pain was notably associated with sharply increasing inequality, and given the disproportionate impact of COVID on the poor, one would expect the pandemic to lead to greater economic inequality as well. But surprisingly, in some countries, this has not happened. Amazingly, thanks to extensive financial support for the working poor included in its COVID relief package, the United States saw poverty levels drop during the first months of the pandemic. While this may point, in part, to how a living wage remains out of reach for the working poor in America, it also demonstrates how effective redistributive government policies can be at reducing poverty. In countries which have deployed digital national ID systems, relief could be deployed immediately without any of the delay from legacy systems

which the vulnerable cannot afford in dire situations. Coming out of the pandemic, these governments have demonstrated the capacity to serve as an insurer of last resort for households belonging to vulnerable groups, which has powerful implications not just in the middle of a pandemic, but over the course of any kind of social transition with clear winners and losers – such as, for instance, the transition into sustainable development. Such a tool could easily be extended to subsidize retraining for workers in displaced industries, to take one example.

Some countries are rightly viewing the pandemic as an opportunity for structural economic change. With low-paid service jobs disappearing en masse, it has never been more important to create a policy environment that encourages retraining, employee transition, and the kind of creative destruction which shields the most vulnerable from harm. India's government has jumpstarted this process by pushing through an ambitious and contentious series of policy reforms meant to address long-standing structural flaws in the economy. These have included a liberalization of the agricultural sector, long-awaited labor reforms to encourage investment, major education reforms, and an extensive restructuring of government bureaucracy. The value of these reforms may be unproven so far, but if they are intended to promote sustainable development, they should be coupled with broad economic support programs to bring the groups on the losing side of them in as key stakeholders. Otherwise, they may approximate the economic reforms needed to help deliver India from the deep economic damage inflicted by the pandemic, but they will shatter the sense of social inclusion necessary to make future reforms reflective of popular will.

Rethinking Trade Networks

As in the wake of prior economic crises, COVID-19 has prompted a new wave of protectionist measures in the international market. Some have ostensibly been for the protection of public health; over 120 new export restrictions have been placed on health equipment and PPE globally so far this year. Other disruptions have come out of either heightened risk or pure economic nationalism. Some of the most fragile and dispersed supply lines have been fully severed, while others are likely to be located closer to end consumers for the long term.

Protectionism has historically served as a drag on economies domestic and foreign, with the negative impacts of inefficiency outweighing the positive impacts accruing to specific favored industries. But amidst the onset of the digital revolution, this could no longer be the case. Automation has reduced the savings that formerly came from locating production in inexpensive labor markets by lowering the labor share of production. At the same time, e-commerce has made rapid production responses to changing trends and preferences increasingly important. Likewise, the environmental impact and labor ethics implications of globe-spanning supply chains have come under increasing scrutiny. These three factors significantly favor the repatriation of supply chains and a new movement toward local manufacturing.

If domestically-oriented manufacturing becomes the new norm coming out of the pandemic, then Indian manufacturing would experience the kind of boom in demand that could revolutionize the sector. If Indian manufacturing can successfully take advantage of the labor and investment reforms mentioned in the prior section, the sector could be set to break out. Meanwhile, the new wave of distributed remote work could lift the Indian services sector just as much. Given

sufficient investment in expanding digital infrastructure, India could be set for a services boom which parallels that in the 1990s and 2000s. The time is ripe for public and private investment to further both goals; borrowing rates in India are at a historic low.

A New Vision of Urban Life

The digital revolution was always destined to reshape cities in ways which would be difficult to predict, but COVID-19 has dramatically accelerated this process. With the rise of near-universal remote work, which loosens employees' geographical ties to their employers' offices, knowledge workers no longer need to live within daily commuting distance of city centers. Workers in some European countries have returned to the office, but others in famously office-driven work cultures such as Japan have not, indicating a permanent shift in lifestyle norms could be underway. Dense clusters of knowledge workers are still envisioned as the backbone of future smart cities, but how will the changing settlement patterns caused by the pandemic alter this vision?

Much of this depends on how local governments respond to the new normal. Cities will remain magnets for culture, education, networking, and relationship-building, and most knowledge employees currently prefer the option to come into a physical office at least once a week. This means that metropolitan areas are likely to expand to cover the area where sufficient digital infrastructure for knowledge work has been built within a geographical radius that would permit infrequent, in-person meetings for those at its edges.

This poses a significant risk of even more suburban sprawl than we see today, which would be diametrically opposed to the platonic ideal of smart, green, and sustainable cities. Fortunately, forward-looking local governments can take two steps to remedy this. First, they can take a direct hand in making their cities sustainable by redirecting transportation infrastructure investments toward green public transit options such as regional light rail. With demand for oil plummeting during the pandemic, oil-importing countries such as India have a golden opportunity to invest the money that would ordinarily be spent on foreign oil purchases into renewable energy and green transit projects. Second, cities should lift the zoning restrictions on residential density which have been one of the primary drivers of suburban sprawl. Despite the outward pressures of new work patterns, this combination of liberalization and investment should direct the development of smart cities along dense, infrastructure-rich corridors, decreasing adverse environmental impact while optimizing the urban environment for the knowledge economy.

Challenges to Sustainable Development in the Age of COVID-19

Since the introduction of the 2030 Agenda, the cause of sustainable development has been threatened by a wave of insular nationalism, stubborn and rising inequality, and populist responses to systemic problems. The COVID-19 pandemic demands a response grounded in principles of sustainable development, but the dynamics of the pandemic itself threaten to heighten the very forces undermining sustainability. The hunt for a vaccine has generated international scientific cooperation at a level never before seen in human history, but it has also witnessed theft of research, threats to limit the distribution of vaccines beyond national borders,

and mass popular distrust regarding the efficacy and safety of an eventual vaccine. Governments wishing to distract from their own failures have at times elevated racist conspiracies that cast the blame for the virus on other countries, rather than investing energy in resolving the outbreak within their borders. At other times, they've attempted to wish the virus out of existence by spreading doubt about its severity, encouraging rumors about miracle cures, and pushing their citizens to ignore the disease and return to business as usual. Meanwhile, the cumulative impact of lockdowns around the world has caused a more severe economic downturn than the Great Recession at a time when many governments lack the capacity to provide adequate economic support to their populations and others have started practicing a counterproductive protectionism which only harms their neighbors. The sum of these actions amounts to a global rise in mistrust at a time when only cooperation at a global scale will be adequate to meet the challenges the world is soon to face. With this in mind, governments and institutions seeking to stay the course towards building sustainable economies and societies will need to remain conscious of the causes of the forces now sweeping the globe in order to avoid unconsciously running afoul of them.

Populism and Nationalism

Accelerating global change over the past decade, accompanied by a global failure to insulate many groups from the negative impacts of these changes, has been one of the major drivers of the populist, nationalist surge the world has experienced since roughly 2016. With digital means of communication newly widespread and mistrust in governments rising, much of popular opinion has fallen back on old scapegoats and xenophobic tropes. This has enabled the rise of nationalist political movements which have encouraged suspicion of foreign governments and citizens, the dismantling of international ties and institutions, and mutual robbing from the global commons. The COVID-19 pandemic has caused far greater disruption around the world than any other global event this century. It has also done so in a way which easily reinforces the type of blinkered, bordered thinking which has become so common. When astronomical infection rates can be blamed not on the failure to implement a comprehensive test-and-trace system, but on a "China Virus" or the actions of certain marginalized religious groups, what sorts of policy solutions are demanded by such a narrow framing of the question? While this approach may score short-term political points, the Coronavirus cannot be defeated this way, and nor can any of the new emergent global challenges of the 21st century sustainable development provides solutions to. Needless to say, a wall cannot be built around climate change.

In short, such a fractured and inimical approach is simply incompatible with the global challenges nations around the world must cooperate to face together. But at the very moment such cooperation is required, fearmongering and mistrust breed the exact opposite. If such an outcome is to be avoided, investments in environmental goals should simultaneously seek to achieve social and economic goals, with particular focus on including groups left behind in the post-COVID transition as key stakeholders. Similarly, social and economic investments should focus on resolving the insecurity, injustice and disenfranchisement these groups are exposed to by these high-level trends. Doing so should mitigate the backlash inherent in big, structural change which could sabotage the project of sustainable development entirely.

Global Economic Instability

The COVID-19 depression will engender precarious economic conditions around the world for the foreseeable future. The impact of this lengthy coming recession on sustainable development will not be limited to the political reaction and diminished trust discussed in the prior section. More directly, it may also limit the total capital available for investment in key sustainability initiatives. While global interest rates are likely to remain low through the near future, limited borrowing costs will be offset by the deep fiscal holes which COVID relief programs have dug for many governments. Countries have experienced unusually low tax receipts while paying record amounts to the unemployed and vulnerable and, in some cases, directly assuming the responsibility for private payrolls. This has put record deficits on the books, and some governments may find it difficult at the moment to justify further investments in projects without immediate financial return. Private investors may feel similarly cautious about investments without short-term return. Yet the coming decade is the most critical period for ensuring not just that the SDGs are met, but that the planet remains livable for the generations to come. Short-term fiscal pain must not serve as an excuse to avoid making the investments needed for our descendants to have a future we can recognize.

One solution to this quandary is simply to make sustainable development projects more compelling targets for public and private investment. Public institutions may have to partner with private investors in order to determine ways in which new infrastructure, physical and digital, can be profitably structured. Alternatively, governments could address their fiscal crunch by shoring up their tax receipts. At the present moment, this calls for international coordination to eliminate the tax shelters and tax havens which keep so much revenue out of the hands of its rightful recipients.[12] While raising taxes would normally be inadvisable in the middle of a recession, the elimination of these tax havens would create permanent increases in investment as the wealthy seek out different places to park their money and governments would have greater revenue to draw upon for public investment with relatively low corresponding negative impact on consumption. If an international agreement to eliminate tax havens were coordinated with efforts to align private sector incentives with major sustainable development projects, private and public investment in these projects would thrive even despite these financial pressures.

Hoarding of Resources and Opportunity

In the international sphere, nationalism is arguably no more than a manifestation of the impulse to hoard resources at the expense of mutual solidarity during times of stress. The same impulse is evident at the domestic level, where the strains resulting from the pandemic will harm the social solidarity needed to fulfill sustainable development priorities. Suburbs have seen record interest on the housing market from city dwellers seeking to escape the perceived dangers of population density and looking for more space in an era of lockdowns, despite the inherent unsustainability of urban sprawl. The rich and famous already find it easier to access rapid testing for COVID-19, and the inequities in opportunity for quality healthcare may widen further on the other side of the pandemic as such disparities in access become more normalized. “Quarantine pods” have resulted in a semi-privatization of education for public school students with the wealth and social connections to be invited to such groups, while students without such access or without internet access at home have fallen further behind in an age of universal online education. If the pressures

[12] https://www.imf.org/external/pubs/ft/fandd/2019/09/tackling-global-tax-havens-shaxon.htm

of and responses to the pandemic further dismantle the expectation of solidarity, other dimensions of sustainability will find themselves under threat.

If COVID-19 poses a threat to the social contract itself, then it is the responsibility of government at all levels to fix the market failures it is causing. Since such inequalities tend to replicate themselves and get magnified over time, preventing these emergent fissures from becoming permanent is of the utmost importance. The best way to do this is for projects incorporating principles of sustainable development, which is defined by the principle of solidarity, to explicitly target the groups on the wrong end of resource and opportunity hoarding during the pandemic. To prevent reaction against the intentionality of these programs, advocacy organizations will need to take a front-seat role to communicate the unique challenges of groups impacted by COVID in all ways, and programs themselves will need to demonstrate how policies for the welfare of all create the greatest benefit for all. Building solidarity in public policy is difficult under the best of circumstances, and even more so when the environment seems to discourage it.

The Perils of Excessive vs. Inadequate Ambition

Moving forward, governments and institutions of all types will need to walk a tightrope between implementing large-scale structural changes in the pursuit of sustainable development and avoiding the inevitable backlash from excessive disruption.[13] Passive responses will not only fail to achieve any progress towards building more sustainable societies, they will also be insufficient to avert populist reaction from groups left behind by the pandemic. Governments may also be tempted into misplaced interventions which work to freeze conditions in place rather than helping businesses and the population adapt to new realities in a post-COVID world. This may preserve the well-being of constituents through the short term, but it will lead both to an inevitable decline in competitiveness and a similar failure to meet the need for structural change which sustainable development demands. Finally, an excessively ambitious response could leave new groups out to dry, resulting in a similar populist backlash from the opposite end of the political spectrum.

Even as the pandemic calls for governments to assume a more expansive role in managing these transitions than in previous recessions, it also calls for reimagining what such a hands-on role for the state would even look like. The e-government initiatives which have emerged over the course of the pandemic hold particular promise as tools for shortening the distance between people and their representatives and avoiding the guardrails which could derail these important transitions. Transformative change requires losers to be taken along and, if possible, to become advocates for change themselves. Innovations in how citizens communicate their needs to the government, and in how government acts on their behalf, could improve the likelihood that these groups are fully included in the sweeping changes which must take place. If COVID has reminded sustainable development practitioners of one thing, it is that transformation and justice must go hand in hand. After all, sustainability is no more than a policy application of solidarity across the breadth of society and with future generations.

[13] https://www.economist.com/special-report/2020/10/08/the-right-kind-of-recovery

References

Aiyar, Shekhar and Mody, Ashoka. "The Demographic Dividend: Evidence from the Indian States. *IMF Working Paper Series* 11/38; February 2011. https://www.imf.org/external/pubs/ft/wp/2011/wp1138.pdf

Ayres, Alyssa. "India: Fighting Coronavirus in an Informal Economy." April 24, 2020. Council on Foreign Relations. https://www.cfr.org/in-brief/india-fighting-coronavirus-informal-economy

Bajpai, Nirupam and Biberman, John. "The COVID-19 Economy: Building a Sustainable Future in the Shadow of a Crisis." ICT India Working Paper #33; July 2020. Columbia University Center for Sustainable Development. https://csd.columbia.edu/sites/default/files/content/docs/ICT%20India/Papers/ICT_India_Working_Paper_33.pdf

Bajpai, Nirupam and Wadhwa, Manisha. "India's National Digital Health Mission." ICT India Working Paper #36; October 2020. Columbia University Center for Sustainable Development. https://csd.columbia.edu/sites/default/files/content/docs/ICT%20India/Papers/ICT_India_Working_Paper_36.pdf

Basu, Kaushik. "India's descent into stepwells of growth." *Livemint*; August 28, 2020. https://www.livemint.com/news/india/india-s-descent-into-stepwells-of-growth-11598537915733.html

"Changing places." *The Economist*; October 8, 2020. https://www.economist.com/special-report/2020/10/08/changing-places

Deep Singh, Karan and Gettleman, Jeffrey. "'Rural Surge' Propels India Toward More COVID-19 Infections Than US." *New York Times*; October 8, 2020. https://www.nytimes.com/2020/10/08/world/asia/india-covid-19-rural.html

Dutta, Prabhash K. "COVID-19: Another reason why Unlock 1.0 may be ill-timed in India." *India Today*; June 9, 2020. https://www.indiatoday.in/news-analysis/story/covid-19-unlock-1-0-india-lockdown-coronavirus-cases-1687162-2020-06-09

"For good and ill, India's prime minister is hard at work." *The Economist*; October 10, 2020. https://www.economist.com/asia/2020/10/10/for-good-and-ill-indias-prime-minister-is-hard-at-work

Gera, Ishaan. "Aarogya Setu is losing relevance; Why the government must be more innovative to push it through." *Financial Express*; July 6, 2020. https://www.financialexpress.com/industry/technology/eavesdropper-aarogya-setu-is-losing-relevance-why-the-govt-must-be-more-innovative-to-push-it-through/2014141/

Gettleman, Jeffrey and Schultz, Kai. “As India Loosens its Strict Lockdown, Coronavirus Deaths Jump Sharply.” *New York Times*; May 6, 2020. https://www.nytimes.com/2020/05/06/world/asia/india-coronavirus-lockdown-infections.html

Gettleman, Jeffrey and Yasir, Sameer. “Modi’s Popularity Soars as India Weathers the Pandemic.” *New York Times*; May 16, 2020. https://www.nytimes.com/2020/05/16/world/asia/coronavirus-modi-india.html
India COVID Map and Case Count. Accessed October 16, 2020. https://www.nytimes.com/interactive/2020/world/asia/india-coronavirus-cases.html

International Institute for Applied Systems Analysis. “Transformations to Achieve the Sustainable Development Goals.” *The World in 2050 Initiative*. July 2018. http://pure.iiasa.ac.at/id/eprint/15347/1/TWI2050_Report081118-web-new.pdf

International Institute for Applied Systems Analysis. “The Digital Revolution and Sustainable Development: Opportunities and Challenges.” *The World in 2050 Initiative*. July 2019. http://pure.iiasa.ac.at/id/eprint/15913/1/TWI2050-for-web.pdf

International Institute for Applied Systems Analysis. “Pathways to an Efficient and Sufficient Post-Pandemic Future.” *The World in 2050 Initiative*. July 2020. http://pure.iiasa.ac.at/id/eprint/16533/1/TWI2050-web.pdf

Kugler, Maurice and Sinha, Shakti. “The impact of COVID-19 and the policy response in India.” July 13, 2020. Brookings Institution. https://www.brookings.edu/blog/future-development/2020/07/13/the-impact-of-covid-19-and-the-policy-response-in-india/

Shaxson, Nicholas. “Tackling Tax Havens.” *Finance and Development* 56.3; September 2019. International Monetary Fund. https://www.imf.org/external/pubs/ft/fandd/2019/09/tackling-global-tax-havens-shaxon.htm

“The peril and the promise.” *The Economist*; October 8, 2020. https://www.economist.com/special-report/2020/10/08/the-peril-and-the-promise

“Zoom and gloom.” *The Economist*; October 8, 2020. https://www.economist.com/special-report/2020/10/08/zoom-and-gloom