

# CORONAVIRUS LOCKDOWN AND TELEWORK: A LESSON TO COMBAT CLIMATE CHANGE?

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## ABSTRACT

As of April 2020, there has been a decrease in pollution levels around the globe. The global pandemic caused by the novel coronavirus (COVID-19) has forced governments around the world to declare lockdowns for their citizens amidst fear of spreading the highly contagious disease. The lockdown has meant the closure of automobile, electronics, and textile factories. Oil refineries have also been forced to reduce output due to a shift to working from home (telework) that reduced demand for petroleum. The purpose of this study is to investigate how telework, as a social and structural shift taken during the COVID-19 pandemic, can be a pathway to help mitigate the environmental crisis. The research questions are the following: 1) How is the lockdown affecting pollution levels? 2) How is telework benefiting the natural environment and society and what are the drawbacks? 3) What are the long-term implications of telework? To answer these questions, earth science literature, recent publications on pollution data, as well as news articles covering the pandemic were reviewed. This article contributes to the field of environmental pollution mitigation by building a bridge between the shift to telework during the global health crisis and the need to alleviate global warming/climate change.

## INTRODUCTION

The Earth's climate enables life on the planet. It is largely regulated by the composition of resident gases in the atmosphere, which trap heat from sunlight and therefore keep the surface temperature at life-sustaining levels of an average of 15°C (59°F). This composition is formed and balanced by complex cycles that occur over thousands to millions of years, such as the carbon cycle. Human activity is altering global climate on a rapid scale due to burning of fossil fuels (Intergovernmental Panel on Climate Change (IPCC), 2014), which add greenhouse gases to the complex cycles of the atmosphere (Kump, 2013). These gases form a blanket layer, which absorbs and sends more heat back to the surface. This is called the greenhouse effect, and it leads to warming of the planet. The increase in temperature combined with increasing human land use could lead to severe loss of biodiversity and also to a global refugee crisis that forces global migration, because warming causes more frequent extreme weather events (Kossin et al., 2020). Changes in the way we live and work need to be made in order to avert global catastrophic scenarios predicted by the IPCC.

The existing global climate crisis is currently being overshadowed, at least in current media coverage, by another global crisis (Hertsgaard, 2020). In December 2019, a novel coronavirus (COVID-19) emerged that infects humans via respiratory transmission. In January 2020, the World Health Organization (WHO) declared the virus a global pandemic. The interconnectedness of the modern world allowed global spreading because of large congregations of humans. Taking the United States as an example, the total deaths of COVID-19 are currently projected to be 295,011 by December 2020 (IHME, 2020). In contrast, outdoor air pollution from vehicles in the US is estimated to cause 208,500 premature deaths each year from diseases linked to air pollution (Bowe et al., 2019). While both the virus and air pollution can cause death from respiratory disease, COVID-19 is perceived as the greater threat due to its current spotlight, immediate onset of symptoms, and contagious nature. There is also a feeling of detachment from the ongoing consequences of climate change because of the spatial distance between developed countries (where the vast majority of greenhouse gases are emitted), and less well-developed countries and the arctic circle (where the effects are

most felt (Mendelsohn et al., 2006)). People also see climate change posing little threat because the impactful consequences are felt after several decades (Pahl et al., 2014). In contrast to this, the response to the COVID-19 crisis has been a fundamental behavioural change in society.

Most governments throughout the world have implemented lockdowns, some at different stages and to different degrees, in order to combat the spread of the virus (Kaplan et al., 2020). Closure of automobile, electronics, and textile factories ensued (Bradsher, 2020), as well as oil refineries agreeing to reduce output (Reed, 2020). The Organization of the Petroleum Exporting Countries (OPEC) finalized an agreement to cut oil production worldwide from April 2020 through July 2020 by a tenth, or 9.7 million barrels a day, due to the fall in demand of oil for petroleum gas (Reuters, 2020). As a fossil fuel that emits greenhouse gases upon extraction and combustion, the drop in petroleum gas production directly translates to a reduction in global emissions (Kump, 2013), which helps to slow down global warming, as will be explained in more detail later.

Lockdown has led to telework (working from home), which in turn has reduced vehicle traffic to a minimum. As the largest contributor to air pollution and emission of greenhouse gases (IPCC, 2014), the reduction of traffic mitigated the nitrogen dioxide (NO<sub>2</sub>) pollution levels in several countries by 30% (Watts & Kommenda, 2020). This highlights how strict governmental measures can lead to the slowing of climate change. Another conclusion from handling the pandemic is that media coverage on global warming could use phrases established during the pandemic, such as 'flattening the curve on greenhouse gas emissions', to communicate the threat more effectively (Hertsgaard, 2020).

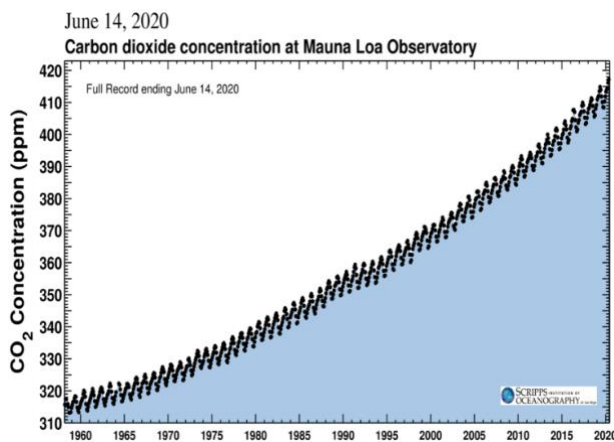
To summarize, global warming will lead to drastic environmental damage and human loss of life, but measures to prevent or slow it down are not as strict as the ones implemented by governments against COVID-19. Once the threat of the pandemic is reduced, governments will have to decide how to continue: is it worth returning to burning fossil fuels, i.e. oil, natural gas, and coal, at the extent of pre-virus levels? This should promote short-term economic growth, but is unsustainable for people and the planet (Ayres, 2008). On the other hand, governments could learn from the way strict

measures have created positive environmental effects to implement laws for a more sustainable future.

One of the measures taken against the pandemic has been the implementation of teleworking, which can have a far-reaching impact on pollution levels. This article focuses on how telework can alleviate the detrimental effects of global warming and benefit people, planet, and profit in a post-pandemic world.

### Population growth as a cause for global warming

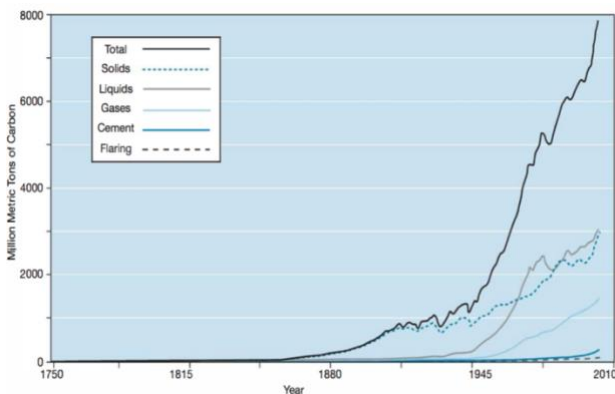
Throughout history, the human population grew relatively slowly. By the year 1800, it had only reached 1 billion individuals (Bongaarts, 2009). Since then, industrial revolutions, technological and medical advancements rapidly increased the human population to 2.5 billion by 1950, and 7 billion by 2011 (Roser et al., 2013). It is expected to peak at 10 billion people in 2056 (Roser et al., 2020). Alongside the tripling of the population since the 1950s, an unprecedented increase in atmospheric CO<sub>2</sub> levels was observed at Mauna Loa Observatory (Keeling et al., 2001), Hawaii, over the same time frame, referred to as the ‘Keeling curve’ shown in Figure 1.



**Figure 1: The Keeling Curve - concentration of atmospheric CO<sub>2</sub> in parts per million from 1958 to 2020**

(Source: Mauna Loa Observatory, 2020)

Figure 2 shows how, beginning in the 1950s, the growing population required more energy production for domestic, industrial, and agricultural purposes.



**Figure 2: Global consumption rates of coal (solids), oil (liquids) and natural gas (gases) in million metric tons of carbon, from 1750 to present**

(Source: Boden et al., 2017)

Comparing the graph in Figure 1 with Figure 2, and acknowledging the tripling of the world’s population since 1950, it becomes evident that there is correlation between growing population, energy demand, and global warming. It is important to note that human-made global warming is a recent

development (Abram et al., 2016) which deserves further explanation.

### The causes and effects of global warming

This section examines the causes and effects of global warming. As mentioned above, demand for energy has skyrocketed since the 1950s. That, along with more combustion engines in cars (Kump, 2013), caused greenhouse gases such as carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>), and ozone (O<sub>3</sub>) to accumulate in the atmosphere. CO<sub>2</sub> is released through most modern industrial and agricultural practices by burning fossil fuels. The gas is naturally absorbed through photosynthesis in plants and phytoplankton, turning it into oxygen and carbon. Humans and other animals breathe the oxygen and consume the carbon (e.g. eating vegetables), and both processes end in the release of CO<sub>2</sub> back into the atmosphere where the cycle begins anew (Kump, 2013).

However, the amount of CO<sub>2</sub> introduced into the atmosphere through burning of fossil fuels for electricity production and transportation is overwhelming the slowly dwindling CO<sub>2</sub> absorbents, referred to as carbon sinks (Baccini et al., 2017). Carbon sinks such as forests and peatlands are in decline due to deforestation for industry and agriculture (IPCC, 2014). When highways are built for people to commute to work and travel with cars, forests are cut down, eradicating the carbon sink. This causes more CO<sub>2</sub> to remain in the atmosphere, enhancing the greenhouse effect and raising global temperatures (Kump, 2013).

Global temperatures were measured to have risen 0.8°C in the 20th century (Kump, 2013). Scientists predict that if global average temperature rises above 1.5°C, climate catastrophes will become more frequent (IPCC, 2018). The results will be rising sea levels, diminishing snow and glacial covers, and heating of the landmasses and oceans (IPCC, 2018). Before examining the micro-level effects of the gases involved in fossil fuel burning, it is important to emphasize that these gases have been accumulating since people started to use cars for driving to work and travel, and are the main driver of global warming.

### Pollution’s effect on human health and the environment

Having examined the Earth’s intricate climate system and the effects of population growth on the climate, this section will move on to explain how the pollution affects human health and the environment. Air pollution is directly linked to, and exacerbated by, global warming (Patella et al., 2018). In addition to releasing CO<sub>2</sub>, vehicular fuel combustion and the burning of fossil fuels for power and domestic heat generation emit pollutants harmful to human health, such as the particulate matter mixture of solid particles and liquid droplets smaller than 2.5 microns (PM<sub>2.5</sub>) (WHO, 2014). PM<sub>2.5</sub> accumulates in the air and is responsible for respiratory diseases, especially asthma, and premature deaths (Prüss-Üstün et al., 2016). Furthermore, motor exhaust releases nitrogen dioxide (NO<sub>2</sub>), a pollutant gas that can inflame the lining of the lungs and can weaken the body’s immunity to lung infections. Common respiratory problems linked to these pollutants are colds, flus, bronchitis, coughing, and wheezing (Bylin, 1993). In addition to adverse human health effects, NO<sub>2</sub> is an impetus to the generation of the greenhouse gas ozone (O<sub>3</sub>), which contributes significantly to global warming.

Black carbon, an air pollutant that is harmful not only because it contributes to global warming (Bond et al., 2013), but is also linked to lung disease and cancer (OEHA, 2007), is causing dark smoke clouds to linger over entire cities (Schmidt, 2011). In Europe, North America, and Latin America, 70% of black carbon emissions are created by the combustion of diesel fuel for vehicles (Amman et al., 2013). Together, these

anthropogenic (i.e. man-made) pollutants weaken the Earth's natural atmospheric balance and harm human health, contributing to higher mortality rates in countries with higher pollution, as is shown in Figure 3 (Parry, 2017).

The WHO approximates that 92% of the global population lives in conditions of below-guideline-level air quality, stating that concentration levels exceeded  $40 \mu\text{g}/\text{m}^3$  for  $\text{NO}_2$  and  $10 \mu\text{g}/\text{m}^3$  for  $\text{PM}_{2.5}$  (WHO, 2014). In summary, air pollution, mainly emitted from cars, has adverse effects for the health of humans and the environment, reaching from respiratory illness-related deaths to exacerbating global warming.

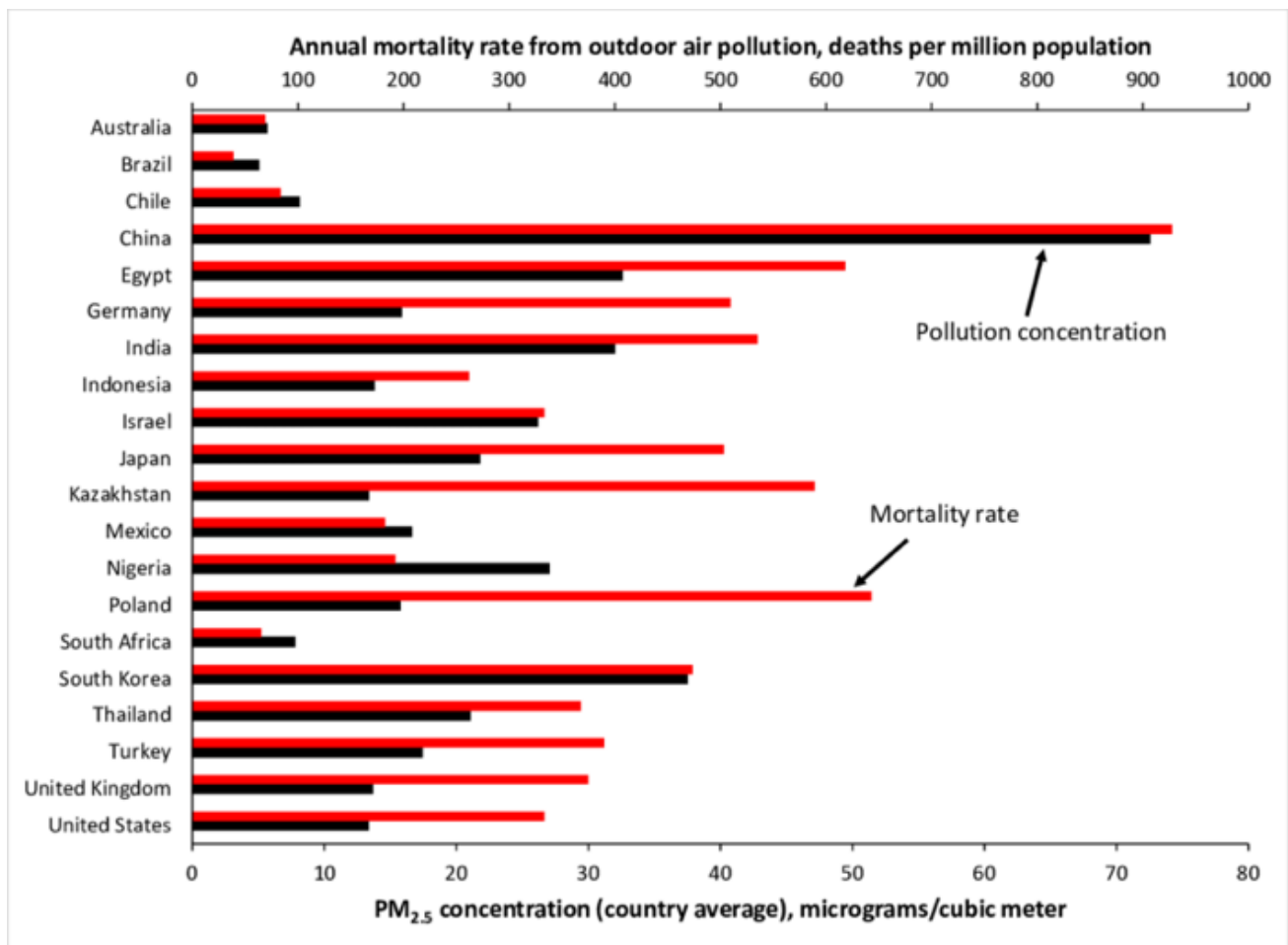
### Environmental effects of telework during COVID-19 lockdown

The environmental pollution that is caused by human activity described in the previous section has slowed down since the start of the lockdown. Globally, the pandemic has led to companies and institutions shifting their employees to telework. The risk of spreading the disease while commuting and congregating in offices was diminished. At the same time, telework has contributed to reduced air pollutants due to less transportation. Manufacturing, shipping, and commuting are major contributors to greenhouse gas emissions and globally, all three were reduced by governments' orders to allow only essential work to continue at companies' premises (Haren & Simchi-Levi, 2020).

Heavily polluted and congested cities such as New Delhi, India, have experienced a smog-free sky for the first time in years, due

to the reduction in cars on its roads (Pathak, 2020). Satellite images show that during the lockdown from January to April 2020,  $\text{NO}_2$  pollution decreased by approximately 40% in China, 28% in western Europe, and 38% in the United States (Bauwens et al., 2020). The extent of the reduction in  $\text{NO}_2$  pollution is illustrated in Figure 4, showing a sizable difference in  $\text{NO}_2$ -levels after cities implemented lockdowns and telework, compared to before the pandemic.

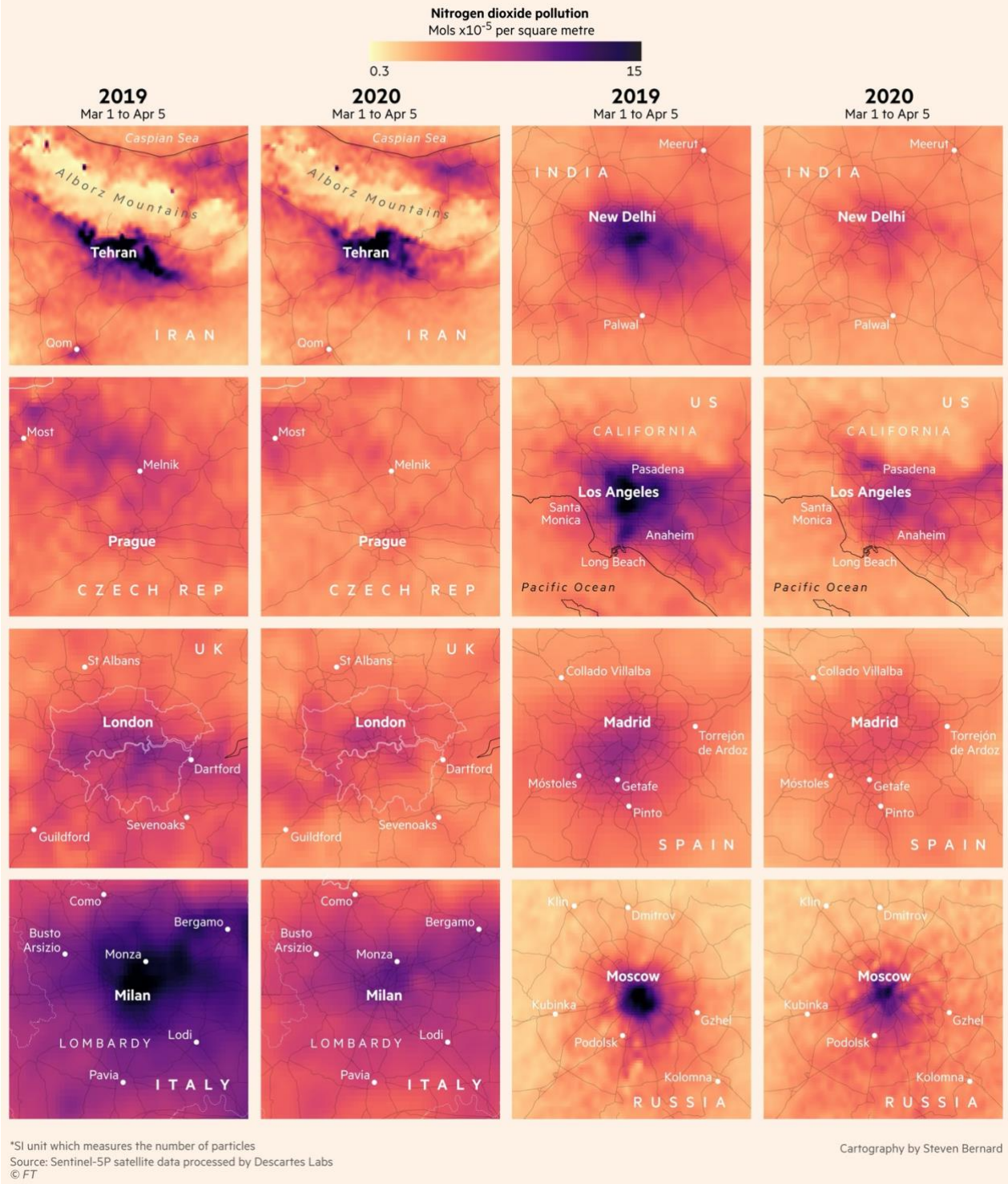
Lower  $\text{CO}_2$  levels mean citizens can breathe in cleaner air, leading to less respiratory issues, as well as less contribution to global warming. The outbreak has forced China to minimize its industrial activities in January 2020, and hence dropped its  $\text{CO}_2$  emissions by 25% by February 2020 (Isaifan, 2020). Telework's effect of decreasing traffic has diminished US greenhouse gas emissions from transportation by 13% within 8 weeks of the start of the lockdown (Shilling, 2020). At peak lockdown in early April 2020, a reduction of 17% daily  $\text{CO}_2$  emissions was recorded worldwide (Le Quere et al., 2020). The biggest contributor to this achievement was also a 50% drop in surface transport, i.e. the movement of people or goods by road, train, or ship (Le Quere et al., 2020). This in turn netted a reduction in air pollution and slowed down global warming, leading scientists to project that the global emissions could be reduced by up to -13% by the end of 2020 (Le Quere et al., 2020). To conclude, people with non-essential jobs who have shifted to telework have led to decreased global emissions from manufacturing and traffic, as well as less pollutants harmful to health in the air, and clearer visibility in big cities.



**Figure 3: Outdoor air pollution mortality rate estimate divided by country population and  $\text{PM}_{2.5}$  concentration in chosen countries**

(Source: Parry et al., 2017. Compiled with data from Global Burden Disease Project, Brauer et al. (2012), IHME (2013), IMF (2016).)

### How the lockdowns have improved air quality



**Figure 4: Nitrogen dioxide concentration in moles x10<sup>-5</sup> per square meter, measured in selected cities over the same time period in 2019 compared to 2020**

(Source: Copernicus Sentinel 5P. Processed by Descartes Labs. Cartography by Steven Bernard.)

### The benefits and drawbacks of telework

Telework refers to working remotely, away from the premises of the employer by using information technology, i.e. computers and phones (Tavares, 2017). Telework does not require physical presence at the employer’s or customer’s premises. Currently, office jobs in information and management industries allow staff to work from home. During the COVID-19 pandemic, other occupations saw a rise in telework, such as teachers and professors, phone operators,

office staff, and sales personnel (Belzunegui-Eraso & Erro-Garcés, 2020). A study by Choudhury et al. (2018) found that companies offering more flexible work are prone to see more employees work remotely. There is also evidence that some medical staff (dermatology, nephrology, rheumatology) can work from home by doing online consultation and then sending treatment (Dr. P. R.J. Ames, personal communication, 2 June 2020). Large congested metropolitan areas saw open roads. This could be more frequent in the future if more telework is practiced.

As Table 1 illustrates, there are downsides to telework. It can be frustrating for employees to deal with more micromanagement of their daily tasks during telework by some bosses (Day & Burbach, 2011). There could also be a lack of structure to the workday for those employees who struggle to create their own schedules. Working from home might lead to more distraction for some due to external factors such as family matters, neighbours, or friends. Some employees might struggle to stay disciplined if they are in the comfort of their own home, watching TV or using the productive hours for personal matters. However, this is a common behaviour from employees even in office environments (Metin et al., 2018). Conversely, some teleworkers might not be able to stop working. These workaholics might be too ambitious to differentiate between work hours and off-time (Metzger & Cléach, 2004). In addition, some employees' health might be affected by the lack of physical movement when working from home, although working in the office can have the same effect (Steward, 2000).

**Table 1: Advantages and disadvantages of telework**

Advantages	Disadvantages
Better balance of home and work life	Blurring of boundaries between work and home time and overwork
Increased flexibility and autonomy	<i>Presenteeism</i>
Reduction in commuting time	Social isolation
Increased productivity	Lack of support, inadequate equipment
Higher morale and job satisfaction	Career progression or promotions
Avoidance of office politics	Resentment from colleagues

(Source: Tavares, A. 2017. *Centre for Health Studies of the University of Coimbra, Portugal*)

Conversely, telework provides many societal benefits, on top of the environmental benefits from less pollution mentioned previously. Firstly, it allows for better balancing of work, social, and family life, due to not being confined to an office for several hours a day (Kitou & Horvath, 2008). Secondly, employees have more time to work or do recreation during their day, as a result of saved time on commuting to and from the workplace. Furthermore, as Table 1 highlights, Tavares (2017) found that working from home increases productivity. Finally, flexibility for when to do the work increases greatly under teleworking (Choudhury et al., 2018).

The flexible schedule inherently has other positive benefits, such as healthier eating habits. A study has shown that teleworkers tend to replace a fast-food diet from working at the office with a nutritious lunch at home (Escoto et al., 2012). On the other hand, snacking habits have increased during lockdown e.g. in Poland, according to Sidor & Rzymiski (2020). Meat consumption has decreased in parts of India during lockdown, which in turn is more beneficial to the environment, due to the saving on cattle raising's water, land, and fuel requirements (Sandhu, 2020).

While the pandemic might have had a negative psychological impact on sleep patterns for some (Zhao et al., 2020), telework greatly benefits sleep time and quality, as commuting to work has been found to make employees suffer from short and disruptive sleep (Hansson et al., 2011). Ordinary tasks, such as shopping for food and products, might require less time due to less distance between a home and shops in the neighbourhood. Rather than making trips from the workplace to stores nearby or going home first, teleworking can save money on fuel (Kitou & Horvath, 2008).

Additionally, teleworkers could feel more autonomy over their lives. The comfort of working in one's own home could reduce stress by not having to worry about traffic jams, finding parking space, and weather conditions (Novaco, 1990). Many office cultures are embroiled in office politics and interpersonal conflicts leading to toxic work environments (Jain & Ansai, 2018). This can be avoided if employees are teleworking, because of less confrontation with the toxic work environment. However, Table 1 suggests that resentment by colleagues who are not teleworking could still affect the teleworker and therefore lead to toxicity (Tavares, 2017). Another benefit is that teleworkers would have no obligation to wear and clean office attire.

For the employers, there are many benefits as well. Empty office space could be turned into functional space for recreation or rented out. Offices could also be converted into housing for the elderly or homeless, adding value towards solving the housing shortages faced by many cities (Feldman, 2002). A company with more teleworkers could save on overhead costs by not having to create or rent large office space, heating and cooling, building insurance, and supplies in expensive cities such as Vancouver, Seattle, Beijing, or London (Kitou & Horvath, 2008). Lastly, telework provides for the 'triple-bottom-line' (i.e. benefitting people, planet, and profit) by reducing total costs for employees, office costs for employers, and external costs for the environment (Kitou & Horvath, 2008).

To implement telework as a norm in a post-pandemic world, public policy must focus more on the quality of life improvements which employees experienced during the times of COVID-19 telework, since the driving force of a society's well-being is its ability to be satisfied by work, recover from it, and balance a work-family-social lifestyle more equally (Diener & Seligmann, 2004). The reason for this is that after juxtaposing telework's effects, the benefits greatly outweigh the drawbacks. Telework might not be able to reverse the driving effects of global warming, however, due to its role in decreasing pollution, it is a solution to slow down the 'curve' of rising temperatures (Pérez et al., 2004).

This section has attempted to provide a brief summary of the benefits and drawbacks of the shift to telework during COVID-19 pandemic, highlighting its contribution to reducing environmental damage from vehicles.

## CONCLUSION

The COVID-19 pandemic is an ongoing health crisis that is reshaping some of society's way of living and working, which in turn has had an impact on alleviating the ongoing environmental crisis. Clearly, the benefits of telework for employers and employees outweigh its drawbacks. For employees, changes in quality of life such as flexibility, time saved on commuting, and improved physical and mental health, are valuable gains. Employers benefit by saving on rent, utilities, and insurance. Telework has also led to many benefits for the environment. A reduction in transportation usage due to telework during lockdown has led to less pollutants such as CO<sub>2</sub>, NO<sub>2</sub>, PM<sub>2.5</sub>, and black carbon, which has made the air cleaner, which in turn reduced respiratory health risks. Perhaps, more importantly, the decrease in greenhouse gas emissions has been enough to slow down global warming. Although the reduction is significant, a structural change is needed in post-pandemic times because anthropogenic CO<sub>2</sub> is still accumulating in the atmosphere. Further research on the implementation of telework is required to establish a direct link with permanently reducing economies' carbon-intense fossil fuel-based infrastructure.

The need to move to environmentally sustainable ways of living is now in times of rapid population growth more necessary than

ever. The global response to COVID-19 has shown that these social measures are possible and implementing them long-term is a viable option to mitigating the climate crisis.

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