



The Impact of Covid-19 on the Environment in Bahrain

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Ghada Abdulla, Abdulaziz Al-Doseri,
Deema Almoayyed, and Omar Al-Ubaydli

Abstract

In addition to its sizeable direct effect on public health, the Covid-19 pandemic has also had an impact on a wide array of socioeconomic variables, which in turn have affected the environment. Many studies of these effects have been conducted either at the global level, or for key economies such as China and the US. However, the Kingdom of Bahrain merits special attention due to its geography (it is a small, arid, densely-populated archipelago in the Middle East) and its economic structure (it has a high dependence on hydrocarbons and on tourism). This paper explores the effect that the Covid-19 pandemic has had on the environment in the Kingdom of Bahrain using qualitative data garnered from interviews with 14 experts on the Bahraini environment working in government, the academic sector, the private sector, and the nonprofit sector. It also presents policy recommendations in light of these findings.

Ghada Abdulla and Abdulaziz Al-Doseri are associate researchers at Derasat; Deema Almoayyed is a Research Associate at UNDP Bahrain; Omar Al-Ubaydli is the Director of Research at Derasat. This project is funded by a generous grant from the UNDP. Views expressed in this study are those of the authors and do not necessarily reflect Derasat's or the UN's point-of-view.

Executive Summary

The Covid-19 pandemic has had many societal impacts beyond its direct effect on the health of people contracting the disease. This paper assesses the impact on the environment in the Kingdom of Bahrain. The insights are drawn from a series of interviews with 14 experts on the Bahraini environment who work in the government, research, private, and non-profit sectors. They are largely qualitative in nature, due to the limited availability of official, quantitative data regarding the Bahraini environment. The main findings are as follows.

1. Decreased air and ground transportation had a positive effect on air quality, though less than that witnessed in other countries.
2. Indications of decreased noise pollution and carbon footprint in Bahrain, though there is a lack of confirmatory data.
3. Indications of a significant rise in medical and non-medical waste relating to personal protective equipment (PPE) and single-use items in Bahrain.
4. Indications of a transient and modest improvement in biodiversity in Bahrain.
5. Significant concerns about the long-term impact of rising waste on biodiversity, and hence on human health.
6. A slight increase in energy consumption in Bahrain, requiring a slight increase in the production and consumption of natural gas, and partially offsetting the above improvements in air quality.
7. An increase in the attractiveness of renewable energy as its cost relative to fossil fuels decreased.
8. Indications of an increase in environmental awareness in Bahrain, but without a significant impact on green behavior, along with a decrease in private sector led recycling and waste segregation due to the logistical challenges posed by the pandemic.

Based on these findings, we have the following policy recommendations.

1. Allocating a greater volume of resources to the systematic collection of environmental data in Bahrain.

2. Further integrating environmental education into the school curricula of young children in Bahrain as a complement to traditional government interventions relating to the environment, such as legislation and fiscal instruments.
3. Exploring the growing environmental nudge policy toolkit, and doing so in collaboration with Bahrain-based scholars.
4. Developing and adopting a more sophisticated waste management system for Bahrain that makes full use of the available opportunities in segregation, recycling, composting, and waste-related bio fuel.
5. Formally studying the ability to permanently increase the use of remote work in the public sector as a way of realizing a persistent decrease in transportation demand.
6. Developing a national strategy for transforming the Bahrain economy into a more sustainable form.

1. Introduction

The Covid-19 pandemic's most salient impact has been the millions who have died globally at the hands of the disease. While the Kingdom of Bahrain has suffered a lower per capita death rate (294 per million) than the global average (359 per million), by late March 2021, 140,000 had contracted the virus, leading to the death of over 500 in a country with a population of 1.7 million.

Early on during the pandemic, in an anticipation of a sharp decline in economic activity, the government launched a series of monetary and fiscal measures aiming to mitigate the pandemic's adverse effect on the economy. Effective procurement and logistics have also enabled Bahrain to provide first doses of the Covid-19 vaccination to almost 30% of the population by the end of March 2021. However, despite the economic and public health measures taken, the government has had to impose significant restrictions on economic activity, including partial lockdowns at various points, resulting in GDP contractions of 8.9% and 6.9% during the second and third quarters of 2020, respectively similar to what was witnessed in other countries. (See Abdulla et al. (2020) for more on the socioeconomic impact.)

Across the world, the dramatic effects of the pandemic on human behavior have led to environmental impacts that are visible to the naked eye. On the positive side, the decrease in vehicular transportation has improved air quality in urban areas, while on the negative side, the sharp rise in the consumption of single-use personal protective equipment (PPE) has resulted in increased waste, including public littering.

Beyond these easily perceptible effects, there have been a wide range of more subtle consequences, such as those relating to changes in energy consumption and biodiversity. Moreover, public and private sectors have been rethinking their long-term environmental strategies due to expectations of persistent changes in the pattern of economic activity.

These developments have spawned a large, multidisciplinary literature on the environmental impacts of Covid-19 globally (Corlett *et al.*, 2020; Eroğlu, 2020; Kuzemko *et al.*, 2020; UN Environment Programme, 2020b; Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020). This paper adds to this literature by

focusing on the specific case of the Kingdom of Bahrain. Bahrain has several unique characteristics that ensure it merits a tailored analysis.

First, in terms of geography, it is a small (760km² land area), arid (71mm average annual rainfall), and densely populated (2,200 people/km²) archipelago located in the Middle East. Second, due to its oil and gas reserves, the economy has a high dependence on hydrocarbons, while its proximity to the neighboring Kingdom of Saudi Arabia means that regional tourism plays an important role in the economy. Due to these factors, Bahrain has high levels of energy consumption: in 2014, its energy use was almost 11,000kg of oil equivalent per capita, compared to a global average of 1,900kg.

An assessment of the environmental impact of Covid-19 in Bahrain would ideally involve a wide range of quantitative and qualitative data, drawn from both primary and secondary sources. However, environmental data in Bahrain are quite limited (Naumann et al., 2018), and the pandemic has itself placed additional hurdles before scholars gathering data, due to the restrictions it entails for movement and interactions between humans. Therefore, this paper relies on qualitative data garnered from personal interviews conducted with 14 experts on the environment in Bahrain. The interviewees work in government, the academic sector, the private sector, and the nonprofit sector, ensuring both depth and diversity in the perspectives gathered.

In addition to yielding valuable information regarding the environmental impact of Covid-19 in Bahrain, the interviews also helped us to formulate a series of policy recommendations, which we present at the paper's conclusion. In the interests of parsimony, this paper will assume a familiarity with environmental issues in Bahrain prior to the Covid-19 pandemic. For those who lack this background knowledge, we recommend Bahrain's Third National Communication under the United Nations Framework Convention on Climate Change (Supreme Council for Environment, 2020).

2. A Brief Primer on the Impact of Covid-19 on the Environment Globally

The Covid-19 pandemic has spawned a vast scientific literature on its impacts on the environment, including contributions from academic and policy scholars. In this section, we provide a brief overview of some of the main findings at the global level, where we intentionally gloss over the large international variation in impacts. The primer's goal is to provide a benchmark for the findings that we report below regarding Bahrain.

2.1. Ecosystems and Climate

The first area of interest is the pandemic's impact on earth's ecosystems and climate. This section will review the impact of Covid-19 on CO₂ emissions, air pollution, and environmental protection efforts and thus natural ecosystems globally.

In assessing the impact of Covid-19 on climate change, understanding changes in CO₂ emissions is essential. Unfortunately, no real-time CO₂ emissions values exist, however several studies have been able to identify trends and changes in CO₂ emissions based on proxy data. Le Quéré *et al.* (2020) show that daily fossil CO₂ emissions reduced significantly as a result of forced confinement worldwide, with a peak maximum reduction of -17% , a reduction so significant it corresponds to emission levels from 2006. Meanwhile, they estimate the annual decrease to be around -4.2 to -7.5% , which is precisely the level of year-on-year carbon emissions reductions needed to limit climate change to a 1.5°C warming.

While these numbers look encouraging, environmental experts agree that these reductions are temporary, and only long-term, structural changes in countries' economies will be able to lead to the permanent and sustainable reduction in CO₂ emissions needed to curb further warming (Le Quéré *et al.*, 2020; Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020).

Similar to CO₂ emissions, the level of air pollution across cities also reduced significantly in the first few months of the pandemic as a result of global lockdown measures (World Health Organization, 2020).

These reductions were especially noticeable in the case of nitrogen dioxide (NO_x), an air pollutant linked closely with traffic. According to the World Health Organization (2020), cities in Europe saw reductions in NO₂ between 50% to 70% in the first few months of the pandemic, whereas China saw a 30% reduction in NO₂ during the first few months (Isaifan, 2020, p. 286).

Unfortunately, in all cases, these pollutants have since rebounded to pre-pandemic concentrations (and in some cases even higher) as economic activities resumed their regular pace and lockdown restrictions were loosened worldwide (Klemeš, Fan and Jiang, 2020; European Space Agency, 2021).

The impact of Covid-19 on biodiversity and conservation, meanwhile, has been slightly more complicated. While the fall in ecotourism has eased pressures on major biodiversity hotspots and sensitive wildlife species, giving vulnerable habitats a much-needed off-period to recuperate, many sources have signaled that competition over resources during economic post-pandemic recovery will mean that less financial support will be available and afforded to conservation efforts, as it takes a backseat to other priorities for policymakers (Corlett *et al.*, 2020; Rupani *et al.*, 2020; Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020).

The impact of these reduced efforts and finances towards conservation have already been seen in Brazil, Colombia, Philippines, Ecuador, and Kenya, to name a few, where communities have seen an uptick in illegal poaching, mining, logging, and deforestation as a result of looser controls over these lands and less finances directed to protecting wildlife (Brown, 2020).

2.2. The Environment and Public Health

The second area of interest is the pandemic's environment-mediated impact on public health. As Section 2.1 shows, the first few months of the pandemic saw a decrease in the levels of pollutants in the air, including particulate matter (PM), tropospheric (ground-level) ozone (O₃), nitrogen dioxide (NO₂), and sulphur dioxide (SO₂), all of which pose major threats to public health (World Health Organization, 2020). Researchers have discerned a strong correlation between long-term exposure to air pollutants and the likelihood of experiencing Covid-19 complications, which suggests that lower pollution levels

could prove to be doubly beneficial to public health during the age of COVID (Rupani *et al.*, 2020). Unfortunately, Section 2.1 also explains that air pollution has since returned to pre-pandemic levels, thus intensifying the risk of mortalities from the pandemic globally (World Meteorological Organization, 2021).

Additionally, many experts warn that the continued destruction of nature will further increase the risk of pandemics in the future. Activities that exacerbate climate change and environmental degradation such as deforestation, industrial agriculture, and wildlife trade, to name a few, raise the odds of zoonotic viruses transferring from animals to humans, thus raising the odds of future pandemics (OHCHR, 2020; Price, 2020).

While this section briefly covers the inextricable link between public health and the health of the planet as they both relate to Covid-19, the experts consulted for this study have discussed this matter in more extensive detail in Section 4.2 of this paper.

2.3. Energy Consumption

The third area of interest is the pandemic's impact on energy consumption. Due to lockdown measures worldwide and the curtailment of commercial air travel, daily personal transportation, and other work slowdowns, the demand for oil and gas has thus fallen significantly worldwide (Center for International Environmental Law, 2020).

Perhaps the most significant impact, however, has been falling oil prices. While this trend began before the pandemic, experts suggest that this falling demand will continue through 2021 and onwards, even reaching "unprecedented lows" (Center for International Environmental Law, 2020, p. 1; Helm, 2020).

Meanwhile, demand and prices for electricity have also declined, while production of liquefied natural gas has also slowed due to reduced demand (Kuzemko *et al.*, 2020). This has resulted in a range of struggles in the industry. In fact, in response to these impacts, energy companies have cut back on investment plans, paused investment decisions, and many independent producers are facing bankruptcy (Center for International Environmental Law, 2020; Kuzemko *et al.*, 2020).

That said, the pandemic has also led to increased energy expenditures in certain areas. For example, the healthcare sector has dramatically increased its power consumption due to increased and urgent needs to build new temporary hospital buildings, as well as to satisfy the increased need for hospitalizations, shifts, and hygiene requirements (Klemeš, Fan and Jiang, 2020).

Additionally, the newfound need to mass produce personal protective equipment (PPE), test kits, disinfectants, and other medical equipment to combat Covid-19, as well as transport life-saving medication and equipment on emergency planes, has been projected to raise energy consumption significantly in this sector (Klemeš, Fan and Jiang, 2020).

The impact of Covid-19 on renewable energy, meanwhile, tells a mixed story. Data projections suggest that capacity growth of wind energy will decrease by 4.9 GW, while investments in solar power will decrease by 28% (Eroğlu, 2020, p. 2). This is due to large-scale employee dismissals and cutbacks across the sector, disruptions in supply chains, and general slowdown of operations due to new safety measures (Eroğlu, 2020; Kuzemko *et al.*, 2020).

Covid-19 seems to have also created a dent in transition plans for renewable energy, due to difficulties in staying in line with pre-pandemic progress plans (Klemeš, Fan and Jiang, 2020). Despite this, demand for renewables has not reduced to the same extent as demand for fossil energy. In fact, demand for renewables was projected by the IEA to increase by 1% in 2020, suggesting that the share of renewables in the energy mix may exceed pre-pandemic expectations (International Energy Agency, 2020). Growth in renewables is expected to rebound even further in 2021, suggesting a positive outlook for renewable energy demand overall (International Energy Agency, 2020; Kuzemko *et al.*, 2020).

2.4. Environment-Related Public Behavior

The fourth area of interest is the pandemic's impact on public behavior in the domain of the environment. Perhaps the most significant of these impacts is that of waste generation. The pandemic saw a sharp rise in the generation of waste due to increased online shopping, PPE usage, and overuse of antiseptics and sterilizers (Klemeš, Fan and Jiang, 2020; Rupani *et al.*, 2020; Zambrano-Monserrate, Ruano and Sanchez-

Alcalde, 2020). Due to the fear of contracting the virus, the increase in single-use plastics also skyrocketed during this period (Sarkodie and Owusu, 2020). According to the World Health Organization, the world needs approximately “89 million plastic medical masks, 76 million plastic examination masks and 1.6 million plastic protective goggles” per month as a result of Covid-19, leading to an extraordinary amount of waste that, if not managed properly, can lead to devastating impacts to the environment (UN Environment Programme, 2020a).

In fact, the UN Environment Programme has urged governments to treat waste management as an “urgent and essential public service to minimize possible secondary health and environmental effects” (Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020, p. 4). Sterilizers and antiseptics contain corrosive chemical compounds that are toxic to the environment, while the increased organic and inorganic waste leads to a range of issues from soil erosion to deforestation to pollution, thus increasing environmental harm and footprint globally (Klemeš, Fan and Jiang, 2020; Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020). There is indeed a concern that this newfound waste generation will curtail efforts at managing climate change and will outweigh any of the benefits discussed above related to positive environmental impacts as a result of Covid-19 (Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020).

Some governments have instituted initiatives to address the issue of waste management from both hospitals and households, while some others are in the process of introducing new policies and guidance on how to manage waste generated as a result of the Covid-19 pandemic, sometimes even operationalizing regulations issued by international agencies such as WHO, UNEP, UN-Habitat, and the World Bank. Despite these efforts, the initiatives remain inadequate (UN Environment Programme, 2020b).

2.5. Environmental Strategy and Policy

The fifth and final area of interest is the pandemic’s impact on government environmental strategy and policy. As mentioned in Section 2.1, reduction in ecotourism revenue and higher competition over finances has led to weaker implementation of environmental conservation across the world (Price,

2020). In many cases, governmental focus on other priorities has also led to less effective enforcement of environmental laws (Helm, 2020). As such, environmental conservation has taken a hit as a result of Covid-19, which has created risks for endangered animals who are at risk of poaching.

Many governments also used Covid-19 as a reason to lower environmental standards and loosen restrictions. The Environmental Protection Agency (EPA) in the United States announced a temporary suspension of its enforcement of environmental laws, thus allowing companies to break environmental laws during the Covid-19 outbreak without fear of penalties (US Environmental Protection Agency, 2021). Meanwhile, Brazil used the coronavirus crisis as a cover to undo environmental regulations aimed at protecting indigenous lands (da Silva and Cordoba, 2020). Finally, many countries either halted or reversed policies surrounding single-use plastic products, including plastic bag bans, as a result of coronavirus fears, which has exacerbated the use of single-use plastic and thus waste generation globally (UN Environment Programme, 2020a; Zambrano-Monserrate, Ruano and Sanchez-Alcalde, 2020).

3. Method

The literature reviewed in Section 2 contains many important insights. However, in light of Bahrain's unique geographical and economic properties, there is a need for an analysis that is tailored to Bahrain's specific circumstances.

3.1. Data Type

Ideally, an evaluation of the impact of the Covid-19 pandemic on the Bahraini environment would involve a diverse range of primary and secondary, as well as quantitative and qualitative data. However, we faced various obstacles to gathering a comprehensive dataset.

The first problem was a lack of high quality, up-to-date secondary data. The availability of environmental data in the Kingdom of Bahrain is generally limited due to a modest allocation of resources to data gathering systems. Consequently, we had to focus our data collection on primary rather than secondary sources.

The second problem was limited time and resources for gathering data. In light of the policy relevance of the research being undertaken, there was a desire to produce an analysis in a timely manner. However, the project team contained only one environmental specialist, and the team did not have access to the sophisticated instruments that could be used to gather high quality quantitative data. Moreover, limited financial resources meant that we could not use procurement to overcome these constraints. Consequently, we decided to use interviews with specialists as our primary source of data, with an emphasis on qualitative insights.

Due to the abundance of secondary data - and complementary scientific analysis - regarding the environmental impact of Covid-19 at the global level (see Section 2 above), we decided to focus our data gathering on Bahrain-specific issues. This would both help fill the prevailing data lacuna in Bahrain, and would also maximize the value of the data gathered to policymakers.

3.2. Interviewees

In light of the emphasis on gathering Bahrain-specific data from these interviews, a precondition for being an interviewee was possessing advanced and specialized knowledge of the environment in Bahrain. Among those qualifying, we solicited interviews from the following classes of expert: officials working in environment-related government entities, academic researchers (both university and think-tank affiliated) working in environment-related fields, representatives of environment-related non-profit and international organizations, and representatives of private sector organizations operating in environment-related sectors. Table 3.2.1 shows the distribution of the 14 interviews conducted.

Interviewee	Government	Academic	NGO	Private sector
Number	3	6	2	3

The sample is skewed toward academics since that is where our research-focused network happens to be strongest, but also because academics tend to have much more freedom to take part in interviews as they represent themselves rather than an organization. Notably, both of the participating representatives

of non-governmental organizations were from international organizations rather than from local civil society organizations. Our efforts at raising this latter number were unsuccessful.

Table 3.2.2 shows some socio-demographic data regarding the interviewees. In general, the participants were highly qualified (over half had a PhD), highly experienced (all but one had more than 10 years of experience), and occupied important positions (11 out of 14 were full professors, directors, or CEOs). In light of the high qualifications and experience, the interviewees' age was naturally skewed toward people over 40 years of age. The gender distribution was quite balanced, with 43% being women.

Socio-demographic trait	Distribution
Gender	Female: 6; Male: 8
Highest educational qualification	Bachelor's: 2; Master's: 4; PhD: 8
Years of experience	Less than 10 years: 1; 10 or more years: 13
Title	Assist. Professor: 3; Full Professor: 3; Director: 4; CEO: 4
Age	18-39 years: 2; 40+ years: 12

We decided to keep the identity of the interviewees confidential, and to commit to this in the consent form that the interviewees signed prior to the interview, because we felt that this would increase the likelihood of candid responses, especially when communicating with the government officials.

3.3. Procedure

A list of potential interviewees was collaboratively drafted by the authorship team. Each potential interviewee was then sent an email that contained an invitation to participate in an interview, an outline of the interview's goals, an official document explaining the broader project under which this paper fell (the Derasat-UNDP Covid-19 socioeconomic impact assessment), and a list of the interview questions. Those who agree to participate were sent a consent form to sign and return to the interviewer.

Three of the authors (all except Al-Ubaydli) conducted interviews. Due to the ongoing nature of the pandemic, all interviews were conducted using video conferencing software (Zoom), with the exception of the experts who opted to reply to the questions in writing.

The interviews followed the same, straightforward script: following a brief introduction, the interviewer posed the relevant questions (see below) and proceeded to take notes, while offering clarification if required. They typically took 30-45 minutes, and they were recorded with the interviewee's permission to facilitate their subsequent transcription by the interviewer.

3.4. Interview Questions

We started by creating a list of 24 questions distributed across the five groups that we covered in section 2. We show the questions below; note that in the interests of parsimony, we omit the component of each question that specifies that it should be answered in the case of Bahrain; this is true by default of all the questions.

The first group of questions focused on the impact of the Covid-19 pandemic on ecosystems and the climate in Bahrain.

- **Question 1.1 (Air quality):** How has Covid-19 affected air quality (carbon emissions, NO₂ and particulate matter that have a diameter of less than 2.5 μm)?
- **Question 1.2 (Noise pollution):** How has Covid-19 affected noise pollution?
- **Question 1.3 (Carbon footprint):** How has Covid-19 affected the carbon footprint?
- **Question 1.4 (Waste generation):** How has Covid-19 affected waste generation? (a) Did the usage of single-use plastic rise? (b) How has Covid-19 affected household food waste?
- **Question 1.5 (Waste management):** How has Covid-19 affected waste management? (a) Waste segregation? (b) Waste collection? (c) Waste treatment capacities?
- **Question 1.6 (Medical waste management):** How is Bahrain managing the large increase in PPE and medical waste?
- **Question 1.7 (Biodiversity):** How has Covid-19 affected wildlife and biodiversity? (a) How has marine life been affected? (For example, the demand for fish dropped around the world; did something similar occur in Bahrain.) (b) How has birdlife been affected?

- **Question 1.8 (Long-term environmental impact):** Do you believe that Covid-19 will have long term effects on the environment, and if so, what are these long-term effects?
- **Question 1.9 (Threatened species):** What has been the impact of Covid-19 on the conservation of threatened species?

The second group of questions were on the environment-mediated effects of the Covid-19 pandemic on public health in Bahrain.

- **Question 2.1 (Environment and public health):** What is the relationship between the environmental impacts of Covid-19 and the subsequent impacts on public health?
- **Question 2.2 (Pollution and public health):** What are the potential long-term public health impacts that air pollution/waste generation (as a result of Covid-19) in particular would cause?
- **Question 2.3 (Environmental public health policies):** What environmental policies do you believe would be the most effective in addressing this pollution-public health dynamic?

The third group of questions were on the impact of the Covid-19 pandemic on the energy sector in Bahrain.

- **Question 3 (Energy industry):** How has Covid-19 affected the energy industry in Bahrain? How has domestic energy consumption been affected? Industrial demand for natural gas and electricity; household demand for electricity; demand for jet fuel and motor gasoline.

The fourth group of questions examined the impact of the Covid-19 pandemic on the environment-related behavior of the general public in Bahrain.

- **Question 4.1 (PPE disposal awareness):** In general, is the public aware of how to properly dispose of masks, gloves, etc.?
- **Question 4.2 (Littering):** How has Covid-19 affected littering in public places such as beaches and public parks?
- **Question 4.3 (Recycling):** How has Covid-19 affected recycling and recycling behavior?

- **Question 4.4 (Water consumption):** How have the government's Covid-19 countermeasures affected water consumption in the commercial, industrial, and public categories?
- **Question 4.5 (Environmental awareness):** Has public awareness of/interest in environmental issues changed during this period?

The fifth and final group focused on the impact of the Covid-19 pandemic on the Bahraini government's environmental strategy, and its chosen policies.

- **Question 5.1 (Overall energy strategy):** How has Bahrain's energy strategy changed?
- **Question 5.2 (Sustainable energy transition plans):** How has Covid-19 affected the plans and investments towards sustainable energy transition? (a) How has Covid-19 affected the transition towards renewable energy? (b) How has Covid-19 affected the transition towards increased energy efficiency?
- **Question 5.3 (Climate change plans):** How has Covid-19 affected the plans and investments towards adapting to climate change?
- **Question 5.4 (Legislative changes):** Has there been any new environmental legislation and/or policies introduced since the start of the Covid-19 pandemic? Has the implementation of any existing legislation or regulations been halted?
- **Question 5.5 (Environmental priorities):** How has Covid-19 affected environmental priorities?
- **Question 5.6 (Financing post-Covid recovery):** Should financing be directed at addressing the environmental aspects of post-Covid recovery?

We only posed a subset of the 24 questions to each expert, with the exact selection depending on the interviewee's area of expertise. Moreover, interviewees declined to answer some of the questions that we posed to them, most frequently because they felt that there was either insufficient data to make an informed comment, or because the interviewee felt that they lacked the background knowledge required for an informed comment.

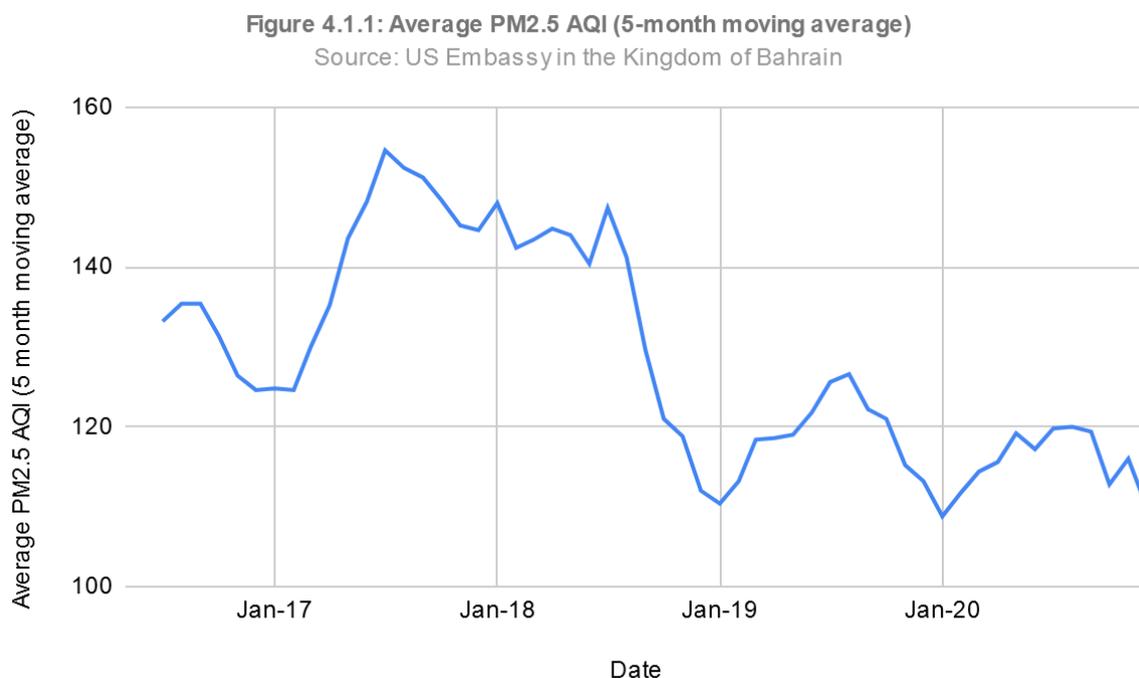
4. Results

The section presents the main findings of the 14 interviews, arranged by question. In the interests of parsimony, we restrict our presentation to the most salient, policy-relevant findings. Those who are interested in the full analysis can see the forthcoming companion academic paper by the same authors.

4.1. Ecosystems and Climate

Question 1.1: How has Covid-19 affected air quality (carbon emissions, NO₂ and particulate matter that have a diameter of less than 2.5 μm)?

Respondents indicated that there were significant measurement challenges. The government's air quality stations encountered technical problems at the end of November 2019, and they are scheduled to come back online in the middle of 2021. Third party data provided by the US Embassy in Bahrain is shown in Figure 4.1.1; due to the volatile nature of the readings, a five-month moving average has been applied.



The data shown indicate that during 2020, there was a slight decrease in PM2.5 compared to 2019, which was equal to 4% when year-on-year averages are calculated. These are consistent with the significant

reduction in ground transportation resulting in a slight improvement in air quality. It is possible that the direct effect of the reduced ground transportation was higher, but that it was partially offset by increased electricity consumption at the national level (see below). Moreover, this is data from only one location (which happens to be next to a major highway away from the central business district), and so it is unclear how representative its observations are of the entire country. One expert remarked:

“Logically, pollution from transportation was reduced but pollution from electricity stations did not change. In fact we find the opposite, the load on electricity from commercial areas moved to become mainly from residential areas because people were staying at home and working remotely.”

We further examine the issue of the aggregate demand for electricity below.

Precise air transport data were also made available by the Bahrain Airport Company. Aircraft movements declined by 58% during 2020 compared to 2019, while total passengers decreased by 76%. It is expected that this decline had a positive impact on air quality in the airport’s vicinity (the US embassy’s station is approximately 14km away from the airport).

Finding 1.1: The available data indicate a slight improvement in air quality, likely driven by decreased air and ground transportation, but data coverage falls significantly short of what is required for a definitive assessment.

Question 1.2 (Noise pollution): How has Covid-19 affected noise pollution?

Respondents indicated that there are no systematic attempts at measuring noise pollution in Bahrain. However, they expected that were data to be available, they would indicate a decrease in noise pollution due to lower traffic congestion, lower usage of transportation, and a greater propensity to be at home from 6pm onwards. The decreased transportation-related noise pollution reflected both ground transportation and air transportation, with aircraft operations declining significantly during 2020, as shown in the figures above.

Finding 1.2: It is likely that there was a significant, transportation-induced decrease in sound pollution, though data non-availability prevented confirmation.

Question 1.3 (Carbon footprint): How has Covid-19 affected the carbon footprint?

All interviewees prefaced their responses by affirming the absence of reliable data on the carbon footprint; one expert remarked:

"... in our region, there's a lack of capacity in measuring the carbon footprint. It's a very technical issue."

The experts agreed that the significant reduction in transportation (both ground and air) caused by the lockdowns and social distancing would have led to a diminished carbon footprint. This decrease would have been significantly reinforced by the absence of the approximately 10 million tourists that Bahrain welcomes from Saudi Arabia annually via the King Fahad Causeway (Naumann et al., 2018), as Saudi Arabia imposed strict restrictions on Saudi nationals' ability to travel outside of Saudi Arabia.

In the case of air transportation, precise figures were available: Bahrain Airport Company indicated a 25% reduction in its 2020 carbon footprint compared to 2019, excluding emissions from electricity as these were temporarily higher due to the need to operate two terminals during the transition from the old airport to the new one. The reduction in carbon was equal to approximately 380 tons of CO₂, and reflected diminished emissions from vehicles, generators, refrigerant top-up, and so on.

However, the experts also indicated that decreased transport-related carbon emissions were partially offset by increases in other sectors. First, in line with other countries, staying at home meant significantly higher levels of residential electricity consumption: recreation, education (online learning), and work (remote) all experienced massive shifts from outside to inside the home.

Second, as part of its fiscal stimulus, Bahrain offered heavy subsidies to residential electricity consumption for citizens: for the six month period March - September 2020, electricity and water bills for Bahraini households were paid by the government up to their level during the corresponding month from the preceding year. This large decrease in the marginal cost of electricity consumption, and the

positive effect on income, together combined to further increase residential electricity consumption, and hence the carbon footprint.

Despite these countervailing forces, the experts generally concurred that the net effect of Covid-19 on Bahrain's carbon footprint was slightly negative.

Finding 1.3: It is likely that there was a slight decrease in Bahrain's carbon footprint, driven by decreased demand for transportation, though data non-availability prevented confirmation.

As a postscript to this finding, it is very likely that any decrease was transient, and that Bahrain has exhibited the same pattern of a return to the previously, higher carbon footprint experienced across the world.

Question 1.4 (Waste generation): How has Covid-19 affected waste generation? (a) Did the usage of single-use plastic rise? (b) How has Covid-19 affected household food waste?

As above, data limitations meant that most of the interviewees' insights were based on their general perceptions rather than on accurate, quantitative data.

The experts indicated an unequivocal rise in medical waste. A significant proportion came from the medical facilities that were dedicated to the treatment of Covid-19, whereas the rest reflected increased waste generation by regular medical facilities. Notably, this type of hazardous waste needs to be incinerated rather than being directed to landfill, and in the case of the waste generated by medical facilities, it was handled by an incinerator in Awali. One of the experts cited an approximately 50% increase in hazardous medical waste during the pandemic.

According to the interviewees, Bahrain also witnessed a concomitant rise in medical waste from households, commercial establishments, and other non-medical facilities, partially in response to regulations, e.g., the mandated wearing of masks created a lot of mask-related waste (though alternatives exist; see below). One of the experts remarked:

"Nobody really used masks or gloves before except medical staff. Now everybody's obsessed with them."

Unfortunately, much of this medical waste has not been handled correctly. People have shown an alarming propensity to dispose of single-use items on the ground (littering) rather than in wastebaskets, creating a direct health risk. Even the waste that is correctly disposed of still enters landfills because its origin is not a medical facility.

Beyond medical waste, the experts also indicated that there had been a significant rise in non-medical waste, with the food sector being a particularly salient source. Partial lockdowns and social distancing created a large increase in the demand for home delivery of food. Nominally, this merely represented a transfer of waste generation from restaurants to households, but the experts indicated that there was a net increase, due to a combination of two factors.

First, to assuage customers' health concerns, restaurants provided extra packaging and one-use versions of cutlery. Even following the reopening of in-restaurant dining during September 2020, restaurants continued to cater to a perceived and actual preference by customers for single-use tableware.

Second, the absence of waiters to respond to diners' needs meant that restaurants preempted potential requests, such as extra ketchup or tissues, by including these items even when not explicitly requested.

Notably, the sharp increase in single-use plastics was contrary to the previous global trend toward restricting the use of such materials as part of broader efforts at combating climate change and protecting the environment.

Several experts also opined that a combination of boredom and depression brought about by the lockdowns increased per capita food consumption, potentially increasing household waste, though it is difficult to determine if such a rise is even perceptible if it did indeed occur.

The Bahrain International Airport was able to provide some detailed data, with the qualifier that it is far from being representative of the broader trends in the economy. Overall during 2020, general waste decreased by 45% compared to 2019, with the largest monthly decline occurring in May 2020, when 43 tons of waste were produced, representing a 65% contraction compared to May 2019. In line with the airport's efforts at protecting the environment, the adoption of single-use tableware was kept to a

minimum, and paper was used instead of plastic where possible, but it was still used in all pantries in an effort to protect the health of employees and travelers.

A final remark concerns the general perception that there is a tradeoff between public health and waste minimization: we use masks and gloves to protect ourselves and each other, but this leads to more waste. One of the experts contested the validity of this perception by citing scientific studies of the impact of single-use personal protective equipment (PPE) on behavior. These studies had found that PPE can exacerbate the risk of community infection as it gives its bearer a false sense of security.

Thus, when an individual does not wear gloves, they exert considerable effort on minimizing their physical contact with their surroundings, whereas when wearing gloves, their behavior veers toward recklessness, as they touch everything (including their own possessions such as their mobile phones) due to a tacit perception of invulnerability. This is in addition to the aforementioned factors such as disposing of masks on the ground, which further accentuates health risks. One of the interviewees remarked:

“If you throw a mask with viruses on the floor and someone needs to pick it up; then what?”

While no such studies have been conducted in Bahrain (to the best of our knowledge), if these observations do apply here, then it suggests that much of the increase of waste has not been productive, and that it may have gone hand-in-hand with increased rates of community infection. We present the relevant recommendations in the last section below.

Finding 1.4: It is likely that there was a significant rise in waste generation, both medical and non-medical, with one-use items playing an important role in both. Household waste increased considerably, though the net increase was attenuated by a decrease in the waste produced by other sectors, most notably the restaurant sector. Data non-availability prevented confirmation.

Question 1.5 (Waste management): How has Covid-19 affected waste management? (a) Waste segregation? (b) Waste collection? (c) Waste treatment capacities?

The experts were collectively unaware of the existence of an official waste segregation system prior to the pandemic, nor were they aware of the establishment of one during the pandemic.

Despite the absence of an official system, environmentally conscious elements of the general public offered their own waste segregation initiatives. Unfortunately, many failed and were suspended prior to the pandemic, making it unlikely that Covid-19 would bring about a much needed increase in efforts. In fact, many forms of civil society work have been impeded significantly by the social distancing measures and other pressures relating to the pandemic (Abdulla et al., 2020).

One expert remarked that pre-Covid-19, public segregation was too low and was abused by households who would not take the time to segregate properly, placing waste in the wrong bin. The expert described the response of one provider that suspended waste segregation as:

“We are not general waste collectors, this is up to the municipality. But if people are misusing our recycling bins, then why should we put them there?”

Unfortunately, due to people’s preoccupation with health risks, the pandemic made the already limited civic appetite for such initiatives even weaker.

Finding 1.5: The pandemic did not lead to any significant change in Bahrain’s prevailing efforts at waste segregation, while it dampened the limited civic efforts.

Question 1.6 (Medical waste management): How is Bahrain managing the large increase in PPE and medical waste?

Building on the answers to question 1.4, in general, the PPE and medical waste that did not originate in a medical facility was treated as general waste and directed to the landfill. One expert remarked how concerning this is in terms of the long-term environmental impact:

“If you have eight billion people [in the world], and half [of the population] are using one per day, it’s quite a big number. And of this number, they are very light obviously, even the gloves, so the wind takes

them to the sea, to the shoreline, and then they get stuck in the water, and then sooner or later they'll come back to us."

Bahrain's airport did exert considerable effort at using different procedures for medical waste from potentially infected people, which was treated as biohazardous and handled accordingly, but this was also due to the presence of an onsite clinic operated by the Ministry of Health to manage incoming travelers.

Finding 1.6: Medical waste originating in medical facilities was classified as hazardous and incinerated; medical waste originating elsewhere was treated as general waste and sent to the landfill.

Question 1.7 (Biodiversity): How has Covid-19 affected wildlife and biodiversity? (a) How has marine life been affected? (For example, the demand for fish dropped around the world; did something similar occur in Bahrain.) (b) How has birdlife been affected?

In general, notwithstanding the lack of data, the experts remarked that in certain cases, wildlife and biodiversity improved. First, there were protected areas, such as AlAreen Wildlife Park and Reserve, which are usually open to the general public, but were closed during the pandemic. Second, the entire winter camping season in the desert was canceled, providing the desert wildlife with a significant boost. Third, during the period of strict decreases in movement, beaches will have experienced an improvement in environmental quality due to decreased littering.

In terms of marine environments away from the shore, some experts claimed that the demand for fish - and therefore the aggregate fishing activity - was constant, while others claimed that there was a significant decline in the demand for fish, thereby decreasing the volume of sorties by fishing boats up to late September, when they recovered their previous levels. In the case of prawns (shrimp), one expert remarked:

“We also have a ban on prawn fishing in certain months and these months happened to be the same months of the lockdown months so this helped the prawns. In earlier years, there have been people who catch prawns even during these months. This year, this illegal catching of prawns decreased.”

However one expert cautioned that if total water consumption increased, then this would have caused an increase in the discharge from desalination plants, damaging marine environments.

Regarding the birdlife, one of the experts provided the following positive remark:

“The most important birds are the migratory birds that come to Bahrain in the end of October and stay in Bahrain during the winter during their migration from the north to the south. This is still happening and was not affected by Covid-19.”

However in all of these environments, the experts affirmed that the gains were temporary, and that upon the lifting of restrictions, the previous threats would reemerge.

Finding 1.7: There is evidence that wildlife and biodiversity improved in certain areas, but in general any benefits were purely transitory and expired upon the resumption of pre-pandemic patterns of activity. Data non-availability prevented confirmation.

Question 1.8 (Long-term environmental impact): Do you believe that Covid-19 will have long term effects on the environment, and if so, what are these long-term effects?

Broadly speaking, there were three narratives circulating among the experts. The first was that any changes witnessed thus far are purely transient, and that the world is anxious to return to its previous patterns of behavior as soon as the pandemic recedes. Consequently, the long-run impact on the environment will be negligible.

The second narrative was that overcoming the current pandemic will take longer than many expect, and that pandemics are likely to become more frequent (for example, every 10 years). As a result, despite being nominally transient, the changes witnessed thus far, such as more waste and less air pollution, will

persist simply because we will become locked into a pandemic cycle for the foreseeable future. In this regard, the rise in waste brought about by a fear of infection is a serious concern.

The third narrative was that regardless of the frequency of future pandemics and the time taken for the current one to recede, some changes are here to stay, with an emphasis on two positive changes. The first is an improvement in environmental awareness, as one expert remarked:

"I think that environmental awareness maybe increased for some people; some people became more interested in reading the reasons behind Covid-19 and its environmental effects."

The second is a sustained shift toward remote work and education, leading to a persistent decrease in air pollution. One expert remarked:

"I expect around 30-50% of meetings and events will become online, because now people realize that it is more feasible to do these meetings and conferences online. But people will move to online meetings not because of environmental reasons but because of feasibility, reduction in monetary costs, ease etc. This will help the environment provided that people do not start doing other activities that hurt the environment."

Regarding the increase in waste, one of the experts cautioned the elevated risk due to the volume of PPE that breaks down with oxygen extremely slowly, and even after breaking down, does not decompose, remaining instead as microplastics that are invisible to the naked eye, but still harmful to the ecosystem.

In terms of diminished transport-related pollution, one of the experts made an additional comment regarding the heterogeneous impact:

"Long term effects will vary by economic sector and by extension the environmental effects. I believe that the biggest sector affected by Covid-19 was the aviation sector, which will take years to recover to operational levels prior to Covid-19."

Finding 1.8: Under a best-case epidemiological scenario (the current pandemic receding quickly and future ones being infrequent), in the long-run, the impact on the environment could potentially be slightly positive due to lower transportation from remote working and meetings, and also due to higher

levels of environmental awareness. Under a worst-case epidemiological scenario (the current pandemic continuing and future pandemics occurring with high frequency), the aforementioned environmental benefits may be swamped by the damage caused by a large, sustained increase in the volume of pandemic-related waste generated, including PPE and single-use items.

Question 1.9 (Threatened species): What has been the impact of Covid-19 on the conservation of threatened species?

In general, there was little response to this question due to experts affirming the need for the implementation of technical studies. However, one expert remarked:

“On land we do not have threatened species other than those in protected areas such as in Alareen or Hawar Island and these are already protected and there not a lot of visits to these areas. In the sea we have some threatened species such as dugongs and these have not been affected during the pandemic.”

Finding 1.9: Initial impressions indicate no impact on endangered species, but there is a need for technical studies to confirm these initial findings.

4.2. The Environment and Public Health

Question 2.1 (Environment and public health): What is the relationship between the environmental impacts of Covid-19 and the subsequent impacts on public health?

A critical overarching remark made by an expert concerned the aforementioned transient environmental benefits:

“Any short-term environmental benefits as a result of Covid-19 come at an unacceptable human and economic cost are no substitute for planned and sustained action on air quality and climate.”

Beyond this, the experts conveyed the complex relationship between human behavior, the environment, and the emergence of lethal pathogens such as Covid-19. A growing body of research argues that many human activities lead to environmental pollution and biodiversity deterioration, while also leading to the emergence and spread of new diseases. One expert provided specific figures concerning this issue:

“30% of emerging infectious diseases can be attributed to land use change, agricultural expansion and urbanization; 70% of emerging diseases (e.g. Ebola, Zika) are caused by microbes found in animals (i.e. zoonotic pathogens) due to contact among wildlife, livestock, and people; almost 100% of pandemics (e.g. influenza, SARS, Covid-19) caused by zoonoses; 631,000-827,000 estimated number of viruses that could have the ability to infect humans.”

In this regard, the increase in waste caused by the pandemic is of grave concern, especially in light of the aforementioned low rates of plastics decomposition associated with single-use items. This seems likely to swamp any positive effect on public health associated with improved air quality.

Finding 2.1: A growing body of evidence suggests that the increasing incidence of lethal pandemics is a direct consequence of pollutive human behavior that leads to diminished biodiversity. Unless steps are taken to control the rise in waste, the long-term impact on public health is likely to be negative.

Question 2.2 (Pollution and public health): What are the potential long-term public health impacts that air pollution/waste generation (as a result of Covid-19) in particular would cause?

The experts noted that at the peak of the initial lockdowns, some regions of the world realized a 40% reduction in atmospheric pollutants, almost coming down to their natural background levels. This is important because a significant percentage of Covid-19 deaths could be attributed to comorbidities caused by higher levels of air pollution. However, there are two reasons to temper the positivity associated with this finding.

First, as mentioned above, it is likely that the air quality improvements are largely transitory, and they will therefore not contribute to a sustained improvement in air quality.

Second, the available evidence suggests that Covid-19 is not transmitted via ambient air, but that it can spread in the case of indoor air, partially undermining the benefits associated with cleaner air.

In the domain of waste, the experts echoed the previous remarks made:

“Health-care waste (HCW) should be securely stored and treated, preferably on-site, and then safely disposed of. All those who handle HCW should wear appropriate PPE (long-sleeved gown, heavy-duty gloves, boots, mask, and goggles or a face shield) and practice careful hygienic protocols.”

Without such steps, beyond the environmental channel, pandemic related waste will have direct adverse health consequences. As mentioned above, Bahrain took the appropriate measures for treating PPE originating in medical facilities, but a significant proportion of PPE comes from outside the health sector and is at present treated like any other waste.

Finding 2.2: Given the largely transient nature of decreased air pollution, this particular impact is unlikely to have sustained effects on public health. Increases in waste, however, and especially hazardous waste associated with PPE, poses a significant threat to public health if not handled correctly.

Question 2.3 (Environmental public health policies): What environmental policies do you believe would be the most effective in addressing this pollution-public health dynamic?

The experts indicated that the traditional approach of trying to deal with the risk of diseases associated with environmental degradation focused on treating symptoms, such as through vaccinations and the therapeutic treatment of diseases. This has not been successful, and the time is right for a shift to controlling the root causes:

“A multi-sectoral shift in the approach is needed to focus on upstream preventive and corrective interventional actions for minimizing the environmental risks. As many aspects of environmental health services are situated outside the mandate of a single agency and the health sector per se, an integrated multi-sectoral framework of work for managing environmental health risks and services.”

The experts also tied these issues to the sustainable development agenda:

“We must emphasize that environmental justice, health equity and socioeconomic equality are not only interlinked but they are actually the public health trinity to the sustainable development agenda 2030.”

Finding 2.3: There is a need for an integrated collection of policies that are proactive and preventative rather than reactive and therapeutic. The focus of these policies should be protection of the environment and the establishment of a more sustainable economic model.

4.3. Energy Consumption

Question 3 (Energy industry): How has Covid-19 affected the energy industry in Bahrain? How has domestic energy consumption been affected? Industrial demand for natural gas and electricity; household demand for electricity; demand for jet fuel and motor gasoline.

The experts were able to share some specific quantitative data in the energy domain. The main measure of electricity consumption cited was peak load consumption, which had been on a downward trajectory due to Bahrain’s National Energy Efficiency Action Plan (NEEAP). In 2017, it was 3,527MW, while this fell to 3,443MW in 2019, before rising due to Covid-19:

“... in 2017, EWA forecasted that for 2018, [energy consumption] will go up because of the population increases and also due to government projects like Diyar Muharraq and [developing] towns like Khalifa Town, Salman City, East of Hidd City; so they expected the electricity to go up by 6%. And instead of going up, it came down. And then in 2019, it also came down. In 2020, because of Covid, it slightly went up, but not by much. Compared with the forecast, it is still less. That shows that the national energy efficiency action plan is working.”

The key elements of the NEEAP include air conditioning standards, as legacy air conditioners are highly inefficient, LED lighting for homes and streets, and so on. Investments in the transition continued during 2020, though it is unclear if the transition’s speed was affected by the pandemic.

Moving to the oil and gas sector, compared to the previous year, consumption reached its nadir during April 2020, and began to stabilize by the end of the year, though at levels that remained considerably below their 2019 levels.

The worst hit element was aviation-related jet fuel, as 2020 revenues contracted by 44%. Experts indicated that this sector would take a minimum of three to four years to recover, and that a vaccine was critical for realizing a sustained improvement.

Gasoline consumption also declined, though more modestly. The shift to remote work and education were the leading causes, as well as people's generally higher propensity to stay at home.

Total exports of petroleum products declined by 12% due to the reductions on global demand brought about by the pandemic. Liquefied petroleum gas (LPG) exports also declined by 10%, while petrochemical exports contracted by 1.6%.

On the production side, approximately three quarters of Bahrain's crude oil production comes from the shared oil field with Saudi Arabia, Abu Saafa (which is operated by Saudi Aramco), with the remainder coming from Bahrain's field. Due to the coordinated OPEC+ production cuts, in tandem with reduced global demand, the Abu Saafa production declined significantly. In contrast, Bahrain's local oil production was generally unaffected as it is all consumed locally as a refinery input. Bahrain also imports Arabian light from Saudi Arabia for refining, and these imports declined by 21% due to decreased global demand.

Natural gas production and consumption did increase slightly (0.6%) since the primary purchaser of Bahraini natural gas is EWA for its power generation. As mentioned above, power consumption increased slightly due to Covid-19.

Covid-19 also affected Bahrain's upstream and downstream oil and gas projects, including the development of the Khalij Al Bahrain field, and the BAPCO refinery modernization.

"In terms of projects the delay was only a few months like the Bahrain modernization project. There will be some positive effects since people will focus more on risk management and crisis management."

The delays were due to Covid-19-induced travel restrictions, especially since project partners came from Italy and the USA, which faced serious challenges in dealing with the pandemic. Moreover, Covid-19 also caused supply chain disruptions which impeded work progress on these large projects.

Finding 3: The demand for electricity increased slightly due to Covid-19, requiring a concomitant increase in the production and consumption of natural gas. Otherwise, retreating global demand was reflected in lower Bahraini exports of oil and oil-related products, while lower demand for transport domestically and globally meant lower demand for jet fuel and gasoline. Upstream and downstream projects suffered minor disruptions due to travel restrictions and supply chain issues.

4.4. Environment-Related Public Behavior

Question 4.1 (PPE disposal awareness): In general, is the public aware of how to properly dispose of masks, gloves, etc.?

Several experts indicated that the government had exerted considerable effort in educating the public about the correct procedures for disposing of PPE. However, based on their own experiences of seeing used PPE on the streets and beaches, the experts concluded that awareness was generally quite low. One remarked:

"In the beginning the media was active in this respect. Now, I feel that people have forgotten this. In general, from what I see in everyday practice, I do not think they know how to dispose of masks properly."

One of the experts affirmed the existence of a high degree of variation in awareness, but accepted that overall, awareness was not at the desired level.

"It is really hard to generalize that all the public are not aware, as you have a very heterogeneous society in Bahrain (citizens, expats, different educational backgrounds, different cultures...). But, I think in general we do have a problem in this department. I based this judgement on the observation that there

are a large number of masks being disposed of in the streets. You can hardly drive without seeing masks in the streets.”

One of the experts conducted numerous surveys in the pre-Covid-19 era concerning environmental awareness, and those surveys had indicated low-to-medium levels of knowledge among the public. The expert extrapolated to conclude that even now, awareness levels were likely to be quite low.

Finding 4.1: Due to a combination of low baseline environmental awareness, and indifference to the media campaign (possibly due to fatigue), effective awareness of the importance of correct disposal of PPE is low.

Question 4.2 (Littering): How has Covid-19 affected littering in public places such as beaches and public parks?

The experts remarked that the partial lockdowns and social distancing measures adopted in Bahrain led to decreased gatherings in certain public places such as parks, but this was partially offset by increased littering in delivery-related settings (residential areas) and near medical facilities, especially PPE.

In the context of beaches, though there was a lower human presence there, the aforementioned light weight of discarded PPE meant that masks, gloves, etc tended to collect there. One expert remarked:

“... it became a nightmare actually. It’s still a nightmare... It’s very sad to see that people are so concerned about their own health that they neglect everything else. For example, people throwing masks 1-2m away from the bin. Everyone has the capacity to throw it into the bin... It is just a disaster for the environment, nature and the animals in the sea and on land.”

Finding 4.2: Notwithstanding the lack of official data, according to the experts’ observations, littering in public places partially decreased due to people staying at home more, but this was offset to some degree by people littering their PPE. Litter, especially PPE, tended to agglomerate in beaches due to its lightness.

Question 4.3 (Recycling): How has Covid-19 affected recycling and recycling behavior?

At the outset, one of the experts remarked:

“Even before the pandemic, the recycling was not in an institutional framework. While it is mentioned in the national strategy for waste management, the recycling efforts are not on par with other countries.”

More specifically, Bahrain doesn't have institutionalized recycling, and instead relies on a variety of for-profit and non-profit initiatives related to paper, glass, plastic, and other materials. The experts remarked that Covid-19 damaged this limited efforts on both depositor and collector sides.

On the depositor side, people's compliance with social distancing guidelines meant that they were less likely to take the time to segregate their refuse and deposit it in the appropriate place. Moreover, the cognitive load associated with maintaining their own health meant a diminished mental capacity to pay attention to recycling.

On the collector side, due to a mixture of health concerns and logistical challenges, collectors decreased their collection efforts. For example, poor segregation went from being inconvenient for collectors to being a genuine health risk. Some depositors were left with no choice other than to deposit at the collector's headquarters, rather than the convenient bins usually located much closer to the depositor, because the collectors suspended pickups for health or logistical reasons.

On the positive side, the experts did note that some people became more mindful, in line with the general rise in importance attached to environmental issues, though the positive effects were swamped by the negative effects caused by depositors poorly segregating or simply not caring. One expert remarked:

“The public are getting more and more aware of these things. From monitoring social media, we see a lot of campaigns against plastic pollution, for clean beaches, all of these things... A lot of civil society actors are working on this. So from this angle I think the awareness is there.”

However the experts also pointed out that in the long run, expanding recycling requires significant infrastructure investment and supporting legislation, or, as one expert put it:

“Minimizing and recycling waste requires an enabling environment based on both command-and-control and economic incentives.”

Finding 4.3: Notwithstanding data limitations, Bahrain low levels of private-led recycling decreased substantially during the pandemic due to logistical challenges and lower effort on the part of the public.

Question 4.4 (Water consumption): How have the government's Covid-19 countermeasures affected water consumption in the commercial, industrial, and public categories?

As of the time of interviews (and writing), official data is yet to be released, and so a definitive response is not possible. However, most of the experts expected stable industrial demand, with a transfer of commercial demand to household demand due to social distancing, school closures, remote work, and so on. They also expected that in aggregate, total consumption would be higher due to the directives regarding increased cleansing, e.g., hand washing. One expert remarked:

“We do have clear evidence about the increase in consumption from other countries (e.g., 11% in Sharjah), but we have not got any data from Bahrain to confirm this. However, insiders have confirmed that the system has been under large stress during the partial lockdowns in Bahrain.”

Finally, the aforementioned subsidies on utility bills as part of the fiscal stimulus included water consumption, and it is likely that these encouraged higher levels of consumption.

Finding 4.4: While official data are yet to be published, a combination of higher demand for water for hygienic reasons and temporary subsidies on water consumption combined to generate higher aggregate demand for water.

Question 4.5 (Environmental awareness): Has public awareness of/interest in environmental issues changed during this period?

In general, the experts agreed that the shock of the pandemic's initial positive impact on the environment, especially the cleaner air and the animals roaming the streets, raised awareness about the environment. Moreover, one expert remarked that awareness increased through the negative channel, too: the pandemic made people more cognizant of humanity's susceptibility to doomsday scenarios, including those relating to climate change.

However there was some scepticism over whether this increased awareness translated to a change in behavior. One expert commented:

"I think it's changed slightly, but it's somewhat superficial. When the pandemic first happened and everyone was on lockdown, there were all those photos that went viral of swans and dolphins returning to canals, and nature has had a chance to reset and breathe... That doesn't really translate to changes in behavior... People have said, oh isn't it nice the swans and dolphins, but I think it's still on a very superficial level."

The experts attributed this to a chronic lack of incentives to behave in a more sustainable manner. Top-down regulatory pressure remains weak, in the experts' view, while bottom-up consumer activism is also very modest, unlike in other areas such as the European Union, where climate change is a major issue during elections.

An example of successful, government-led impetus was the Central Bank of Bahrain (CBB) surveying financial institutions to gauge the extent to which they were thinking about climate risks and climate disclosure, as there is a global trajectory to systematically incorporate such considerations into investment decisions. However, the experts remarked that both before and during the pandemic, the tangible impact on decisions remained modest.

A final remark about environmental awareness on the regulatory side was that certain government monitoring activities had been impeded by Covid-19. For example, authorities had recently implemented a ban on single-use plastic bags, but enforcement systems were significantly curtailed during the pandemic due to the logistical challenges of monitoring during lockdowns and while complying with social distancing measures.

Finding 4.5: Experts perceived nominal increases in awareness about the environment, but without tangible changes to people’s behavior, due to chronically low levels of environmental activism in Bahrain.

4.5. Environmental Strategy and Policy

Question 5.1 (Overall energy strategy): How has Bahrain’s energy strategy changed?

It is worth noting that Bahrain’s energy sector has, loosely speaking, a tripartite structure: oil and gas activities come under the purview of the National Oil and Gas Authority (NOGA), power issues are managed by the Electricity and Water Authority (EWA), while efforts at transitioning to a more environmentally friendly energy system are overseen by the Sustainable Energy Authority (SEA). Thus, there are three distinct strategies to be considered.

The experts indicated that NOGA’s strategy did not experience any significant changes, due to built-in adaptability, as at the global level oil and gas regularly experience crises and disruptions. One expert remarked:

“The oil and gas sector in Bahrain thankfully has taken crisis management and risk management and business continuity very seriously for a very long time due to the volatile nature of the business.”

As an illustration, Bahrain’s energy sector had a recent experience with a major supply chain disruption during the 2019 attack on Saudi Aramco’s facilities in the Eastern Province of Saudi Arabia, which are the source (via pipeline) of the Arabian light crude that BAPCO procures, refines, and reexports. Thus, for NOGA, it was a case of activating existing business continuity plans rather than having to develop new systems.

The experts also indicated that thus far, there have been no substantive changes to EWA’s strategy.

“When it comes to strategies and policies at EWA, they follow a five-year master plan cycle where this master plan serves as a strategic blueprint for EWA’s projects. [Accordingly] while Covid-19 had an

impact on EWA in certain aspects, when it comes to ongoing sanctioned projects within the 5-year plan, there was little change.”

One expert indicated that the financial challenges posed by Covid-19 had impacted the implementation of some Bahraini projects relating to electricity and water.

The SEA’s strategy has two pillars: the aforementioned NEEAP, and the National Renewable Energy Action Plan (NREAP). The experts indicated that both plans, which feature targets for 2025 and 2035, have not been affected directly by Covid-19, but that they continued to evolve organically alongside Covid-19. One expert described the status as follows.

“As far [Bahrain’s] strategy and national targets, they have not changed. But [the SEA knows] that [it] will be looking in the future to improve or increase [the] national targets. That [it] will do in the future because from the trend we can see, now with Covid-19 and the impact of Covid-19 on the health of people and so on, there is more of a drive to go towards renewable or clean energy.”

The drive that the expert was referring to was partially in response to falling crude oil prices, which increased awareness regarding the need to transit to renewable energy and improve sustainability. The drive is also due to the coincidental cumulative training of Bahrainis in solar energy, combined with the continually falling price of solar energy which has increased its commercial attractiveness.

“[The SEA] have trained more than 300 people to be professionals in solar installation, [and it has] encouraged the establishment of factories for solar panels.”

In the past, a shortage of local expertise in solar energy constituted a significant impediment to the expanding use of solar energy, but with time this barrier is being eroded.

Finding 5.1: A combination of built-in adaptability and the limited passage of time meant that there were no major changes to Bahrain’s energy strategy, but there are indications of a greater emphasis on sustainable energy going forward.

Question 5.2 (Sustainable energy transition plans): How has Covid-19 affected the plans and investments towards sustainable energy transition? (a) How has Covid-19 affected the transition towards renewable energy? (b) How has Covid-19 affected the transition towards increased energy efficiency?

In line with the prevailing and pre-Covid-19 trend, Bahrain has been investing more in renewable energy, and continues in its plans to open new factories soon and bring online its solar farm. However, the direct impact of Covid-19 is debatable, as important causes of the transition - such as the falling cost of renewable energy - have been underway for some time, creating an impetus for further adoption. But Covid-19 has arguably had an indirect impact:

"[The SEA] did a pilot project with the Ministry of Education for eight schools to put solar on the rooftops of the buildings of these eight schools. On the basis that the private sector will finance, build, and operate, maintain, and manage in return for a tariff. The government now, EWA, charges schools and the Ministry of Education 29 fils per kilowatt hour. And these developers said if you are building, then give us a tariff that is less than the EWA tariff. So we got tariffs around 19.8 fils, 21.8 fils, 23 fils, which is 30% less, without the Ministry of Education putting up any money or capital for this. And all the paperwork was done by the SEA... the documentation, the tender board, the negotiations, the power purchase agreement. So that's why the ministries now, all of them want to go into this process. Because they want to reduce their costs. And this is, if you like, an indirect result of Covid-19. Because the government was sort of hoping that they can reach break-even by 2022, but with the reduction in the cost of crude, they have to cut costs more. And because they want to cut costs more, these ministries will look for any way to reduce their costs. And what is available now is renewables, which reduces the cost. And we have examples of that."

The same economic challenges have made people more conscious of how they can save on energy bills. Businesses and government ministries are now more willing to invest in energy audits, carried out by energy services companies (ESCOs) who specialize in this area. The SEA has agreements or understandings with around five ESCOs who assist ministries and the private sector in improving energy efficiency.

However, one expert speculated that in the short term, the financial strain of transitioning may lead to a Covid-19-related slowdown.

“Given the fragility of the private sector... the government will likely refrain from imposing any new regulations that result in increased costs to developers and business owners. An example of these regulations is a proposal to have 30% renewables capacity requirement for new project developers.”

Finding 5.2: Covid-19 has enhanced the incentive to cut costs, making the public and private sector more willing to consider how renewable energy and energy efficiency can help them save money.

Question 5.3 (Climate change plans): How has Covid-19 affected the plans and investments towards adapting to climate change?

The experts were not aware of any specific plans in this regard beyond the aforementioned developments under the NEEAP and NREAP. However, during the Covid-19 pandemic, one of the key environmental policy makers was given an elevated role. Dr. Muhammad bin Dayna, the Chief Executive Officer of the Supreme Council for the Environment, was given the rank of minister (having previously had the rank of undersecretary), and was also appointed as Special Envoy for Climate Affairs.

Finding 5.3: Beyond the aforementioned economic and environmental awareness driven impetus toward energy efficiency and renewable energy brought about by Covid-19, the pandemic also coincided with an increase in the power and responsibilities of the highest environmental authorities in Bahrain.

Question 5.4 (Legislative changes): Has there been any new environmental legislation and/or policies introduced since the start of the Covid-19 pandemic? Has the implementation of any existing legislation or regulations been halted?

According to the experts, in general, 2020 did not involve new initiatives, which is natural given the ongoing nature of the pandemic, and to the passage . The minimal legislation that was passed

represented implementation of previously planned legislation that coincided with Covid-19, rather than an active response to the pandemic.

For example, the SEA continued in its plans for district cooling and green building codes, which are both in advanced stages. The Supreme Council for the Environment also passed some legislation relating to the protection of the ozone layer. Yet an expert affirmed:

“There are no new legislations related to Covid-19 and the environment in Bahrain. There are also no legislations that have been halted... [However there were] the following directives only: (1) Consider all wastes generated within the quarantines as hazardous waste. (2) Use an incineration technology to treat quarantine wastes. (3) Select Muharraq sewage treatment plant for treating sewage waste from quarantines based on the technical capabilities available.”

Despite the absence of new regulations, one expert did remark that Covid-19 contributed to regulatory momentum:

“My feeling is that with the effect of Covid-19 and people realizing now that keeping the environment clean is very important, the momentum will increase and we will have to adjust the legislation accordingly in the future.”

Finding 5.4: With the exception of some technical directives relating to the treatment of quarantine waste, Covid-19 had no direct impact on the regulatory environment. However, rising awareness may assist in generating grassroots support for green regulation in the future.

Question 5.5 (Environmental priorities): How has Covid-19 affected environmental priorities?

In general, the experts did not express opinions here, since the government had not produced any new official doctrinal documents that indicated a change in priorities. However, one expert remarked that the size of the health crisis, and its relationship with the underlying environmental pressures, e.g., the role of respiratory diseases in increasing the Covid-19-related mortality rate, could work to raise the importance

of environmental protection going forward. Yet this remained a speculative rather than definitive opinion.

Finding 5.5: There was no indication of a change in official environmental priorities due to Covid-19.

Question 5.6 (Financing post-Covid recovery): Should financing be directed at addressing the environmental aspects of post-Covid recovery?

The experts emphasized two distinct but complementary approaches to the issue of post-Covid-19 recovery.

The first was affirming the need to invest in education and awareness, rather than simply purchasing the latest green equipment. One expert remarked:

“Because you can have a fantastic facility, but if people don’t know how to properly use it, then it becomes a waste of money. The money should be put into education and knowledge to build local capacities, and then it’ll have a snowball effect, or spreading effect -- once people have knowledge in the right positions and family levels and parts of society, then people will be more able to follow these instructions.”

The second was drawing attention to specific downstream opportunities that the experts felt were underappreciated by investors. One suggestion related to entrepreneurial activities.

“... encouraging people to go into SMEs for sustainable businesses: composting, gardening, fruits, and all of these stuff... and encouraging them to have eco-friendly or environmental- and health-items that are cheaper than the plastic stuff (for packaging the products).”

Another expert argued that mangrove trees were a potentially shrewd investment that would yield a diverse array of returns.

“One way of mitigating [climate change risk] that would drive economic growth is mangrove restoration. Mangroves absorb storm surge - they absorb up to 70-90% of a wave’s impact, they act as a coastal buffer, and they protect from soil erosion.”

The expert also indicated that mangroves create ecotourism revenues, sustainable fisheries, cleaner air, food security, better biodiversity, and reduced temperatures. They also suggested the popularity of engineering in Bahrain could be wielded as a tool for further greening:

“Bahrain has a huge number of engineers, a lot of people graduate with engineering. So looking at creating jobs around solar technicians and engineers. People love cars here, so electric vehicle engineers.”

Finally, the experts contested the long-standing view that green investments realize lower rates of return than conventional ones, creating a growth vs. environment tradeoff. They claimed that green investment funds actually outperformed conventional ones by a significant margin, affirming the inherent profitability of sustainable sources of growth.

Finding 5.6: Covid-19 represents an opportunity to reformulate investment strategies and to reap the considerable, underappreciated benefits associated with green investment strategies.

5. Conclusions and Policy Recommendations

In light of the interviews that we conducted, an overarching point - arguably the most important conclusion of the paper - is that there is an acute need to allocate a greater volume of resources to the systematic gathering of environmental data in the Kingdom of Bahrain. This is in line with previous studies of the Bahrain economy that have cited a lack of data (Naumann et al., 2018).

High quality data are a critical input to the process of realizing the sustainable development goals which Bahrain has committed to: without data, progress cannot be monitored, ideas cannot be formulated, and policies cannot be adapted to the ever-changing circumstances. A lack of data is what has made this study almost completely reliant on qualitative insights garnered from interviews with experts, which should normally act as a complement to - rather than a substitute for - high frequency quantitative environmental data.

In spite of the data challenges, we were able to arrive at the following general conclusions regarding the impact of Covid-19 on the environment in Bahrain.

First, regarding the impact on ecosystems and climate: there has been a slight improvement in air quality due to decreased air and ground transportation, though - according to the available data - not at the levels witnessed in other countries. Moreover, the impact was at least partially offset by increased energy consumption, and any improvement was almost certainly transient. It is likely that noise pollution and Bahrain's carbon footprint also decreased, though there are no confirmatory data. Moreover, there are various indirect indicators of significant increases in waste due to PPE and a sharp shift toward single-use items, but no official data to support this conclusion. Bahrain did not have a pre-pandemic waste segregation system, nor did it develop one during the pandemic, but social distancing impeded civic waste segregation efforts.

In terms of biodiversity, there is evidence of a transitory improvement brought about by decreased human activity in some natural habitats. In the long-run, some of these gains might persist due to a transition toward remote work and learning, but these have to be balanced against the risks posed by the aforementioned increases in waste production. However, there is a pressing need to collect data to substantiate these conclusions.

Second, regarding the environment-mediated impact on public health, the outlook is somewhat negative. There is significant evidence that expanding human activity is adversely affecting biodiversity and therefore causing public health risks, including an increased frequency of pandemics such as Covid-19. The fact that the pandemic has led to increased waste production, without substantive diminutions in the threats to biodiversity posed by humans, together suggest that the environment-mediated public health problems will likely get worse, pending a rethink of the prevailing model of economic growth.

Third, regarding the impact on energy consumption, Bahrain witnessed a slight increase, which required a concomitant increase in the production and consumption of natural gas. However, Bahrain's energy and energy-related exports, namely hydrocarbons, suffered from the decrease in global energy demand and economic activity, adversely affecting Bahrain's economy.

Fourth, regarding the impact on environment-related public behavior, pre-pandemic environmental awareness was generally low, and while the pandemic did improve awareness, there was no discernible impact on the actions that people took. Accordingly, one manifestation of low environmental awareness was widespread ignorance of and/or indifference toward the correct techniques for dealing with PPE waste, despite substantial government efforts in that regard. Moreover, any increase in the civic desire to recycle was likely overwhelmed by the countervailing logistical challenges posed by the pandemic, such as a fear of interacting with deposit containers, and lower manpower to arrange collection.

Fifth, regarding the impact on the government's environmental strategy, official changes to official policy trajectories or governmental priorities remain a work in progress, though there was a coincidental and unrelated increase in the power of the highest environmental authorities. Beyond this, the economic challenges posed by Covid-19 made various public and private organizations more receptive to the cost-cutting benefits of energy efficiency and renewable energy.

Based on these findings, we have the following policy recommendations.

First, we reaffirm the pressing need to allocate a greater volume of resources to the systematic collection of environmental data in Bahrain. Moreover, the data gathered should be made publicly available, to facilitate the participation of scholars and civil society in the formulation of new ideas for tackling environmental problems, especially ideas that are tailored to the unique circumstances of Bahrain.

Second, while it is tempting to use legislation and material incentives (fines, subsidies, etc.) to deal with both chronic and Covid-19-related environmental problems such as increased waste and low levels of recycling, there needs to be a much greater emphasis on the role of education. Green behavior needs to become a social norm rather than merely an optimal response to governmental incentives, and people also need to be equipped with the knowledge required to behave sustainably.

Third, in addition to these educational interventions, the Bahrain government should consider making greater use of green nudges that have been successfully deployed elsewhere, such as using clear waste bins to encourage more efficient waste management, and making customers have to opt-in to single-use cutlery for food deliveries. These are cost-effective and non-invasive ways of motivating people to

behave in a more environmentally friendly manner. However, in light of the context-sensitivity of many nudges, it is important that these efforts be embedded in a broader collaboration between behavioral scientists and government officials, as interventions need to be adapted to Bahrain's cultural idiosyncrasies.

Fourth, in light of the waste-related challenges posed by Covid-19 and other pandemics, Bahrain is in need of a more sophisticated national waste management system that makes full use of the available opportunities in segregation, recycling, composting, and waste-related bio fuel. Again, the effectiveness of such steps will be amplified by the active involvement of local scholars in the development and management of the waste management system, as lessons learned outside of Bahrain do not necessarily apply directly to Bahrain.

Fifth, Covid-19 has forcibly demonstrated that remote work can help reduce the carbon footprint associated with work-related travel, be it commuting to work or traveling to meetings. In light of the unique structure of the Bahrain economy, most notably the large levels of public sector employment, there needs to be a formal study of the opportunities for making remote work a permanent feature of the Bahrain labor market in specified jobs, due to the environmental benefits that it can confer. This recommendation further affirms the contribution that research can make to green policies.

Finally, many countries are treating the pandemic as an opportunity to permanently refashion the economy in a manner that is more sustainable, such as greater use of renewable energy. Both public and private sectors in Bahrain need to examine these possibilities in light of the economy's unique properties, and to jointly develop a suitable national strategy.

Beyond the recommendations, the qualitative interviews used in this paper due to the lack of data are no panacea, and follow-up research should use the relevant quantitative data once it becomes available, as well as comparing the findings to those of similar countries in the region.

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