

ENGINEERING LAW(ENG384) TERM PAPER

ON

ENGINEERING STRATEGIES FOR HANDLING COVID-19 FOR ENVIRONMENTAL HEALTH AND ECONOMIC SUSTAINABILITY

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**Abstract**

The paper reviews strategies which can be put in place to handle covid-19 which may have shown possibilities of affecting the environmental health and economic sustaiaility of countries around the world. The paper contains background information of the virus, how it is transmitted, cases of the virus confirmed, strain it has put on the environmental health and economic sustainability of the world and also a few ways in which we as Engineers can strategically handle the virus to prevent further damages.

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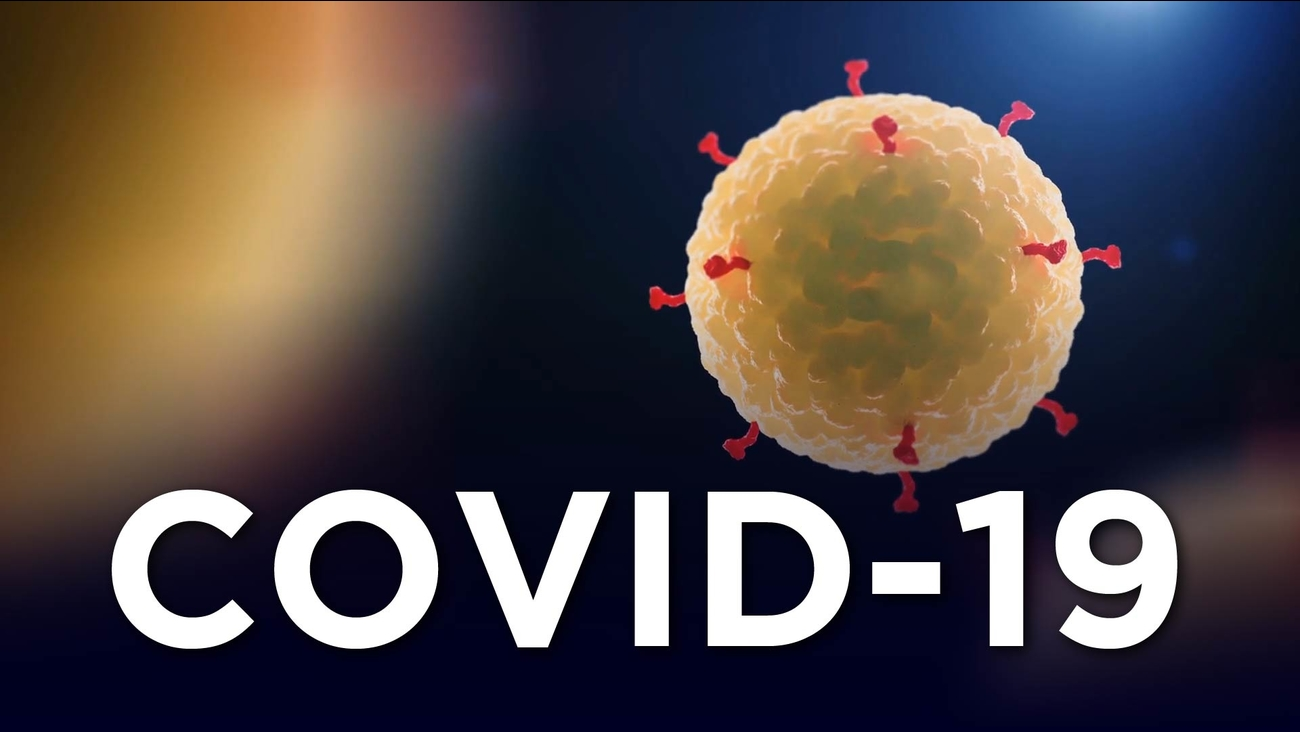
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**Chapter 1**

**Introduction**

**What is Covid-19?**

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COVID-19 also known as coronavirus disease 2019 or SARS-CoV-2 can be said to be an illness which is caused by a novel coronavirus which was first identified amid an outbreak of respiratory illness cases in Wuhan City, Hubei Province, China.It was then made known to the WHO(World Health Organization) on December 31, 2019 and later on by January 30, 2020, the World Health Organization declared the COVID-19 outbreak a global health emergency.On March 11, 2020, the WHO declared COVID-19 a global pandemic.Illness caused by SARS-CoV-2 was recently termed COVID-19 by the WHO, the new acronym derived from "coronavirus disease 2019." The name was chosen to avoid stigmatizing the virus's origins in terms of populations, geography, or animal associations. On February 11, 2020, the Coronavirus Study Group of the International Committee on Taxonomy of Viruses issued a statement announcing an official designation for the novel virus: severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

The official first confirmed case of the COVIS-19 in Nigeria was announced on 27 February 2020, when an Italian citizen found in Lagos was found positive after testing for the virus which is caused by [SARS-CoV-2](https://en.wikipedia.org/wiki/Severe_acute_respiratory_syndrome_coronavirus_2). By 9 March 2020, another case of the virus was found in Ewekoro,Ogun State. This happened due to a Nigerian citizen having contact with the Italian citizen found with the virus in Lagos. On 28 January 2020, the [Federal government of Nigeria](https://en.wikipedia.org/wiki/Federal_government_of_Nigeria) assured citizens of the country of its readiness to strengthen surveillance at [five international airports](https://en.wikipedia.org/wiki/List_of_airports_in_Nigeria) in the country to prevent the spread of coronavirus. The government announced the airports as [Enugu](https://en.wikipedia.org/wiki/Enugu_State), [Lagos](https://en.wikipedia.org/wiki/Lagos_State), [Rivers](https://en.wikipedia.org/wiki/Rivers_State), [Kano](https://en.wikipedia.org/wiki/Kano_State) and the [FCT](https://en.wikipedia.org/wiki/Federal_Capital_Territory,_Nigeria). The [Nigeria Centre for Disease Control](https://en.wikipedia.org/wiki/Nigeria_Centre_for_Disease_Control) (NCDC) also announced the same day that they had already set up a coronavirus group and was ready to activate its incident system if any case emerged in Nigeria.

On 31 January 2020, following the [developments of COVID-19 pandemic in mainland China](https://en.wikipedia.org/wiki/2019%E2%80%9320_coronavirus_pandemic_in_mainland_China) and other countries worldwide, a coronavirus preparedness group was set up by the federal government to reduce the impact of the virus if it eventually spreads to the country. On the same day, the [World Health Organization](https://en.wikipedia.org/wiki/World_Health_Organization) listed Nigeria among other 13 African countries identified as high-risk for the spread of the virus.

The CDC(Center for Disease Control and Prevention) has confirmed that the situation may lead to a very large number of patients needing continuous medical attention, which will lead to overcrowded and overloaded hospitals and healthcare systems and a potential high number of deaths and people in need of hospitalization. The CDC advises that nonpharmaceutical interventions (NPIs) will serve as the most important response strategy in attempting to delay viral spread and to reduce disease impact.

The feasibility and implications of strategies for suppression and mitigation have been rigorously analyzed and are being encouraged or enforced by many governments in order to slow or halt viral transmission. Population-wide social distancing of the entire population plus other interventions (eg, home self-isolation, school and business closures) is strongly advised. These policies may be required for long periods to avoid rebound viral transmission.

According to the CDC, people who have a high probability of contracting the virus and getting infected include people that reside at areas where the virus has been located, healthcare workers like Doctors and Nurses who take care of the sick patients with the virus, travelers which are returning from a place where the virus has been located and people in close contact with infected persons. Person-to-person spread of SARS-CoV-2 has been reported severally in Nigeria.Individuals who believe they may have been exposed to SARS-CoV-2 should immediately contact their healthcare provider.

The CDC has also has also released recommendations for people who have a high risk of having COVID-19 complications which includes older people and people with underlying health conditions like lung disease,diabetes e.t.c. These following people should consider the following instructions:

* Stock up on supplies.
* Avoid close contact with sick people.
* Wash hands often.
* Stay home as much as possible in locations where COVID-19 is spreading.
* Develop a plan in case of illness.

**Signs and symptoms of COVID-19**

COVID-19 have ranged from mild symptoms to severe illness . Symptoms of the virus appear between 2 days -2 weeks after being exposed to the virus.A pooled analysis of 181 confirmed cases of COVID-19 outside Wuhan, China, found the mean incubation period to be 5.1 days and that 97.5% of individuals who developed symptoms did so within 11.5 days of infection.

Wu and McGoogan reported that, among 72,314 COVID-19 cases reported to the Chinese Center for disease Control and Prevention (CCDC), 81% were mild (absent or mild pneumonia), 14% were severe (hypoxia, dyspnea, >50% lung involvement within 24-48 hours), 5% were critical (shock, respiratory failure, multiorgan dysfunction), and 2.3% were fatal. In Nigeria by 6th of April, 2019, there were six new confirmed cases: two in [Kwara State](https://en.wikipedia.org/wiki/Kwara_State), two in Edo State, one in Rivers State, and one in the FCT. This brings it to a total of 238 confirmed cases, 5 deaths and 35 recoveries. The highest number of virus cases in the country is recorded in Lagos where the virus first broke out with 120 confirmed cases, 2 deaths and 29 recoveries.

Common symptoms have included the following:

* Fever
* Cough
* Myalgia
* Fatigue

Less-common symptoms have included the following:

* Headache
* Sputum production
* Diarrhea
* Malaise
* Shortness of breath/dyspnea
* Respiratory distress

The most common serious manifestation of COVID-19 appears to be pneumonia.

A complete or partial loss of the sense of smell (anosmia) has been reported as a potential history finding in patients eventually diagnosed with COVID-19, but this has not been a distinguishing feature in published studies, so its clinical importance is questionable.

Symptoms in children with infection appear to be uncommon, although some children with severe COVID-19 have been reported.

Patients who do not require emergency care are encouraged to contact their healthcare provider over the phone. Patients with suspected COVID-19 who present to a healthcare facility should prompt infection-control measures. They should be evaluated in a private room with the door closed (an airborne infection isolation room is ideal) and asked to wear a surgical mask. All other standard contact and airborne precautions should be observed, and treating healthcare personnel should wear eye protection.

Till date there has been no antivirus cure which is recommended for the COVID-19. Infected patients therefore should have access to supportive health care to help alleviate symptoms.Vital organ function should be supported in severe cases.No vaccine is currently available for SARS-CoV-2. Avoidance is the principal method of staying free from the virus.

**How is COVID-19 transmitted?**

Transmission is believed to occur via respiratory droplets from coughing and sneezing, as with other respiratory pathogens, including [influenza](https://reference.medscape.com/article/219557-overview) and [rhinovirus](https://reference.medscape.com/article/227820-overview).Virus released in respiratory secretions can infect other individuals via direct contact with mucous membranes. Droplets usually cannot travel more than 6 feet. The virus can also persist on surfaces to varying durations and degrees of infectivity. One study found that SARS-CoV-2 remained detectable for up to 72 hours on some surfaces despite decreasing infectivity over time. Notably, the study reported that no viable SARS-CoV-2 was measured after 4 hours on copper or after 24 hours on cardboard.

The duration of viral shedding varies significantly and may depend on severity. Among 137 survivors of COVID-19, viral shedding based on testing of oropharyngeal samples ranged from 8-37 days, with a median of 20 days. ] A different study found that repeated viral RNA tests using nasopharyngeal swabs were negative in 90% of cases among 21 patients with mild illness, whereas results were positive for longer durations in patients with severe COVID-19.

Data have suggested that asymptomatic patients are still able to transmit infection. This raises concerns for the effectiveness of isolation.Zou et al followed viral expression through infection via nasal and throat swabs in a small cohort of patients. They found increases in viral loads at the time that the patients become symptomatic. One patient never developed symptoms but was shedding virus beginning at day 7 after presumed infection.

**What to look out for**

Risk factors for severe COVID-19 include (but are not limited to) the following:

* Advanced age
* Immunocompromised state
* Diabetes
* Cardiovascular disease
* Hypertension
* Chronic pulmonary disease
* Chronic renal disease
* Liver disease
* Malignancy
* Severe obesity

Early in the outbreak, one patient with COVID-19 (a 61-year-old man with an underlying abdominal tumor and [cirrhosis](https://reference.medscape.com/article/185856-overview)) was admitted with severe [pneumonia](https://reference.medscape.com/article/300455-overview) and [respiratory failure](https://reference.medscape.com/article/167981-overview). Complications of infection included severe pneumonia, [septic shock](https://reference.medscape.com/article/168402-overview), [acute respiratory distress syndrome](https://reference.medscape.com/article/165139-overview) (ARDS), and multiorgan failure, resulting in death.

A complete or partial loss of the sense of smell (anosmia) has been reported as a potential history finding in patients eventually diagnosed with COVID-19, but this has not been a distinguishing feature in published studies, so its clinical importance is questionable.

**What is Environmental Health?**

Environment can be defined as everything that is around us and It can be classified into living or non-living things. The environment includes physical, chemicals and other natural forces. Us Living things that inhabit an environment constantly interact with it and change with respect to the conditions in the environment. Environmental health in the cambridge dictionary is defined as the [activity](https://dictionary.cambridge.org/dictionary/english/activity) of [trying](https://dictionary.cambridge.org/dictionary/english/trying) to [prevent](https://dictionary.cambridge.org/dictionary/english/prevent) or [protect](https://dictionary.cambridge.org/dictionary/english/protect) against things that might [harm](https://dictionary.cambridge.org/dictionary/english/harm) people's [health](https://dictionary.cambridge.org/dictionary/english/health) in the [places](https://dictionary.cambridge.org/dictionary/english/place) where they [work](https://dictionary.cambridge.org/dictionary/english/work) and [live](https://dictionary.cambridge.org/dictionary/english/live) This involves understanding the impacts of environmental and human-made hazards and protecting human health and ecological systems against these hazards. The study of the impacts of human-made chemicals on wildlife or human health, as well as how the environment influences the spread of diseases is an important factor for environmental health.The health situation in Nigeria is similar to that in many other countries, where insufficient funding is allocated to environmental health and universal healthcare and people suffer as a consequence.

**Importance of Environmental Health?**

* Environment plays an important role in the healthy living of human beings.
* It matters because it is the only home that humans have, and it provides air, food, and other needs.
* Humanity's entire life support system depends on the well-being of all the environmental factors.
* Environment plays an important role in regulating air and climate.
* Another reason the environment is so important is because it is a source of natural beauty, and it is necessary for proper physical and mental health too.

**What is Economic Sustainability?**

Economic sustainability are practices that support economic growth for a long-term without having any negative impact on the social, environmental, and cultural aspects of the community. It can also be defined as the maintenance and sustenance of a high real growth rate of the economy to achieve the development or economic objectives. The importance of the environment to man and every other living creature cannot be over-emphasized. The environment is an essential part of man’s existence and human beings are at the centre of concern for environmental sustainability. Economic sustainability forms an important component of sustainable development. Economic sustainability. Despite the huge resources in Nigeria, the country ranks low in economic performance. Nigeria has not been able to maintain the growth rate necessary to reduce poverty. Nigeria suffers from lack of balanced development where economic, social and environmental dimensions are given due consideration for long term sustainable development.

**Goals of Economic Sustainability**

The goals for economic sustainability include:

* The end of poverty and hunger
* Better standards of education and healthcare - particularly as it pertains to water quality and better sanitation
* Sustainable economic growth while promoting jobs and stronger economies
* All of the above and more while tackling the effects of [climate change](https://www.environmentalscience.org/history-climate-change), pollution and other environmental factors that can harm and do harm people's health, livelihoods and lives.
* Sustainability to include health of the land, air and sea

**Chapter 2**

**Literary Review**

**Effects of COVID-19 on Environmental health?**

Covid-19 has had both positive and negative effects on the environmental heatlh.Here are some of the effects of COVID-19 on our planet:

1. Since all planes have been grounded, all forms of events including sports have been canceled and factories in charge of production have been shut down. The coronavirus has in fact affected the world economy.
2. With the unexpected fall in greenhouse gas emissions in industrial countries has been seen as a positive impact of the virus on the environment. As Industries, transport networks and businesses have closed down, it has brought a sudden drop in carbon emissions. Compared with this time last year, levels of [pollution in New York have reduced by nearly 50% because of measures to contain the virus](https://www.bbc.com/news/science-environment-51944780). In China, [emissions fell 25% at the start of the year](https://www.carbonbrief.org/analysis-coronavirus-has-temporarily-reduced-chinas-co2-emissions-by-a-quarter) as people were instructed to stay at home, factories shuttered and [coal use fell by 40% at China’s six largest power plants since the last quarter of 2019](https://www.axios.com/coronavirus-china-carbon-emissions-3453d9a1-1ae9-4789-8a41-3ed257946dbd.html). The proportion of days with “good quality air” was up 11.4% compared with the same time last year in 337 cities across China, according to its Ministry of Ecology and Environment. In Europe, satellite images show [nitrogen dioxide (NO2) emissions fading away over northern Italy](https://www.esa.int/ESA_Multimedia/Videos/2020/03/Coronavirus_nitrogen_dioxide_emissions_drop_over_Italy). A similar story is playing out in [Spain](https://english.elpais.com/society/2020-03-24/pollution-in-spain-falls-to-record-lows-under-coronavirus-lockdown.html) and [the UK](https://www.standard.co.uk/news/uk/pollution-falling-uk-coronavirus-lockdown-a4396051.html).
3. The UN has brought the attention of the public to facts that around 2.2 billion people have no access to drinking water and that up to 4.2 billion which makes up to half of the world population or more are deprived of safe methods of sanitation.
4. With the aim of controlling the spread of Covid-19, and hopefully reducing the death toll. The streets of most world countries like Wuhan, China, are deserted after authorities implemented a strict lockdown. In Italy, the most [extensive travel restrictions](https://www.bbc.co.uk/news/world-51737226) have been in place since World War Two. Flights worldwide have been cancelled due to this the aviation industry buckled.Everyone has been told to stay at home, practicing social distancing and are told to work remotely if necessary.
5. At the time of writing this paper the global deaths from the virus had passed 190,000, with more than 1,700,000 cases confirmed worldwide as well as the toll of early deaths.
6. Unemployment is reaching record highs and trillions have been pledged by governments to help restore their economies.The effects of economic downturn and quarantine have hit the poor the hardest - those that do not have access to unemployment insurance, those who live paycheck to paycheck, and those who do not have social safety nets bear the economic brunt of the crisis.Accepting the deaths of the vulnerable and extreme restrictions on everyday life is not a realistic or reliable way to fight climate change.

**Effects of COVID-19 on Economic Sustainability?**

There is little doubt that the pandemic will result in a very large cut in international trade as a result of falling global demand, both for consumption as well for investments. Sectors such as travel, tourism and construction would be particularly hard hit.There may be some recovery as Governments in the USA and Europe launch expansionary fiscal and monetary interventions to counter the expected recession, but the positive impact of these interventions on international trade may be limited.A key factor is that expansionary measures would likely favor domestic production and employment. In particular, Government support funds would be focused on employment intensive activities which have been hardest hit, such as the retail trade, catering and entertainment – which have limited import needs. Trade will also be affected by changes in production patterns. Over the last two decades the thrust for improved efficiency and productivity has driven manufacturing, as well as many service industries, towards minimizing costs.Two key elements of this have been just in time delivery which meant firms holding minimum stocks and inventories; and outsourcing to reduce costs, which meant long supply chains. The crisis has brought to the fore the vulnerability of both these processes.With disrupted supply chains and low stocks, firms are already finding it hard to maintain operations. As time goes on, supply shortages will become a major constraint in Europe and the USA. As firms make future investment decisions in the post-COVID world, diversifying risk is something that they will be obsessed with and this will mean a strong push to reduce dependence on suppliers in other countries. The countries most likely to be hit hardest by the changing international trade patterns are China and India, who are major suppliers of components and services to the international markets.However, a number of other countries, irrespective of whether they are exporters of raw materials or finished good, from Vietnam to Bangladesh, and from Nigeria to Mexico, will suffer as a result of lower export revenues and balance of payments difficulties. These trade problems will be exacerbated by developments on the monetary side. Falling sales and liquidity shortages are beginning to hit companies around the world. Many risk having to lay off workers or even close down completely.Central banks everywhere are trying to push money into the system and cut interest rates. However, its impact may be limited in the USA and Europe where base interest rates are already close to zero, and further cuts may not be enough to overcome pessimistic market sentiments.

Nevertheless, banks and other lenders may maintain or expand lending as a result of Government guarantees or pressure, or a combination of the two. However, they will almost certainly curtail lending to firms in developing countries who may see even normal lines of credit being restricted and foreign direct investments drying up.The combination of trade and monetary problems emanating from Europe and the USA will put severe strain on Governments in developing countries which are already battling with soaring medical costs, pressing demands to provide emergency assistance to the poorest sections of the population, and assistance to bail out faltering firms. It will also put tremendous pressures on banks and firms in these countries. With their backs to the wall, there is a serious risk of defaults. External debts of developing countries, by both Government and the private sector, have risen sharply in the last decade as a result of low interest rates, high commodity prices and availability of credit due to quantitative easing by developed countries.For middle and low-income countries external debt (excluding China) now stands at around US$6 trillion – more than the combined GDP of France and UK. The poorest countries (those with Gross National Income per capita of below US$1,175) have doubled external debt since 2008.A World Bank report issued late last year pointed out their debt-vulnerability and stated that “with increased access to international capital markets, many low- and middle-income countries shifted away from traditional sources of financing and experienced a sharp rise in external debt, raising new concerns about sustainability”.If, due to problems caused by the COVID-19 crisis, there is widespread defaults among poor countries this would pose serious problems for the global economy. It is therefore imperative that requests for debt forgiveness or rescheduling do not fall on deaf ears.

**Strategies as a Civil Engineer which will help maintain economic stability and environmental health.**

Steps that can be taken by civil engineers to maintain economic stability and environmental health include:

1. Water supply to remote areas:

Globally, the use of improved drinking water sources increased from 76 percent in 1990 to 91 percent in 2015 ([WHO and UNICEF 2015b](https://www.ncbi.nlm.nih.gov/books/NBK525207/#)). As of 2015, 663 million people still used unimproved water sources, compared to 1.3 billion in 1990; 2.6 billion people have gained access to improved water since 1990. Rural dwellers remain unserved compared with urban dwellers (16 percent and 4 percent, respectively). In Sub-Saharan Africa, 44 percent of rural dwellers continue to use an unimproved water supply. Water hauling costs Sub-Saharan Africans, especially women, billions of hours each year. In 2008, more than 25 percent of the population in several Sub-Saharan African countries spent more than 30 minutes to make one round trip to collect water; 72 percent of the burden for collecting water fell on women (64 percent) and girls (8 percent), compared with men (24 percent) and boys (4 percent) ([WHO and UNICEF 2010](https://www.ncbi.nlm.nih.gov/books/NBK525207/#)). With this information it can be seen that lack of water supply has plagued rural areas and therefore leaves them prone to virus infection as they do not have adequate clean and uninfected water to wash their hands if in contact with the virus. This will cause spreading of the virus as them also with unclean hands will touch other members of the rural areas which will therefore lead to exposing all of them to it.This will cause much problem to the environmental health of such regions.Civil engineers can play a major role in helping the people in these areas have access to water by creating water supply channels by using any of these methods below:

* Bucket Pumps: In this arrangement, small buckets are attached to an endless chain. The chain is rotated on sprockets using a handle. As the buckets move down and dip into water, they get filled. Further rotation brings to the top and to run around the sprocket, as they empty into a collection trough attached with a pipe.
* Groundwater-based Water Supply Systems: Among the various sources of supply, groundwater is by far the most practicable choice. Groundwater can be extracted either from perennial springs or from open wells/tube wells, as they normally yield safe drinking water in rural areas. Exceptions are areas of fissured limestone where groundwater may be contaminated by intrusion of surface runoff. In areas where groundwater is available at moderate depths, constructing a number of wells fitted with hand operated pumps is by far the cheapest means of providing a good water supply.
* Ground Catchment and Storage: By appropriately preparing a piece of surface on ground, it can be used as a catchment for harvesting rainwater for small communities. Part of the rainfall will serve to wet the ground or get lost due to evaporation or infiltration. A considerable reduction in such losses can be attained by making the catchment surface smooth and impervious using clay, tiles, asphalt or plastic sheets
* Roof Catchment and Storage: Rainwater with reasonable qualities can be collected using rooftop areas that can be stored to provide individual households in rural areas with adequate water supplies. By directing the rainfall on the roof areas to flow through simple collection gutter arrangements, water that would otherwise join surface run-off can be gainfully utilized. Roofs made of tiles, slates, corrugated iron/tin or asbestos sheets are more suitable.

If any of these are put in place in such areas where water supply is low it will help to provide them with a means of staying clean and will lead to prevention of virus spreading.

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1. Cleaning of water supply for remote areas:

Cleaning of wastewater will help to combat the low amount of water available in such areas and will also help in the improvement in their environmental health. Since the beginning of collective societies, people have struggled to find solutions to the removal of wastewater produced by human actions. The overall goal of treating wastewater is to eliminate harmful bacteria, chemicals, and virulent toxins found in sewage. Engineering technologies have now progressed to the point where wastewater can be converted into clean water that is suitable for discharge back into the environment. The technology civil engineers have developed has progressively gotten more efficient, and the process of converting wastewater into clean water can be divided into three basic categories.

* Physical Wastewater Treatment: Physical wastewater treatment relies on natural physical forces like gravity and electrical attractions to separate harmful substances from water. Physical barriers can also be used to filter out solid masses floating in the water. Some examples of physical wastewater treatment include sedimentation, flotation, and adsorption.
* Chemical Wastewater Treatment: Chemical wastewater treatment requires the use of chemical solutions to treat wastewater, such as chemical precipitation, neutralization, and disinfection using chlorine, ozone, and ultraviolet light.
* Biological Wastewater Treatment: This treatment process utilizes a bioreactor to allow bacteria, algae, and fungi to transform organic matter within wastewater into energy. This process of bioconversion relies on biological oxidation and biosynthesis, which does leave some end products that must be discharged, like minerals.

1. Creation of job opportunities:

The economic and labour crisis created by the COVID-19 pandemic could increase global unemployment by almost 25 million, according to a new assessment that calls for urgent, large-scale and coordinated measures across three pillars: protecting workers in the workplace, stimulating the economy and employment, and supporting jobs and incomes. Civil Engineers should help by creating more employment opportunities that will keep the people of the country on their feet. By the International Labour Organization (ILO).These measures include extending social protection, supporting employment retention (i.e. short-time work, paid leave, other subsidies), and financial and tax relief, including for micro, small and medium-sized enterprises. In addition, the note proposes fiscal and monetary policy measures, and lending and financial support for specific economic sectors.

1. Creation of awareness:

In this COVID-19 pandemic, timely access to accurate information can be the difference between life and death. The stakes are high in developing countries like Nigeria where millions of people have limited access to information because of low media access, insufficient internet penetration, illiteracy, and language diversity. If awareness of the virus can be spread through our Civil Engineering organization by passing information to our business partners and colleagues about the virus and from there give reason to them to spread the information to the public. It will help to keep people updated on what is happening about the virus and how best to stay safe. This awareness will help to reduce the number of deaths as people will be more aware of what is going on and take a lot more precautions to stay safe.

**Conclusion**

In conclusion COVID-19 has posed a great threat to civilization as we know it. It will take the intervention of engineers, doctors and other professionals and specialists to be able to strategically tackle this virus without letting it damage our environment and crumble the economic sustainability of all people of Nigeria and the people of the world. As no cure has been created yet at the writing of this paper it is best to prevent exposure to the virus and this is best done by awareness and self isolation. I strongly believe if some of the strategies given in this report are put in place,there will be an improvement of the situation of the world.

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