Quantifying the Effect of Covid 19 on Environment Based on Human Activity Change

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Introduction

Problem Statement

During the covid-19 period , there was locked down implemented by government to curb the spread of this diseases and virus killing majority of citizen. With effect to this, A lockdown was poised to individuals and country at large. Economic activities stopped, leading to poor GDP for most country and hunger is struggling countries.

However, despite all this, nature happens to be recuperating, and the environment seems to be in its best moment of non-human involvement.

Solution

With an interlude in completion, this analysis attempts to **quantify** the effect of locked down imposed during covid on the environment and **relate** it with **human activities** and actions that can be effected to enable sustainable ecosystem similar to scenario presented during the lockdown period; but in an efficient way that won't increase hunger and lower **GDP** of starving nations.

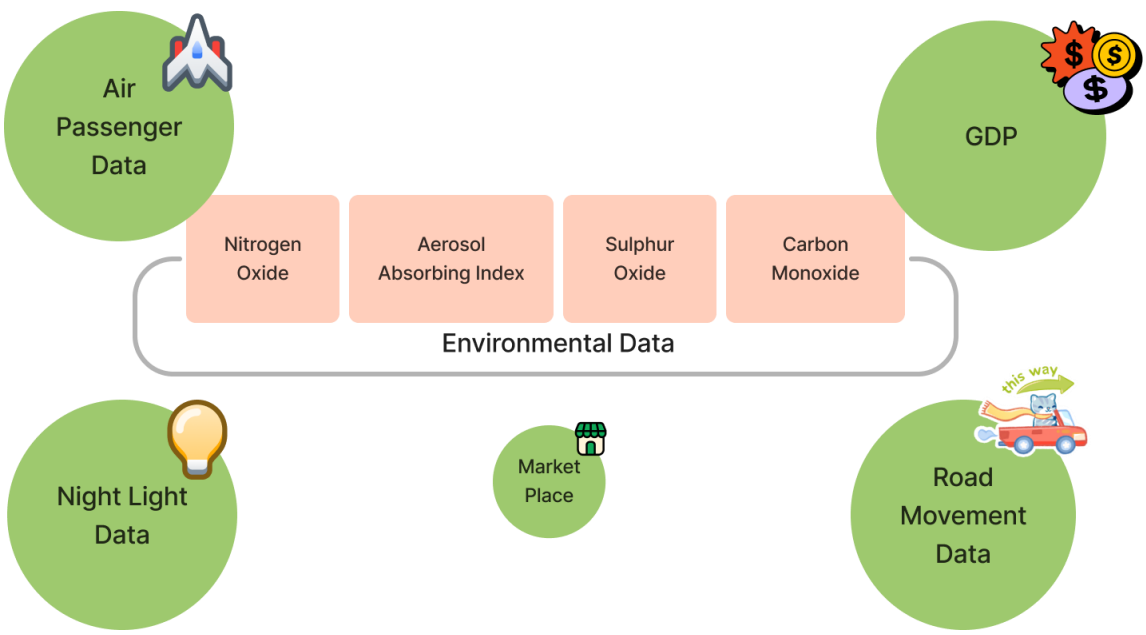
This analysis will correlate human activity and its effect with real-time data from climate, and satellite maps as well as identify possible areas of high emission and propose an technology that will still increase GDP.
This is targeted towards agencies and decision-makers to give them an idea in finding alternatives and investing in economical-friendly resources.

N/B: Lockdown Period – 30th March 2020 – 5th May 2020

Solution

Data Utilized in this Analysis:

- Environmental as such as NO2, Carbon Monoxide, sulphur oxide and Aerosol Absorbing Index from Sentinel 5-P extracted from Google's earth engine
- Road Transportation Movement (Google Mobility)
- Air Passenger Movement data from Nigeria Bureau of Statistics (NBS)
- GDP data from (NBS)
- Point of Interest (Market Place) from Google Map



Data Source Used

Data Collection/Walk Through

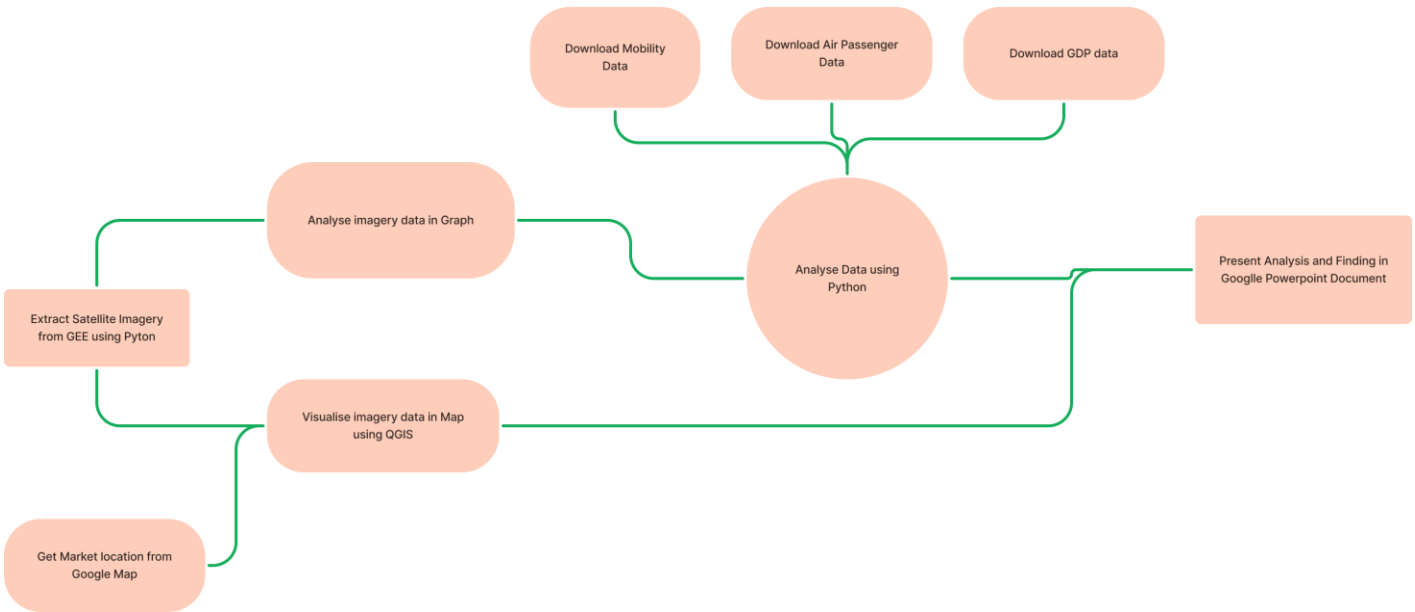
In this analysis, our focus area will be in Lagos Nigeria, the central economical hub of Nigeria. Choosing this location because of the huge economic impact business in Lagos has on the GDP in Nigeria and also the huge population poised in this location.

Considerably, road transportation movement was considered with respect to the environmental variable; with special interest In Nitrogen Oxide gas, because of huge influx of pollutant seen from mobile combustion in Lagos. And during the COVID-19 lockdowns, lagos communities were strict about stay at home during the day.

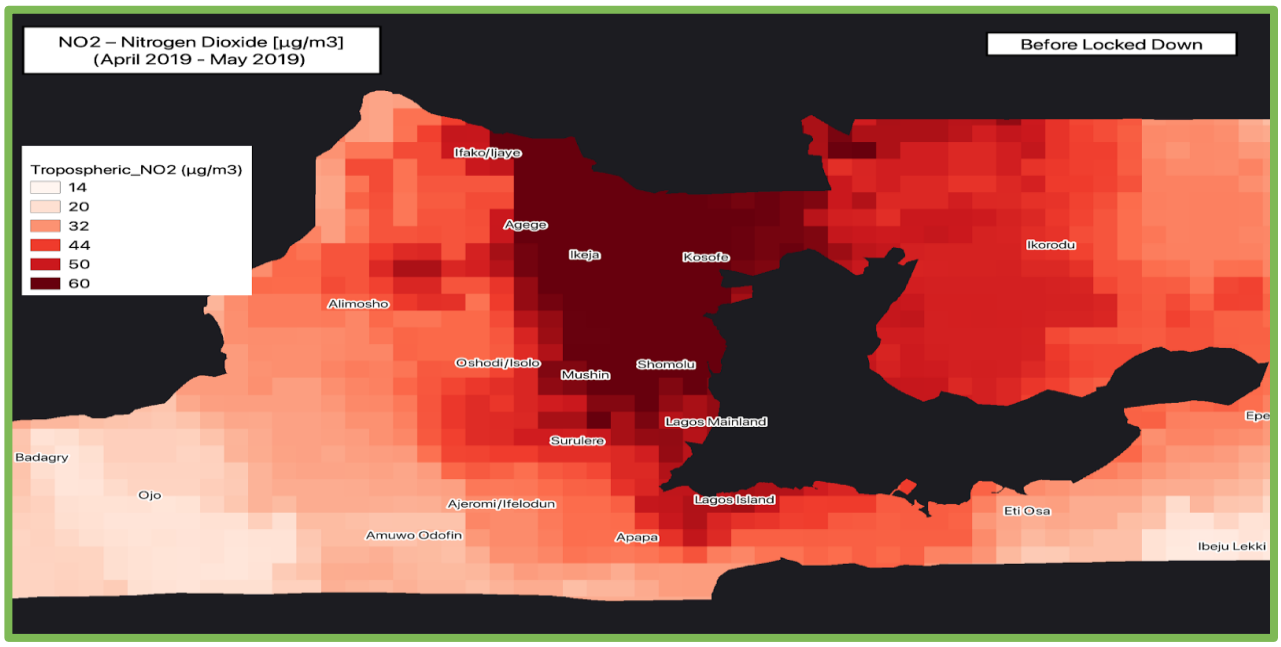
The analysis compare correlation between mobility data and No2 gas with the year 2019 -2021 in view of looking at the Impact during lockdown.

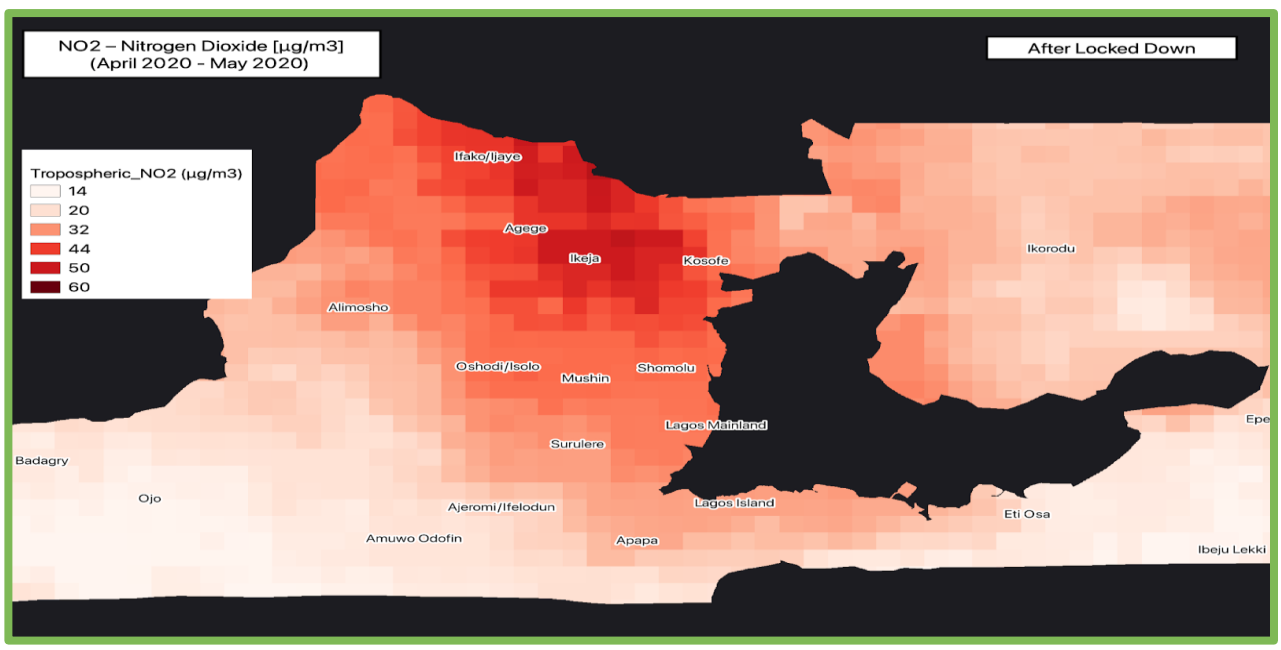
Cursory look on air passenger was done; and finally Nigeria GDP was compared during the period.

Process


Download Mobility Data
Download Air Passenger Data
Download GDP data
Analyse imagery data in Graph
Analyse Data using Python
Present Analysis and Finding in Googlle Powerpoint Document
Extract Satellite Imagery from GEE using Pyton
Visualise imagery data in Map using QGIS
Get Market location from Google Map

Analysis (Environmental Data)





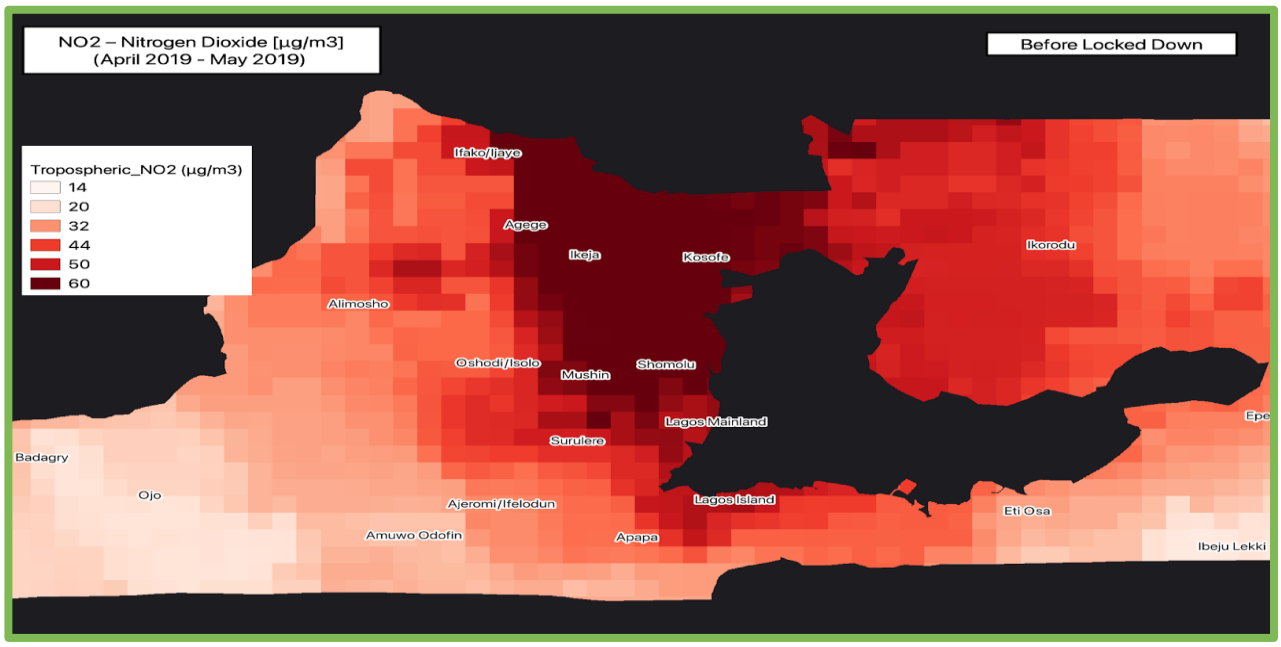
Environmental Data (NO2)

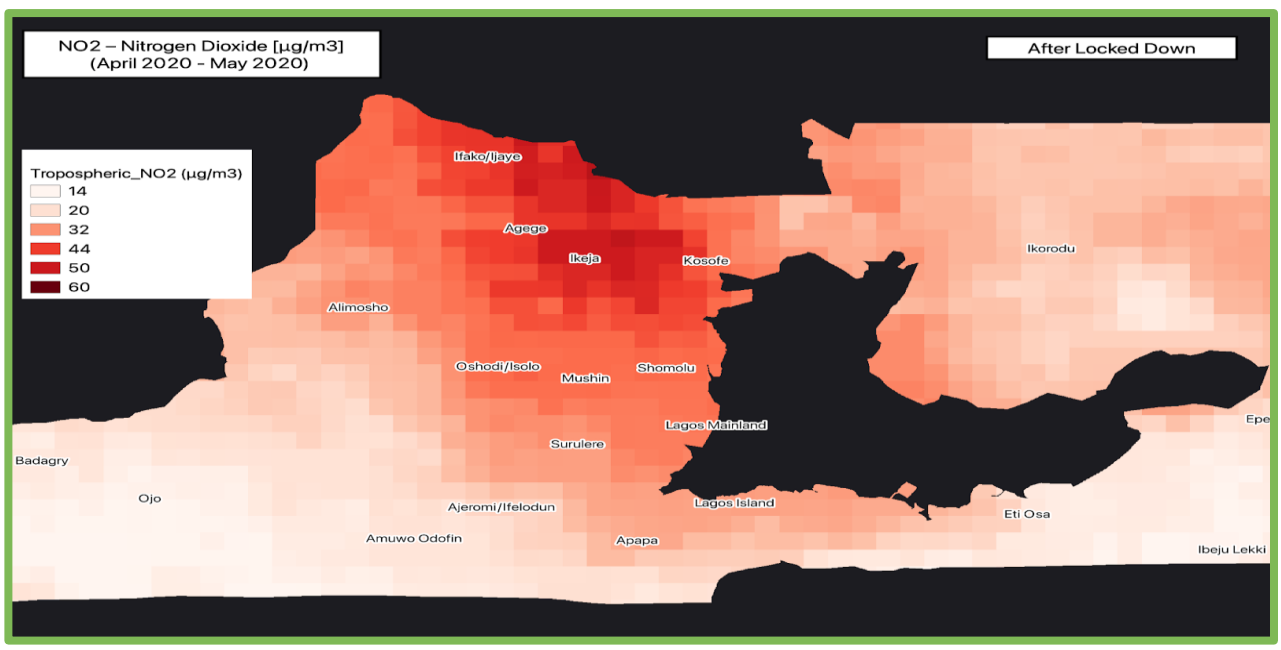
The map shows the decrease in Tropospheric NO2 across different locations in centre of Lagos, Nigeria in April 2019 – May2019 before lockdown; compared to April 2020 – May2020.

Data show how concentrations of NO2 — a pollutant mainly emitted by road transport — fell sharply in the centre city(**Ikeja**) of Lagos.

Areas that are known to have high traffic and high population experience a significant drop in nitrogen levels as shown in the map; see in **Apapa**, **Agege, Agege** before and during lockdown. **Ikeja** still experience high Tropospheric NO2 level but not high enough compared to what was experienced in the period before covid- 19 lockdown(2019).

Analysis (Environmental Data)





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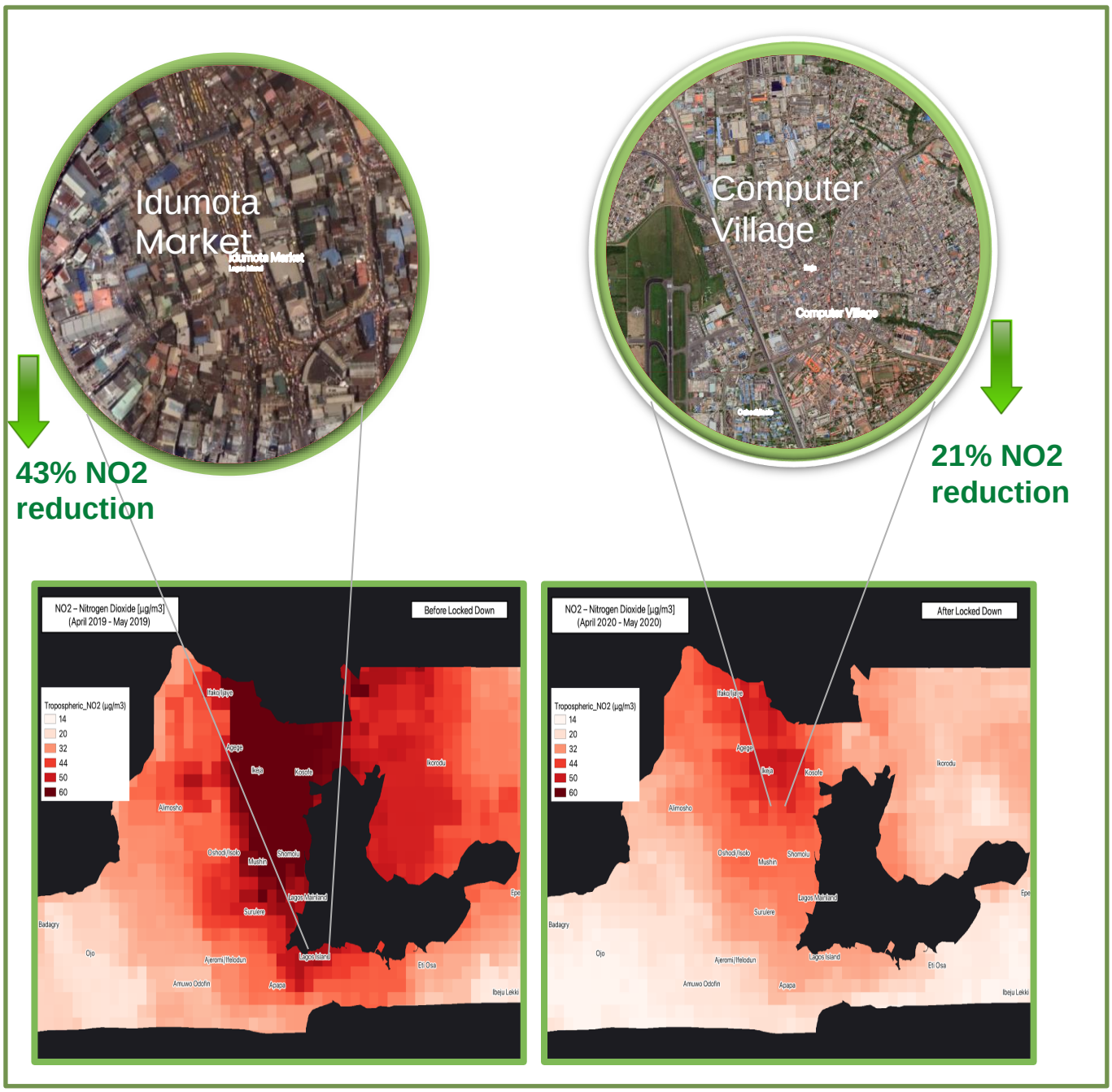


Selected areas

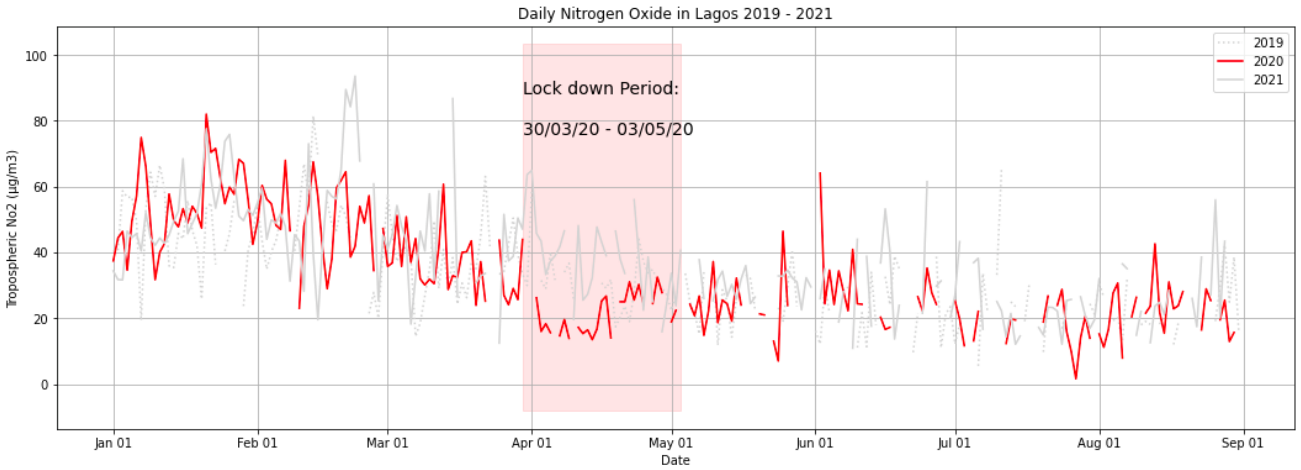
This are sample areas known to have high population as with high business and retail activity in Lagos shows a drop in the percentage of Nitrogen during the lockdown period.

Idumota Market is the one of the biggest market in Lagos Mainland; it shows **43%** decresase in No2 level; while Computer Village is the biggest market that sells gadgets and electronics in Lagos also experience drop in **21%** in No2.

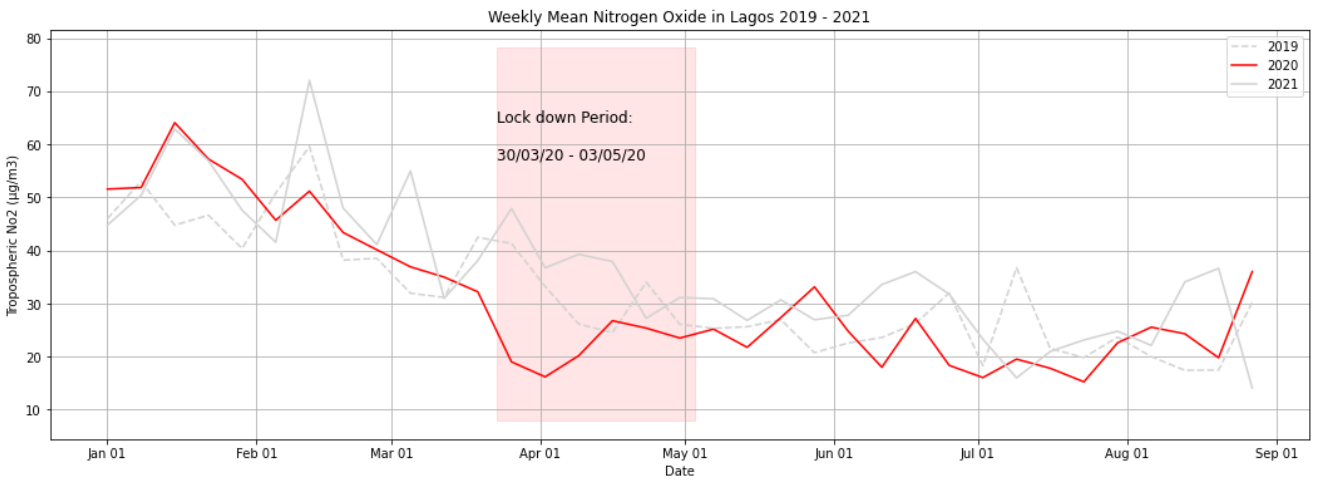
As there were not much commercial for retail during the covid lockdown; it is not suprising to see this drop in huge commercial location where there used to be more movement and motor transportation during Business period.

Analysis (Environmental Data)

No2 Data changes over time

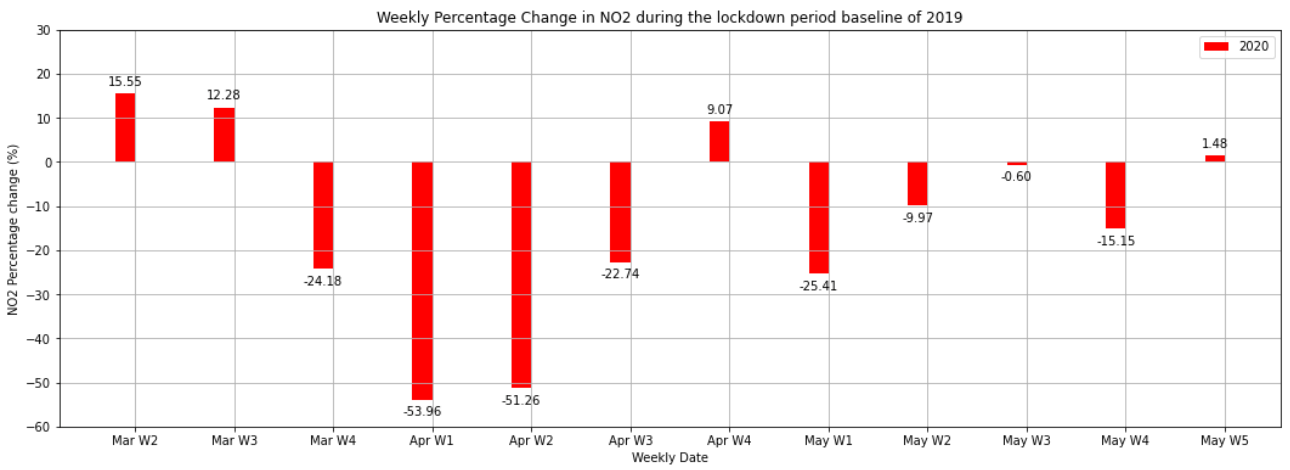


Daily NO2 with highlight on lockdown period.



Weekly NO2 with highlight on lockdown period.

During the locked down period, there has been as much as a **53%** decrease in No2 value in 2020 compared to 2019 for the same month.



Percentage change in NO2 during the lockdown period.

As seen in the graph the week following the lock down experienced a higher drop in NO2 value. It is possible that individuals during the 2nd week of the intense lockdown shown more resilient in staying home are the announced hike in contacted individual in Lagos, Nigeria.

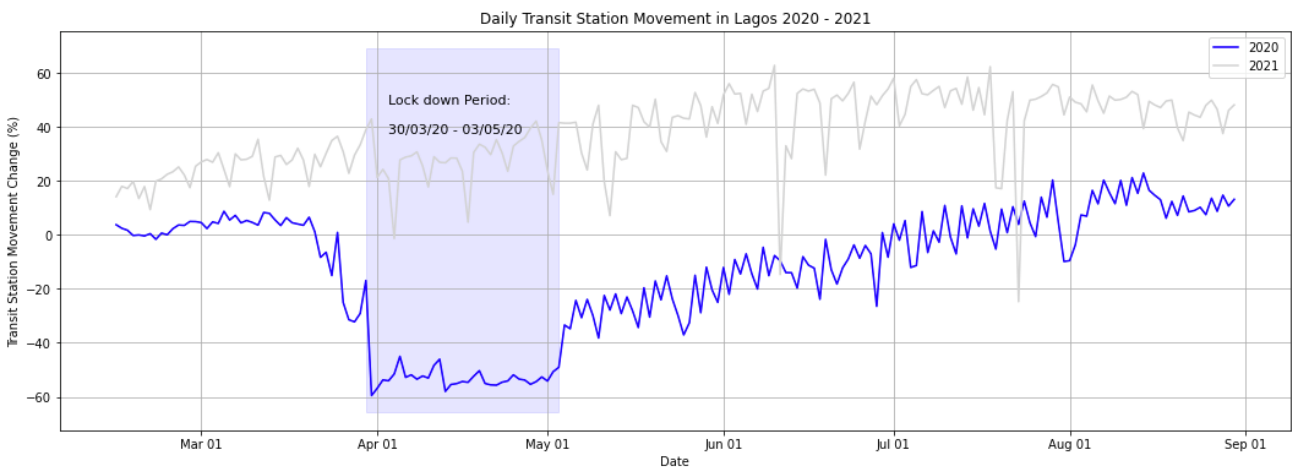
Analysis (Movement Data)

Road Transportation

So we have seen a decrease in nitrogen level; so what action effected this. Here we go to road movement data.

Why road?

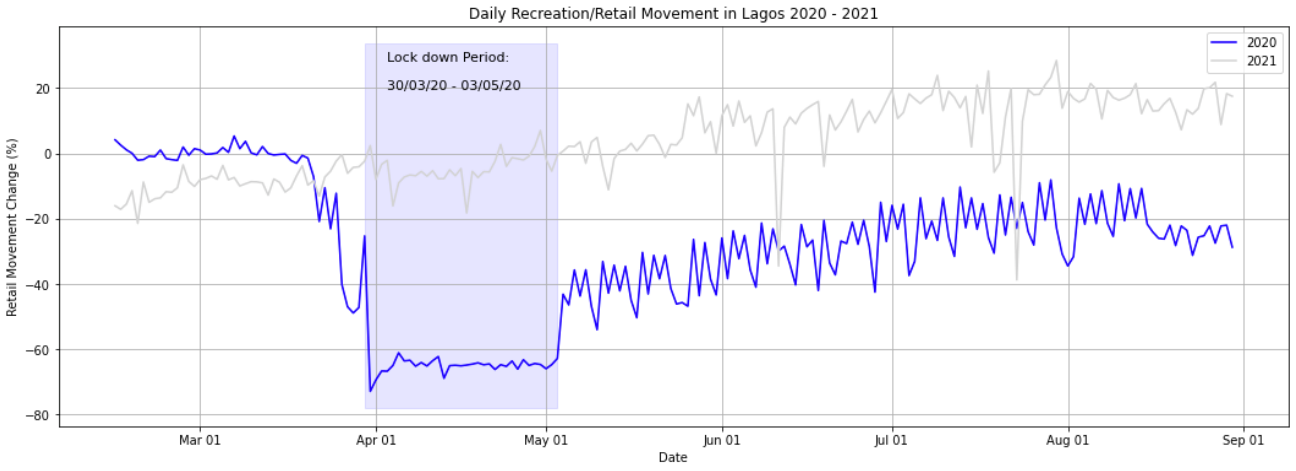
Road transport is the primary source of pollution in Lagos. Due to limited transportation option and the huge number of population in Lagos, commuting within Lagos takes longer time, and the average number of commute time is 4 hours; so what happens and how does it happen? With respect to this; since there was no movement in during lockdown lets see what data says about this.



Daily Transit Station Movement Change Lagos, Nigeria.

It was shown that movement and mobility in Lagos reduced as seen in google mobility data. As much as **60%** decrease on movement to Transit Station is seen during the lockdown period.

Our data, shows the drop in human mobility during the lockdown period of 30th March 2020 to 5th May 2020



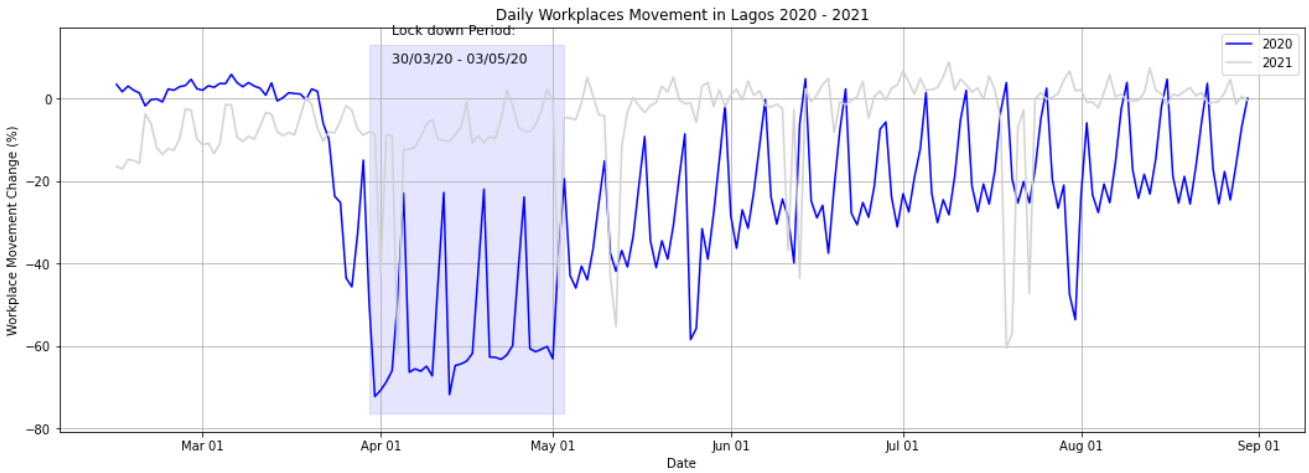
Daily Retail Movement Change Lagos, Nigeria.

Same with retail movement which is more prominent for business activity in Lagos, which drives transportation.

Analysis (Movement Data)

Road Transportation

Looking deeply, we see the workplace movement also drops but not significant as the Retail and bus stations.

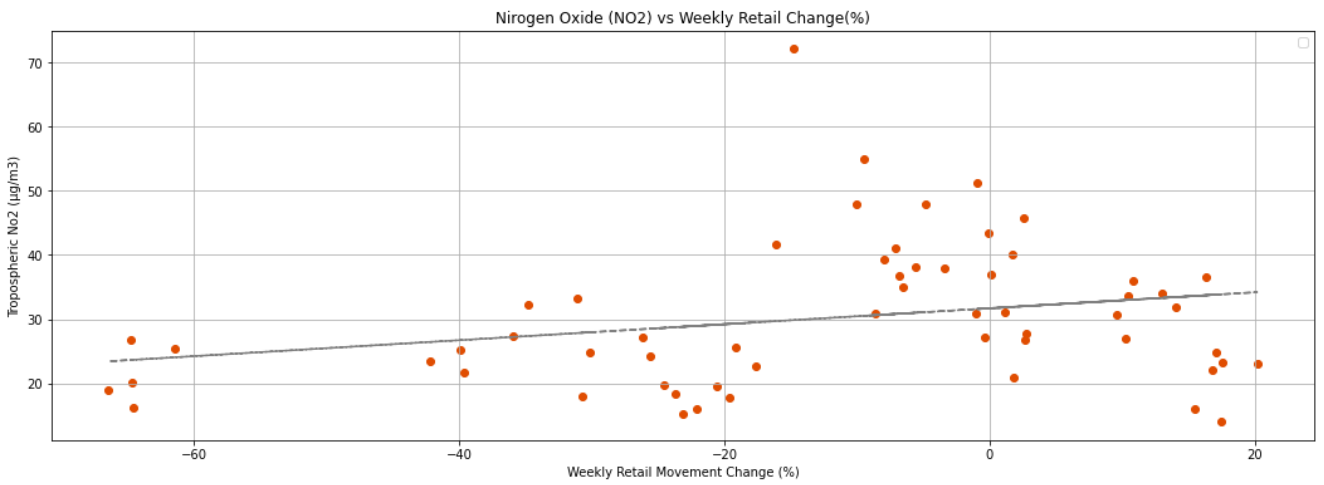


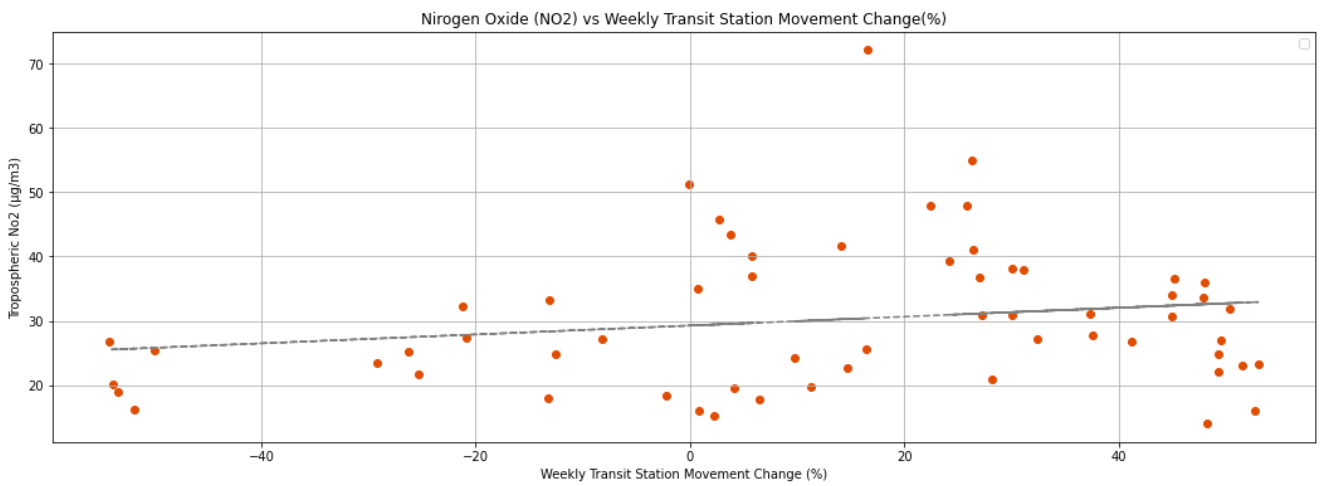
Daily Workplace Movement Change Lagos, Nigeria.

The drop in workplace ripples as workers in essential sector were allowed to move on with activities in Lagos and Nigeria. Owing to the difference in other Landmark.

Correlating Movement Data and NO2

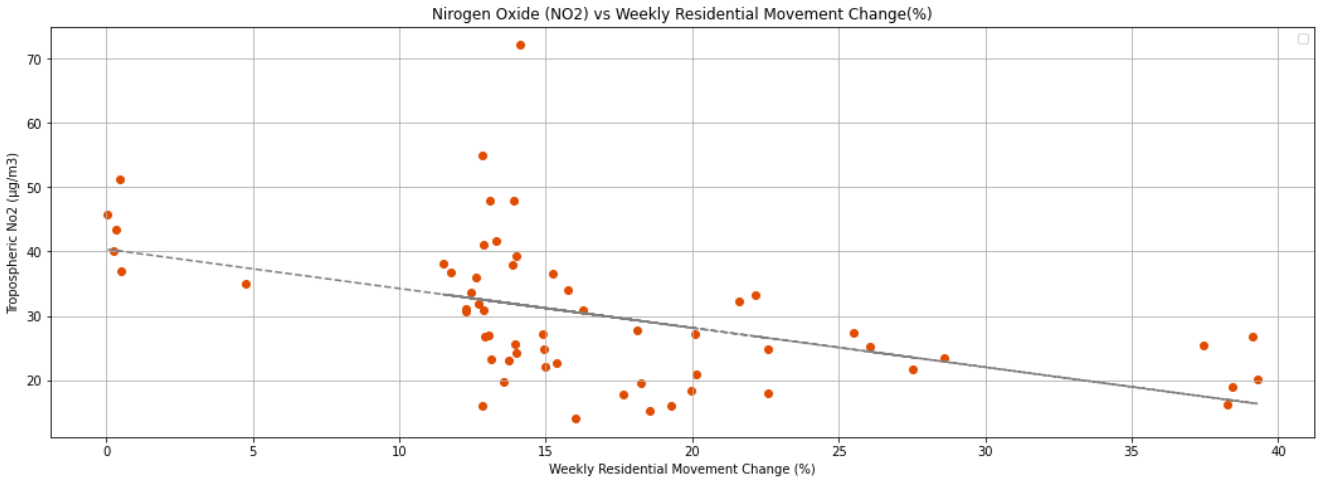
Basically we can see there is a strong drop in movement similar to what is experienced in the No2. Drawing a correlation of this with the 2019 covid period. We can see a strong correlation level with this data. There is a subtle straight line trend shown in the data.





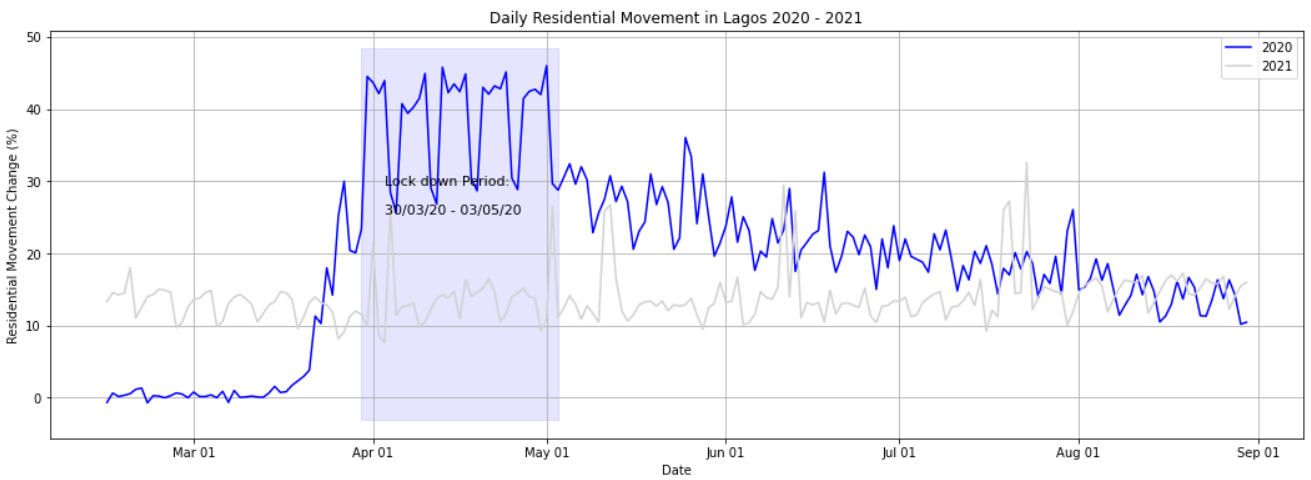
Analysis (Correlating Movement Data and NO2 Data)

Correlating Movement Data and NO2

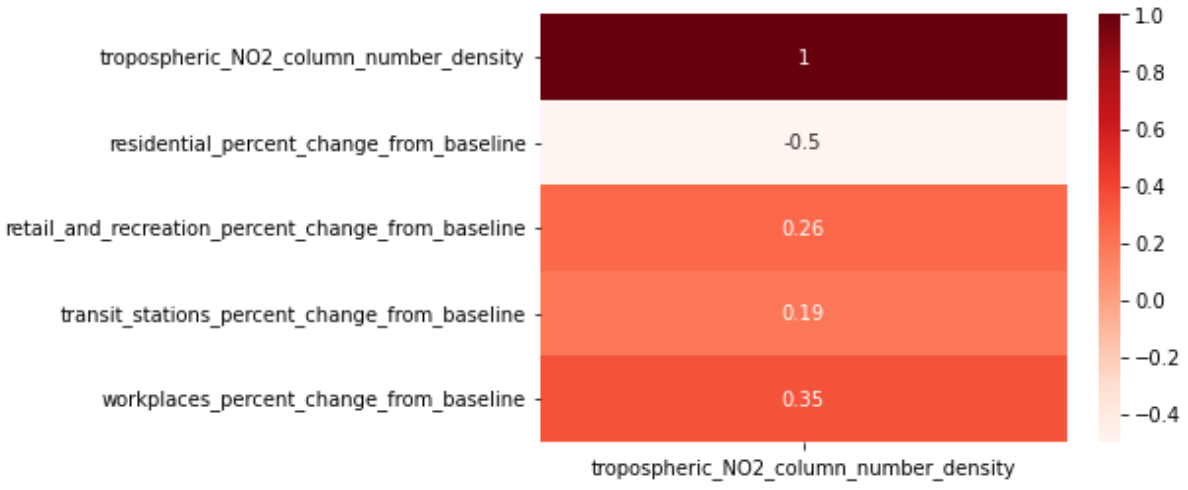


Relationship between NO2 and Residential Movement Change

Bringing in residential change, we see that the more individual tend to stay at home, we see a reduce in No2 value.



Daily Residential Movement Change Lagos, Nigeria.



Pearson correlation coefficient of Movement value and NO2

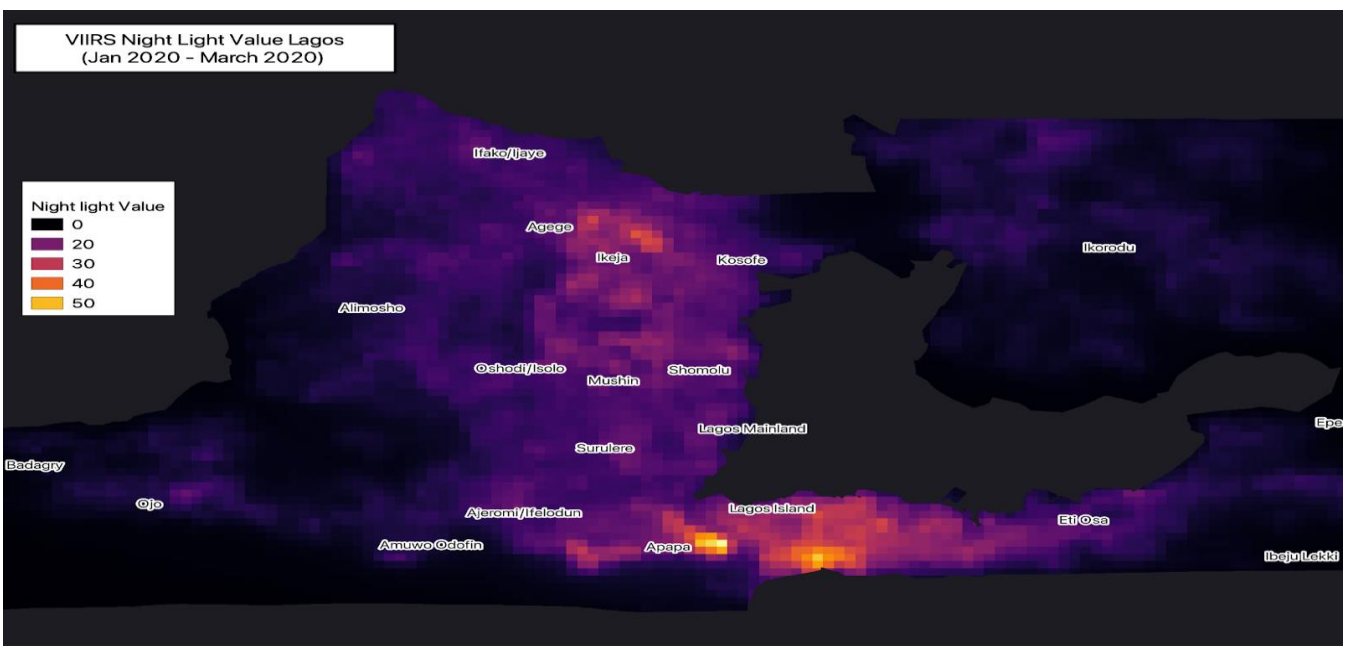
We can see a moderately high correlation with the Nitrogen Oxide level. A strong negative correlation of -**0.5** is observed in the residential movement change. While Workplaces, Retail and Transit station are hanging on **< 0.5** value.

Analysis (Night-light Data)

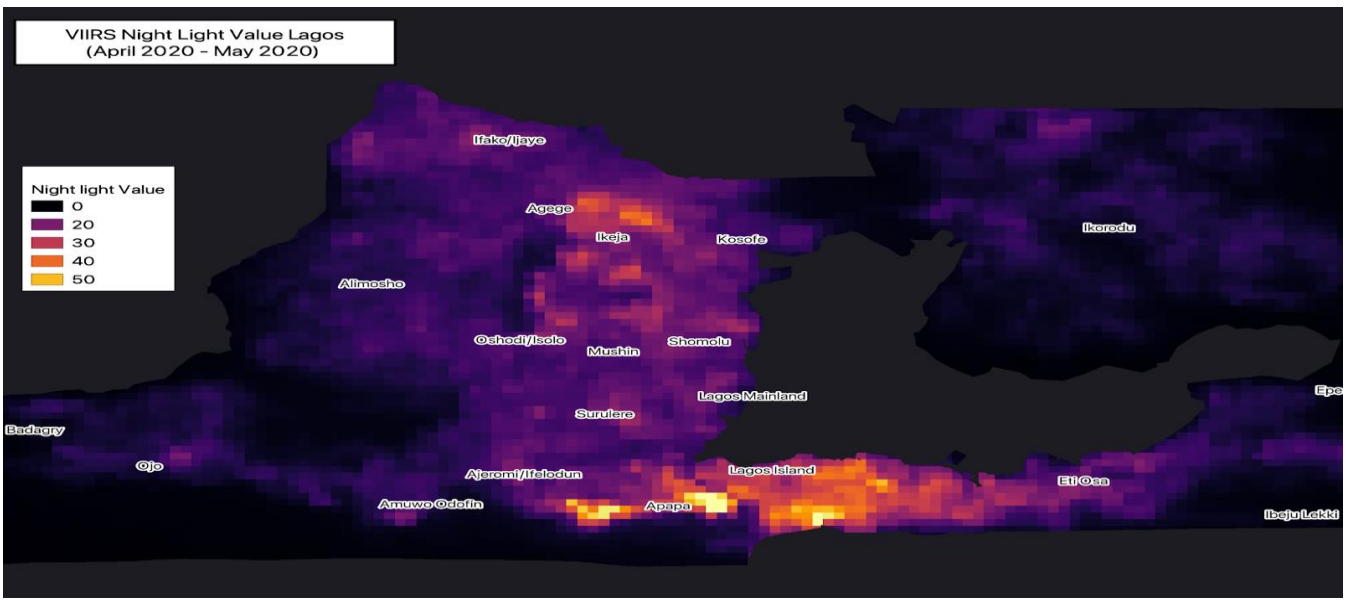
In overview, we can see that Road transportation proves a very high relationship with Pollutant of Nitrogen Oxide. A good alternative is the idea for more work from home.

However, staying at home might have its own side effect when living in Nigeria where the primary source of power is from the self-generation set.

Looking at the graph , we can see a high nightlight level in some places in Nigeria. In Apapa and Ikeja, Majorly location well known to combine residential and office location. Trying to quantify the overall effect of this; which show an overall increase in **15%** of night light value in Lagos. Our fear might be the use of self-generating set which produces combustion to the atmosphere.



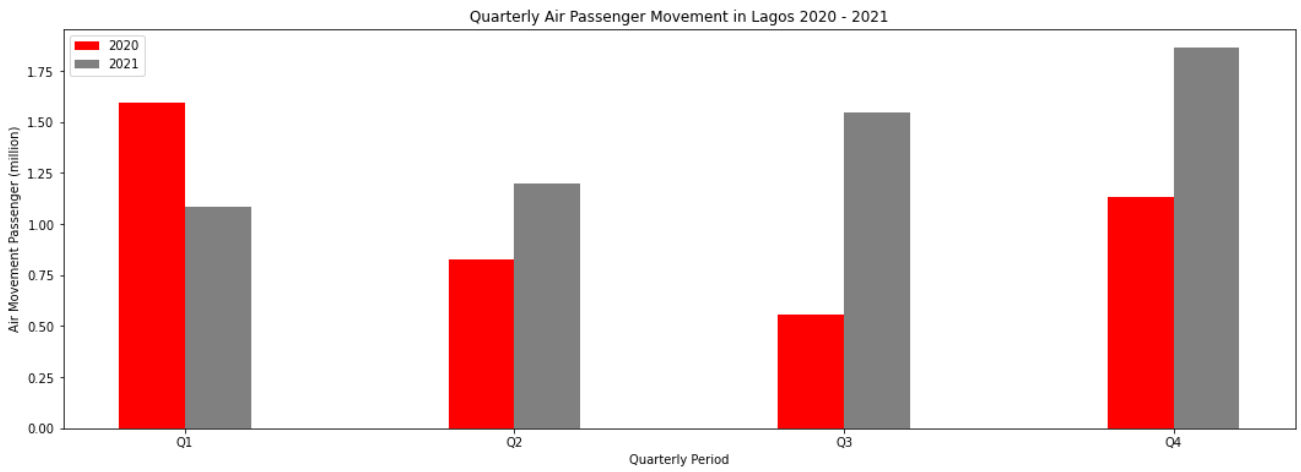
VIIRS Night light Value before Lockdown



VIIRS Night light Value during Lockdown

Analysis(Air Passenger Data)

More look into the air transportation; though there is no substantial data correlating air passenger and NO2 pollutant. With the data expantiating on this; we show the drop in the air passenger level in Q2 and Q3 of 2020 and 2021; .



Quartely Air Passenger Movement

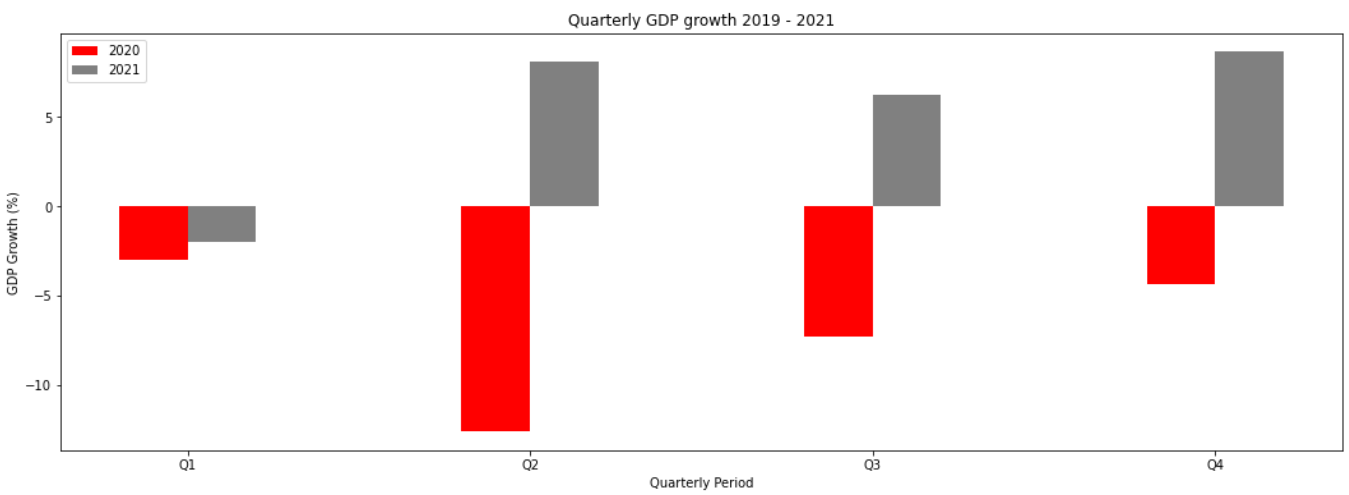
As shown in the image shown in diagram of NO2 change. we saw no significant drop in NO2 value compared to 2019. Hence; there was no means to escalate that air passenger has significant effect in affecting air pollution.

However, with further prop can be carried out with more detail data in aircraft movement compared to the quarterly aggregation.

Economical Data

Economically, what is actually going on. Again in this data is only available at quarterly level. We saw a drop in the GDP value in Q2 and Q3 ; also as much as 10% decrease in GDP.

Seeing that the lockdown really affected the economic situation of Nigeria; using Lagos as a location with viable economical activity been in halt during the locked down; shows to hinder the growth in the economy.



Quartely GDP growth Nigeria 2020 -201

Conculsion

However, there is an alternative to growing the economy and sustaining the environment by running a periodic stay at home.

If most corporation and the government allows stay at home at least once a week, this will help and result in atlease **40%** in the NO2 value generated by Transportation.

This will not crumble the economy as other areas in Agriculture can be invested since it portrayed large contribution to the GDP during the Q1 and Q2 period.

In addition; efforts need to be made to improve the Power situation so that stay at home won't increase more air combustion obtain form self-generating power set.

Improvement

Inorder to confirm how satellite imagery data on pollutant correlates with the air quality in the environment; there should be available air quality measurement station and data openly accessible at more strategic location around the country.

In addition, improving analyses to quantify air craft movement will be more variable with daily or weekly air craft movement compare to the quarterly provided by NBS

References

- Sentinel 5P Offline Nitrogen Dioxide https://developers.google.com/earth-engine/datasets/catalog/COPERNICUS_S5P_OFFL_L3_NO2
- Sentinel 5P Offline sulphur Oxide https://developers.google.com/earth-engine/datasets/catalog/COPERNICUS_S5P_OFFL_L3_NO2
- Sentinel 5P Offline Carbon Monoxide https://developers.google.com/earth-engine/datasets/catalog/COPERNICUS_S5P_OFFL_L3_NO2
- VIIRS Nighttime Imagery from https://developers.google.com/earth-engine/datasets/catalog/NOAA_VIIRS_DNB_MONTHLY_V1_VCMCFG
- GDP from https://www.nigerianstat.gov.ng
- Air Passenger from https://www.nigerianstat.gov.ng
- Google's Mobility Data https://www.google.com/covid19/mobility/
- Market Place Data https://www.google.com/maps
- How safe is the air we breathe https://www.ft.com/content/7d54cfb8-cea5-11e9-b018-ca4456540ea6

Thank You!