

# Problem Statement

HELP International as an international humanitarian NGO is committed to fighting poverty and providing the people of backward countries with basic amenities and relief during the time of disasters and natural calamities.

It runs a lot of operational projects from time to time along with advocacy drives to raise awareness as well as for funding purposes.

After the recent funding programmes which has raised around \$ 10 million, it is now required that the CEO of the NGO needs to decide how to use this money strategically and effectively where the countries that are in the direst need of aid (which is determined by Socio-economic and health factors) need to be chosen with the help of Analysts.

# Analysis Approach

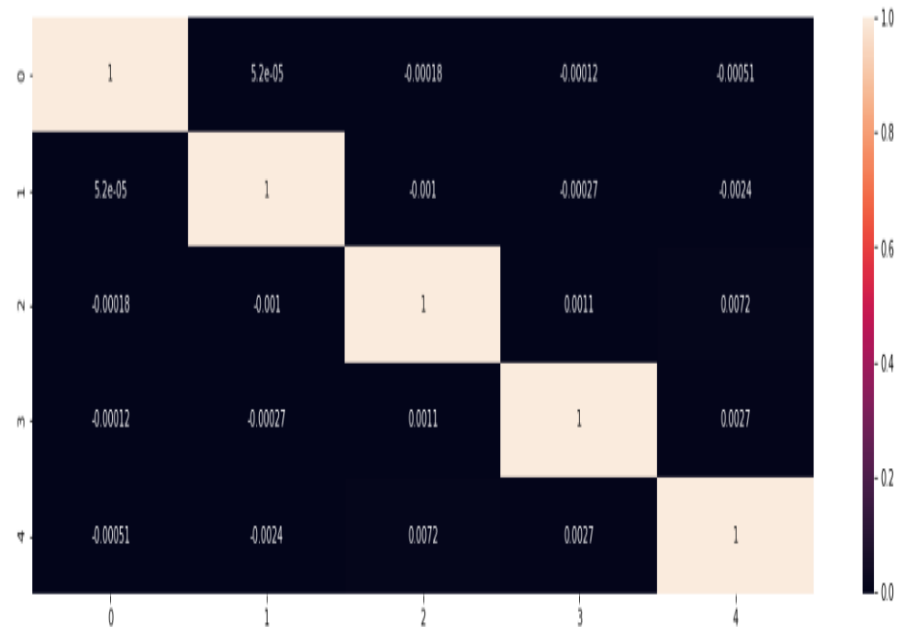
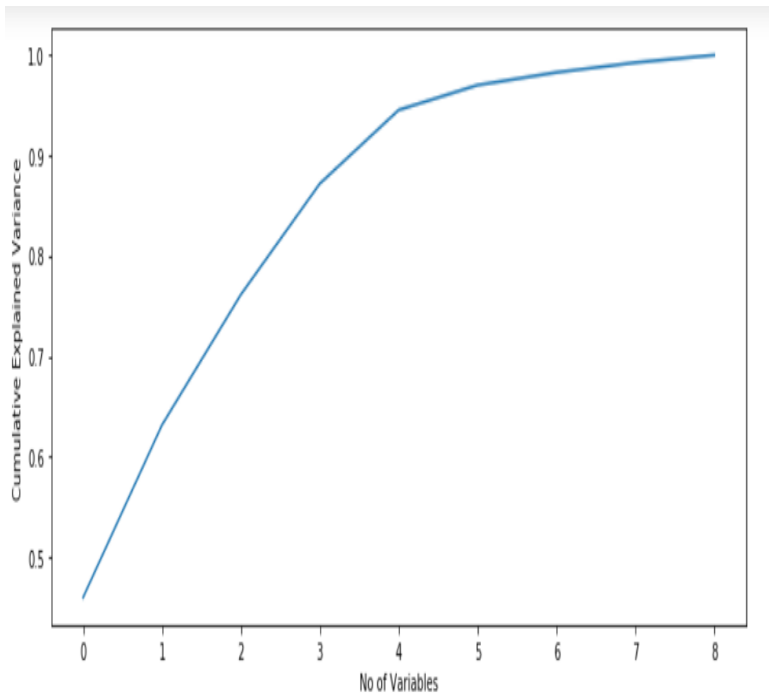
- We have 167 Countries having 9 Factors each namely - [child mortality, exports, health, imports, income, inflation, life expectancy, total fertility, GDP ]
- We will reduce these factors to the principal components that explains most of the data without losing information, instead of getting rid of some factors that seemingly looks as though it does not contribute to analysis.
- We will then apply K-means clustering and Hierarchical clustering on the principal components to find the country clusters, pick the clusters that are not doing too well and find countries with in those clusters.

# Observations

## 1. Principal Component Analysis

Using a scree plot, we are able to conclude that 5 principal components would explain 95% of the (variance in) data.

The Heat map shows that there is negligible or no correlation between the principal components.



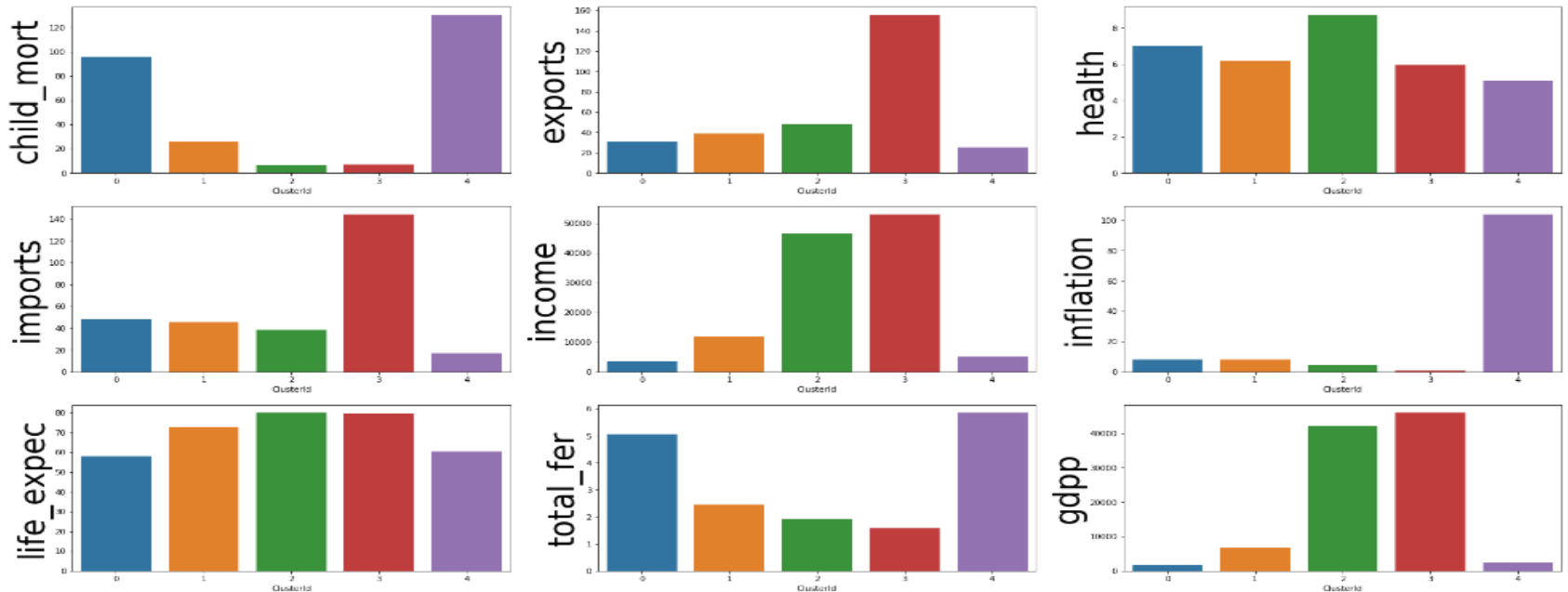
# Observations

## 1. Hierarchical Clustering

Using a Dendrogram – the complete method , using Euclidean distance, we cut 5 clusters, two of which have very low data points. However reducing these into 3 clusters only groups the other clusters with a good no. of data points into 1 cluster, we therefore choose to have 5 clusters.

The below bar graph uses the mean value of each factor/variable in each cluster.

Using Bar graphs, we were able to determine the Clusters that are backward countries fighting poverty.



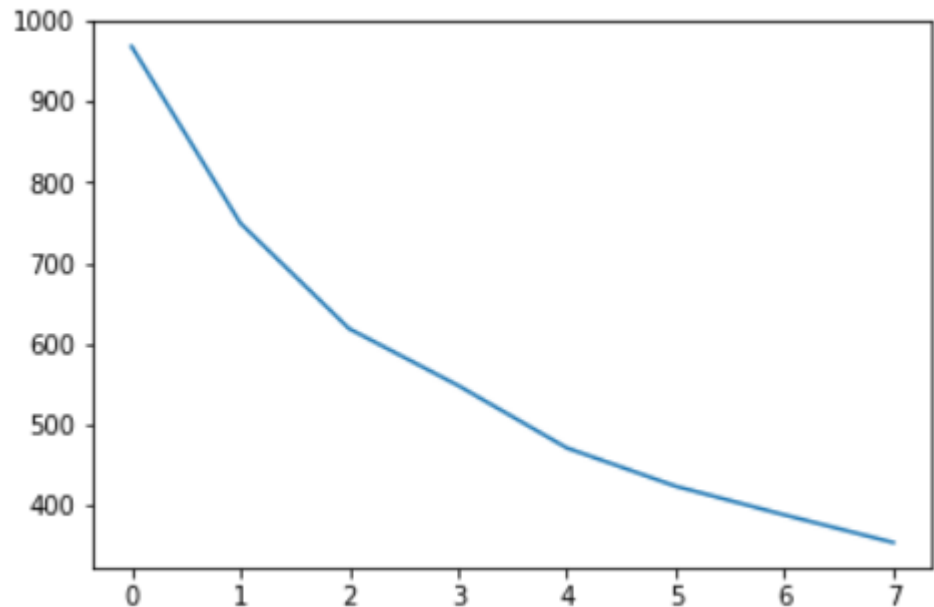
# Observations

## 2. KMeans Clustering

Using Hopkins analysis, it is determined that the dataset has tendencies to form good clusters.

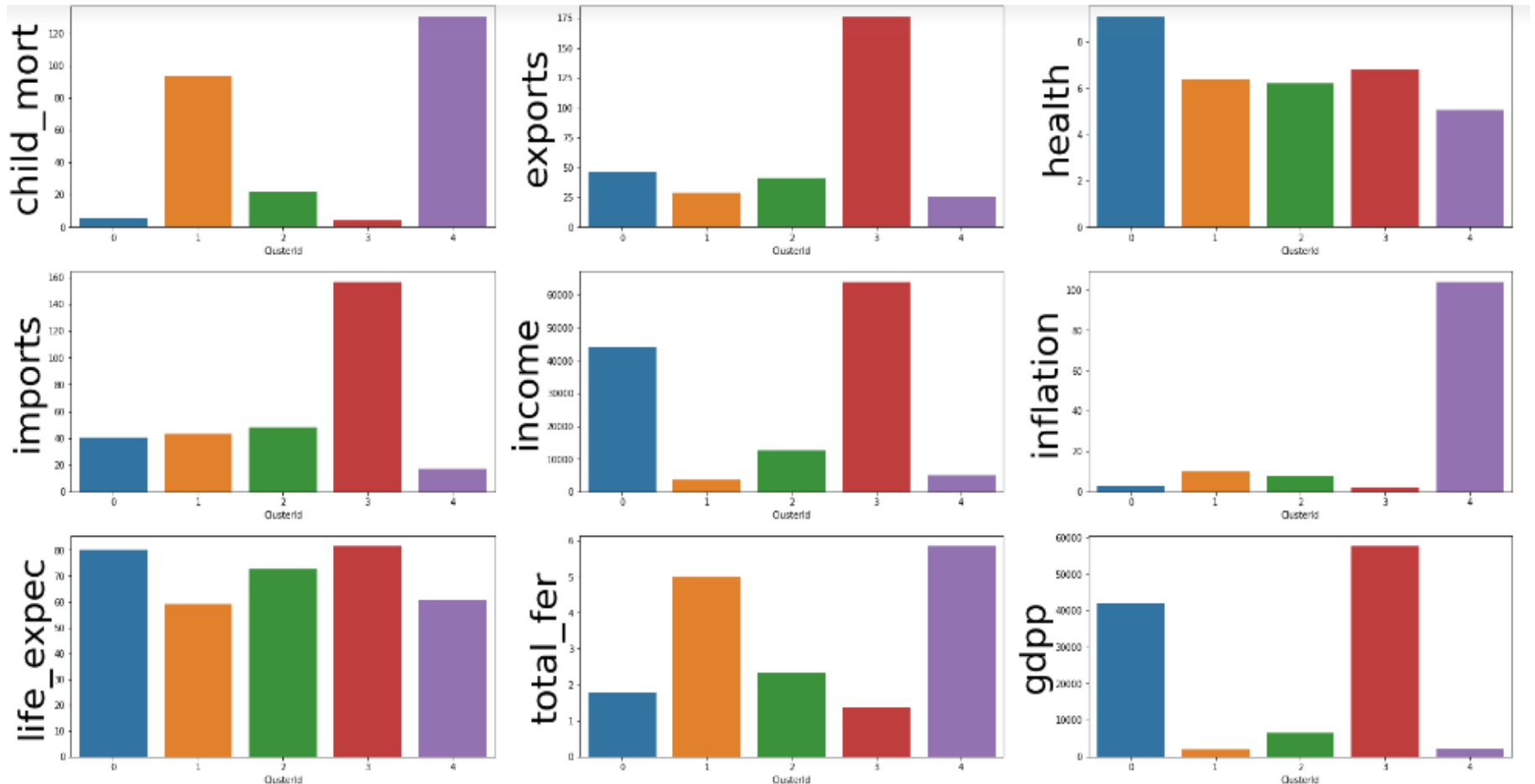
Using Silhouette Analysis, it is seen that we can for 3 – 5 clusters.

When we form 5 clusters, 2 of these have very low data points, we therefore now have 3 clusters.



# Observations

The below bar graph uses the mean value of each factor/variable in each cluster. Using these bar graphs, we are able to determine which of the Clusters that are backward countries fighting poverty.



# Method Chosen

Using the Hierarchical Clustered method

Reasons.

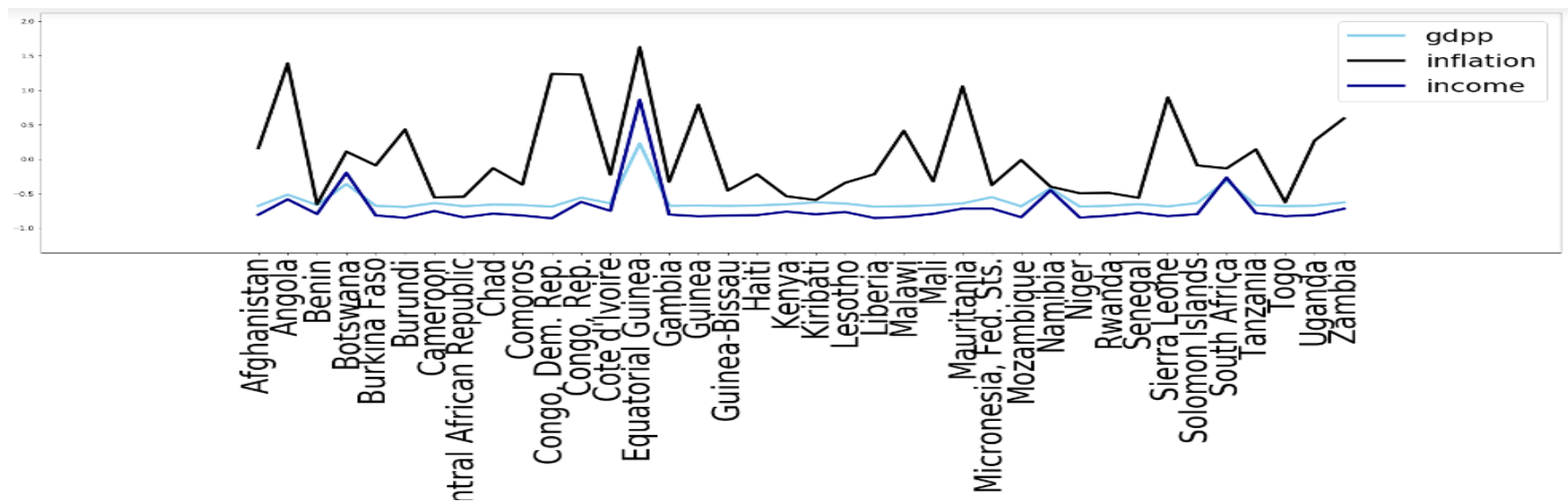
1. There is one clearly poor country, more poor than the others that should not be grouped into another cluster. This country forms a single data point cluster K-means does merge this country with another cluster with a good no. of data points.
2. Also there is another small cluster with less no. of data points which is doing better than other poor countries. This also stands out while trying to use hierarchical clustering to merge these into a different cluster with more data points. But it fails to merge.

# Observations

Using the below graphs, we draw our conclusions.

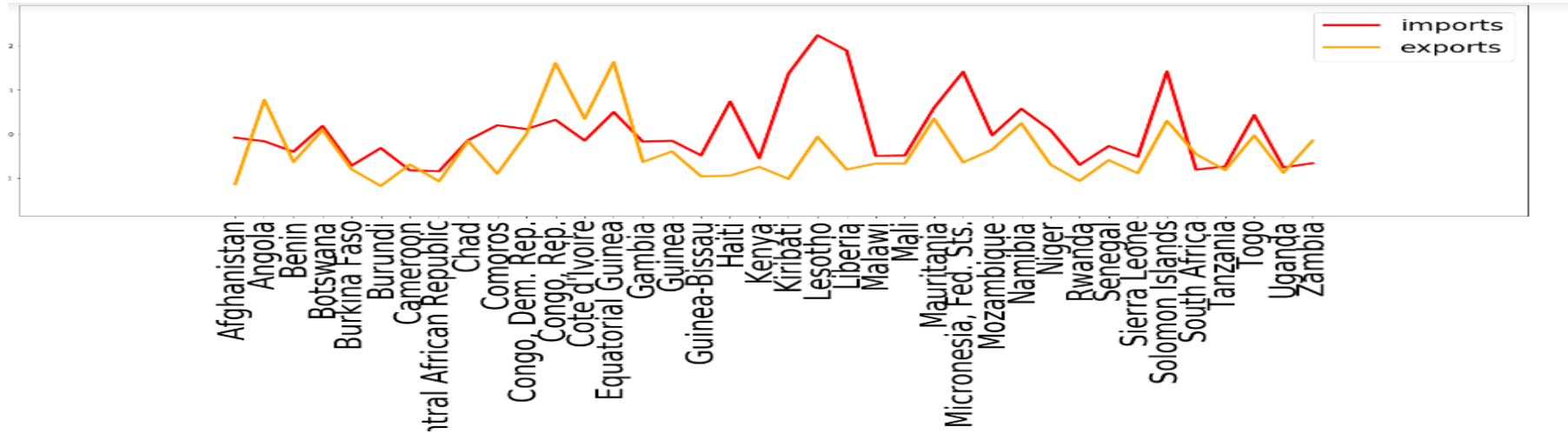
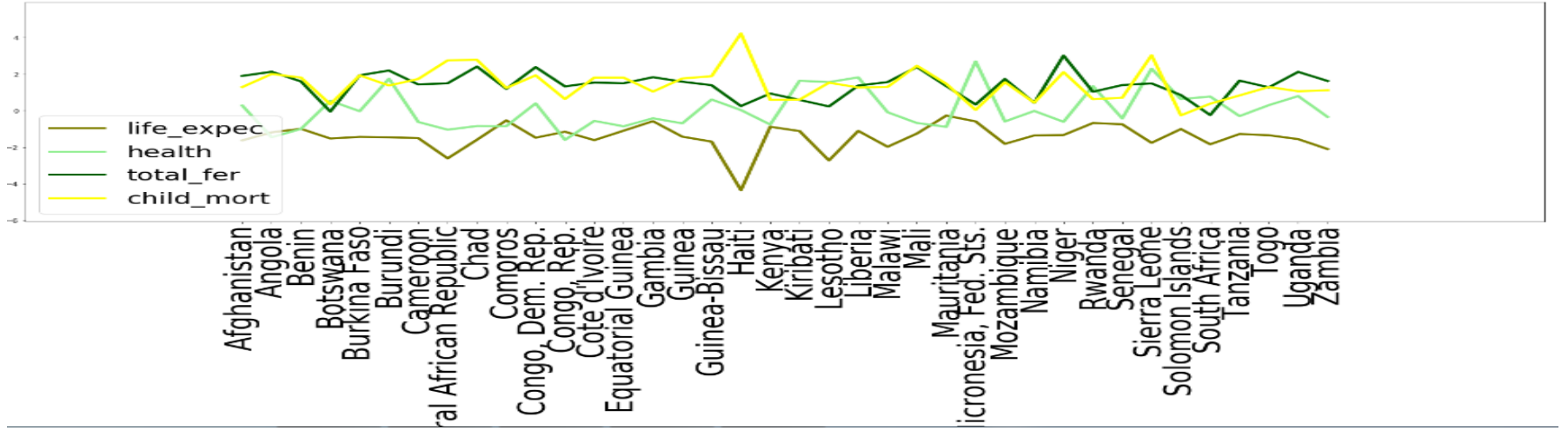
The three Graphs below explain the following –

1. Inflation v/s Income v/s GDP
2. Life Expectancy v/s Child Mortality v/s Health Spending v/s Fertility
3. Imports v/s Exports





# Observations



# Results

Below are the Countries that are direst need of aid with the current situation stated per the available data.

1. Nigeria (High Inflation, Low Income, Low GDP)
2. Sierra Leone (High Inflation, Low Income, Low GDP)
3. Haiti (Low Life Expectancy, High Fertility, High Child Mortality, Low Health Spending)
4. Central African Republic (Low Life Expectancy, High Fertility, High Child Mortality, Low Health Spending)
5. Lesotho (Imports higher than Export)