Clustering of Countries

By - Mukesh Chaurasia

Abstract

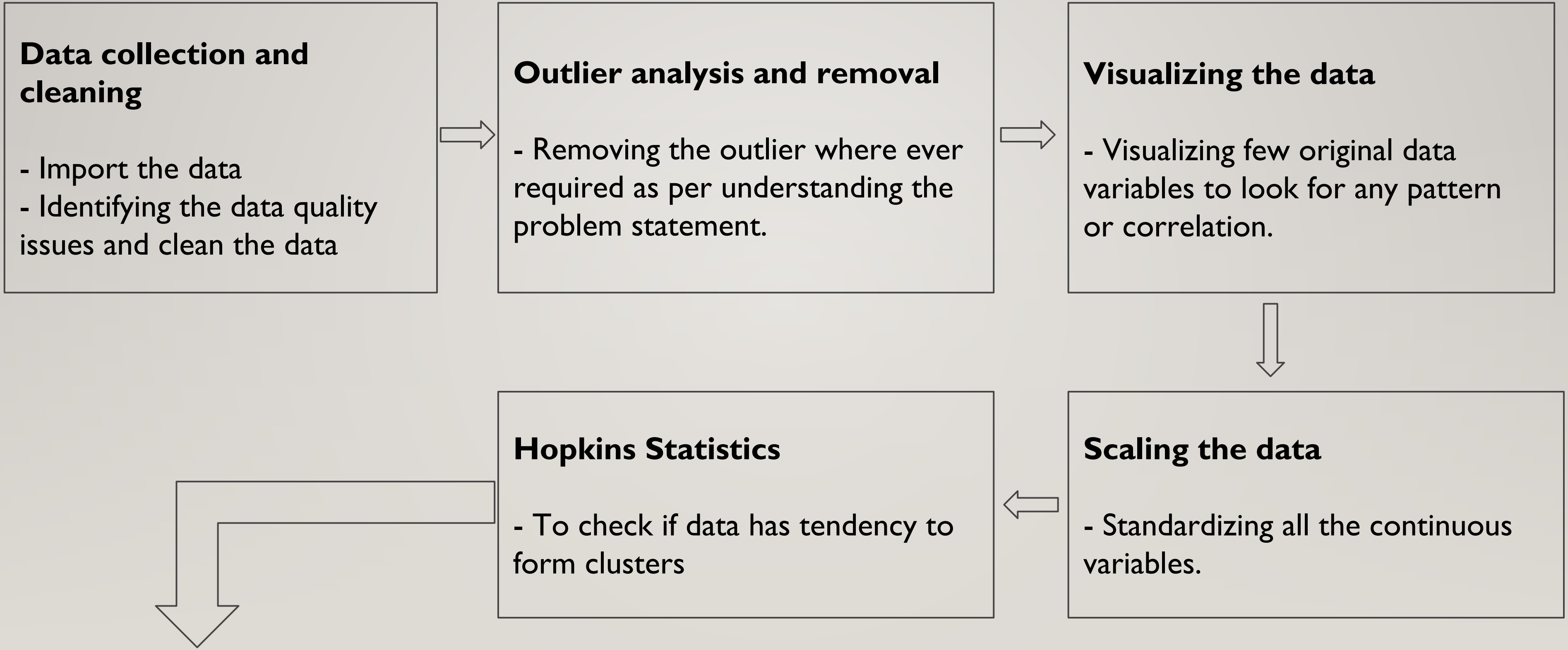
Objective:

We, HELP International humanitarian NGO, committed to fight poverty and provide the people of backward countries with basic amenities and relief during the time of disasters and natural calamities. We run a lot of operational projects from time to time, along with advocacy, drives to raise awareness as well as for funding purposes.

Problem statement:

During the recent funding programmes, we have been able to raise around $ 10 million. As an analyst, we have to come up with the countries list that are in the dire need of aid.

Analysis methodology



Data collection and cleaning

- Import the data
- Identifying the data quality issues and clean the data

Outlier analysis and removal

- Removing the outlier where ever required as per understanding the problem statement.

Visualizing the data

- Visualizing few original data variables to look for any pattern or correlation.

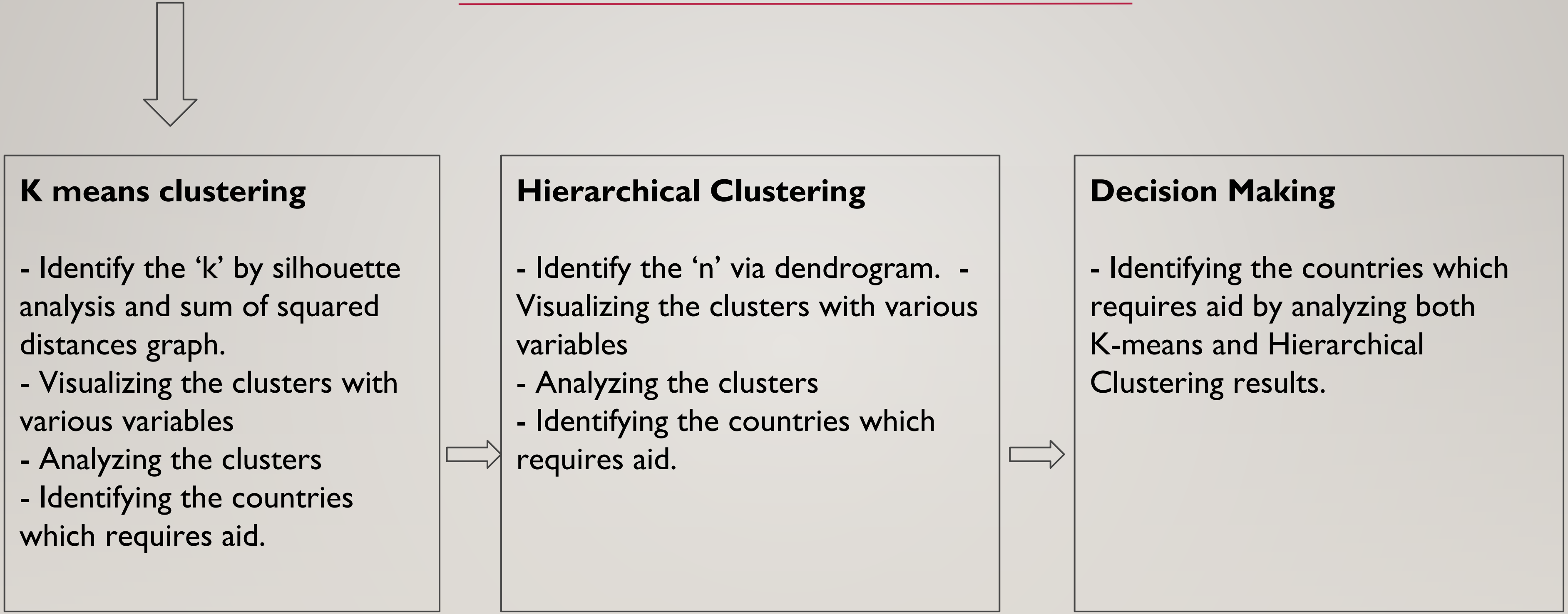
Scaling the data

- Standardizing all the continuous variables.

Hopkins Statistics

- To check if data has tendency to form clusters

Analysis methodology cont…



K means clustering

- Identify the ‘k’ by silhouette analysis and sum of squared distances graph.
- Visualizing the clusters with various variables
- Analyzing the clusters
- Identifying the countries which requires aid.

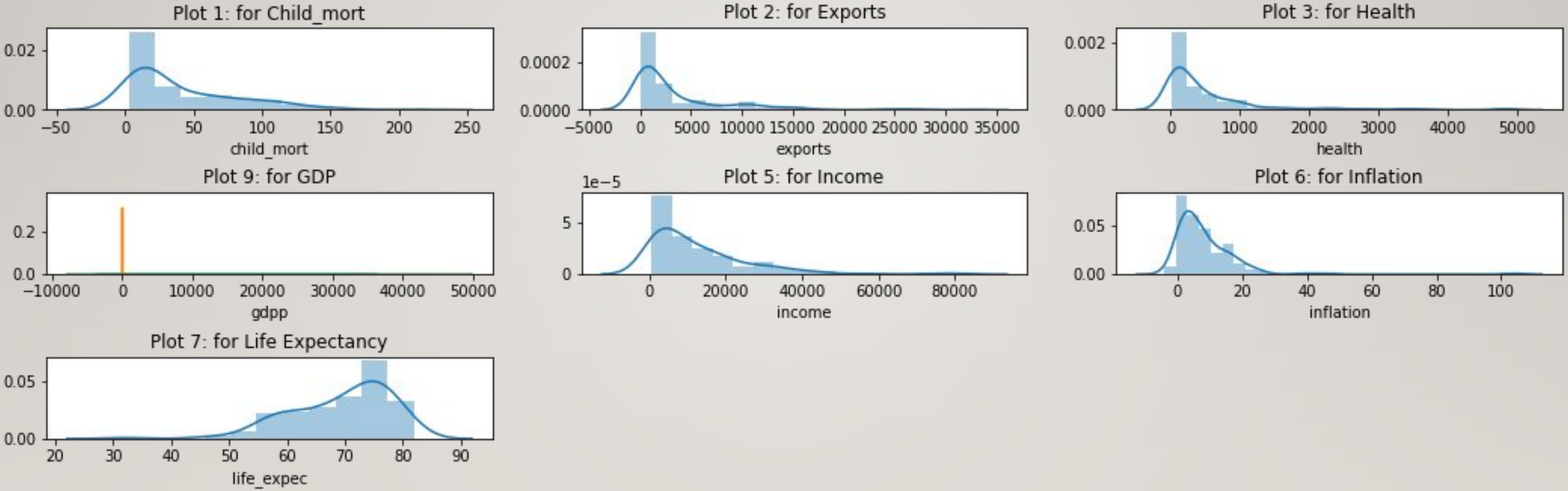
Hierarchical Clustering

- Identify the ‘n’ via dendrogram. - Visualizing the clusters with various variables
- Analyzing the clusters
- Identifying the countries which requires aid.

Decision Making

- Identifying the countries which requires aid by analyzing both K-means and Hierarchical Clustering results.

EDA (Univariate analysis Categorical variables)



EDA (Univariate analysis Categorical variables) Contd...

Plot 1 : Child Mortality

- There are many countries which has very less child mortality that's why it has peak at below 50.

Plot 2 : Exports

- Poor countries has less exports so there is peak at start below 5000.

Plot 3 : Health

- Poor countries do not have high budget for health so there is peak at start at below 1000.

Plot 4 : GDP

- Poor countries do not have high GDP so there is almost flat curve for GDP

Plot 5 : Income

- Per capita income is less for poor countries so there is peek at start close to zero.

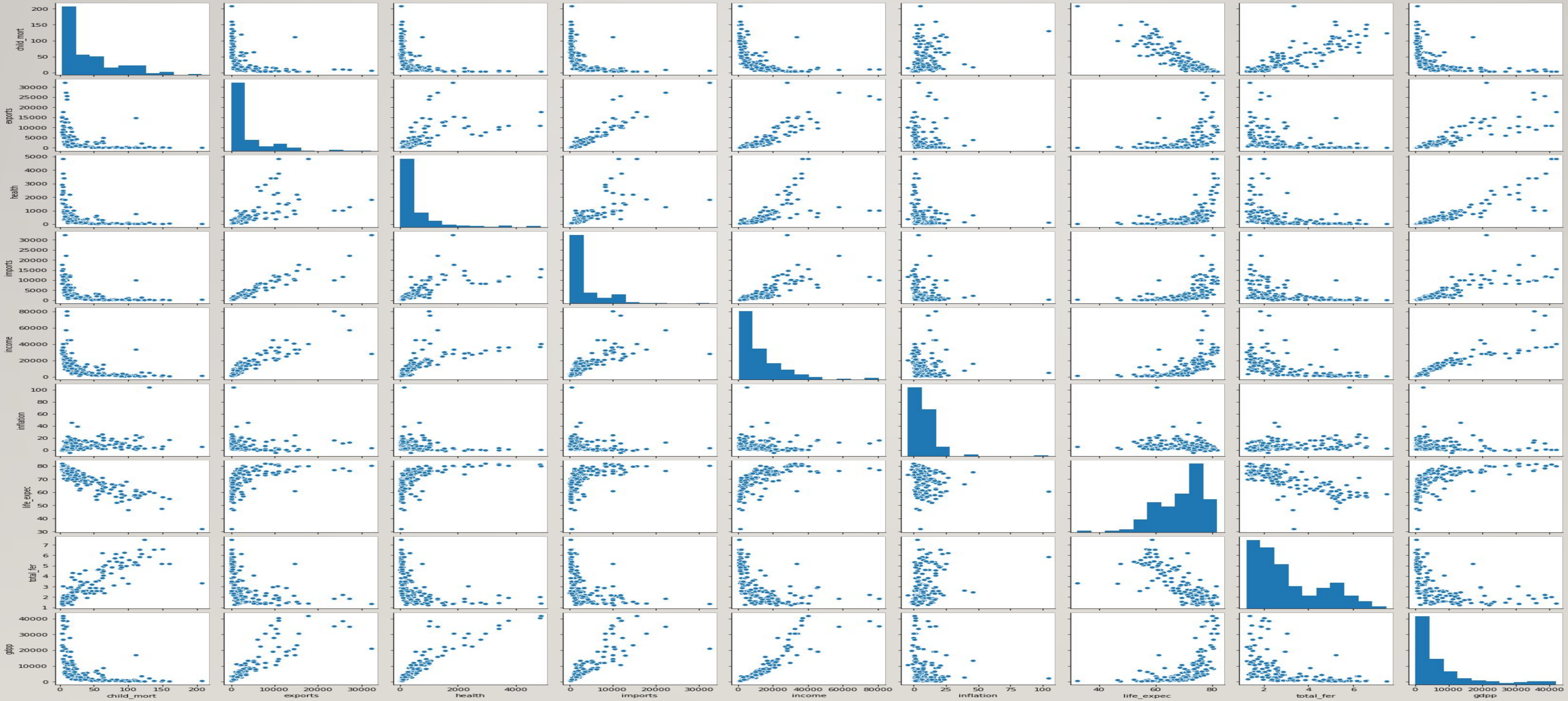
Plot 6 : Inflation

- Inflation rate are less for countries so peak is at start near to zero only.

Plot 7 : Life Expectancy

- Life expectancy is high except few countries so peak is at around 75.

EDA (Bivariate analysis Continuous Continuous)



EDA (Bivariate analysis Continuous Continuous) Contd...

1. GDP vs Child_mort
- it's clearly indicates there is negative correlation between GDP and child mortality. As GDP increases Child mortality decreases

2. GDP vs exports
- GDP and exports has positive correlation. GDP increases exports also increases.

3. GDP vs health
- GDP and health has positive correlation. GDP increases health also increases.

4. GDP vs imports
- GDP and imports has positive correlation. GDP increases imports also increases.

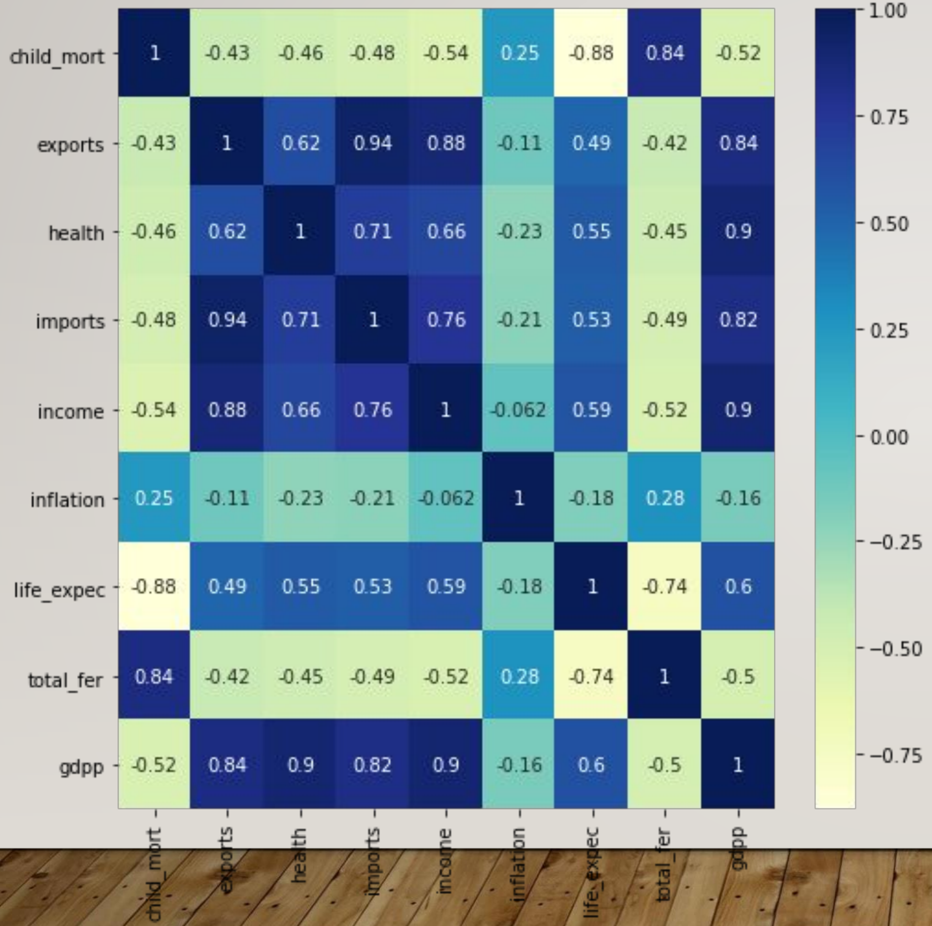
5. GDP vs income
- GDP and income has positive correlation. GDP increases income also increases.

6. GDP vs inflation
- countries having low GDP has higher inflation rate.

7. GDP vs life_expec
- countries having high GDP has higher life expectancy.

8. GDP vs total_fert
- countries with low GDP has higher fertility rate.

Correlation in the data:



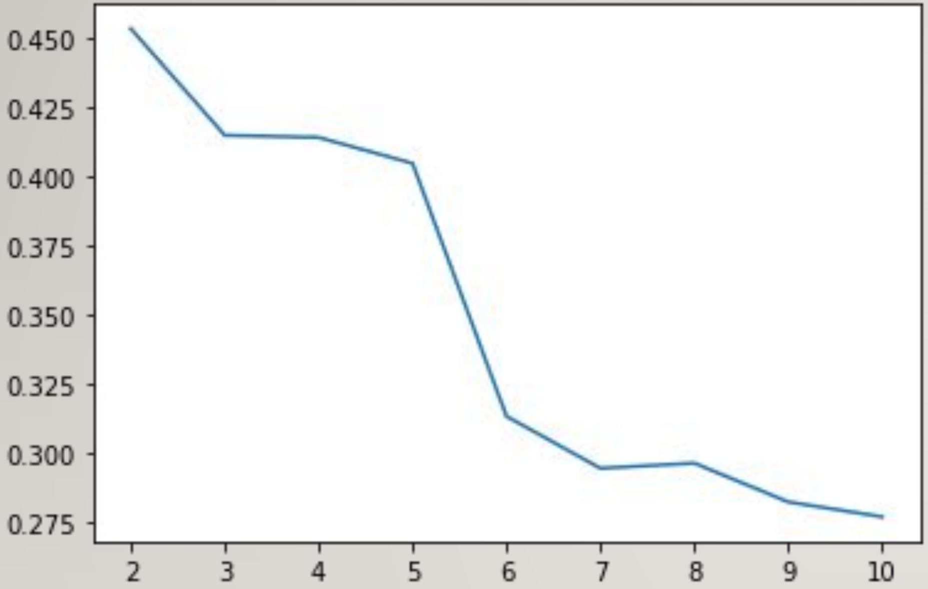
	child_mort	exports	health	imports	income	inflation	life_expec	total_fer	gdpp
child_mort	1	-0.43	-0.46	-0.48	-0.54	0.25	-0.88	0.84	-0.52
exports	-0.43	1	0.62	0.94	0.88	-0.11	0.49	-0.42	0.84
health	-0.46	0.62	1	0.71	0.66	-0.23	0.55	-0.45	0.9
imports	-0.48	0.94	0.71	1	0.76	-0.21	0.53	-0.49	0.82
income	-0.54	0.88	0.66	0.76	1	-0.062	0.59	-0.52	0.9
inflation	0.25	-0.11	-0.23	-0.21	-0.062	1	-0.18	0.28	-0.16
life_expec	-0.88	0.49	0.55	0.53	0.59	-0.18	1	-0.74	0.6
total_fer	0.84	-0.42	-0.45	-0.49	-0.52	0.28	-0.74	1	-0.5
gdpp	-0.52	0.84	0.9	0.82	0.9	-0.16	0.6	-0.5	1

- After data cleaning , we removed outlier from gdpp column because the country with high gdpp would not require any aid as there are already doing good.

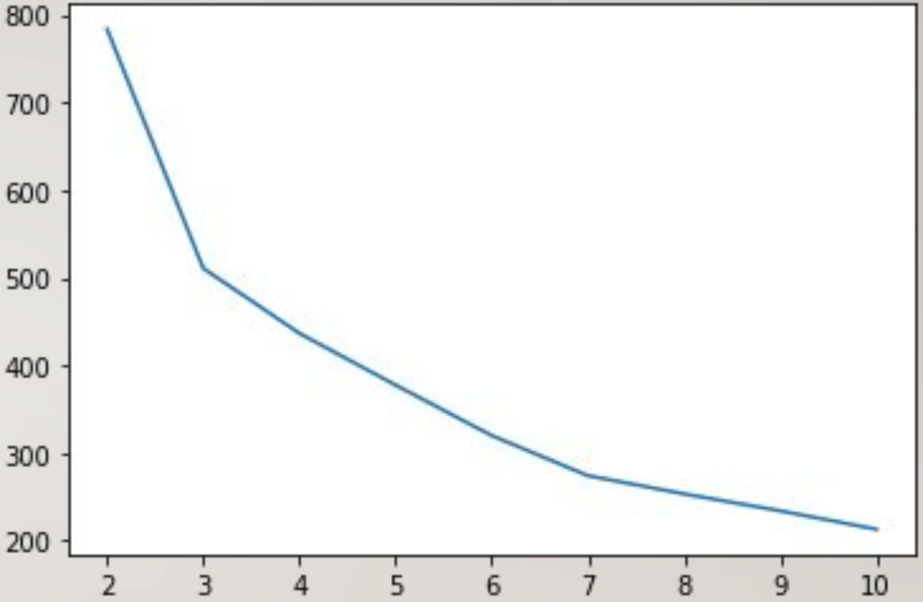
- We did standardized scaling to standardize all parameters on cleaned, outlier removed data.

- Looking at the heatmap, we see that few variables like (total fertility, child mortality) , (income , gdpp) and (imports and exports) have high correlation.

K-means clustering



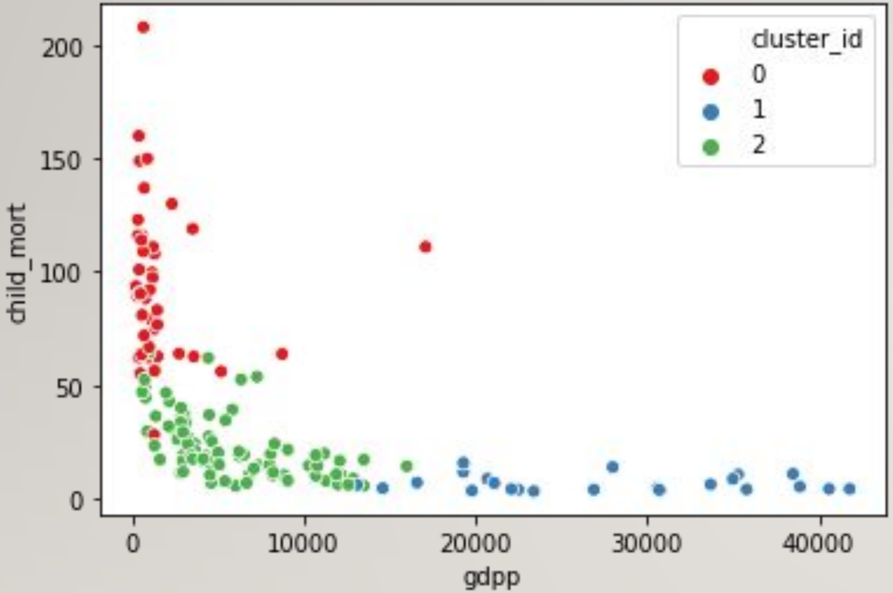
Silhouette Analysis



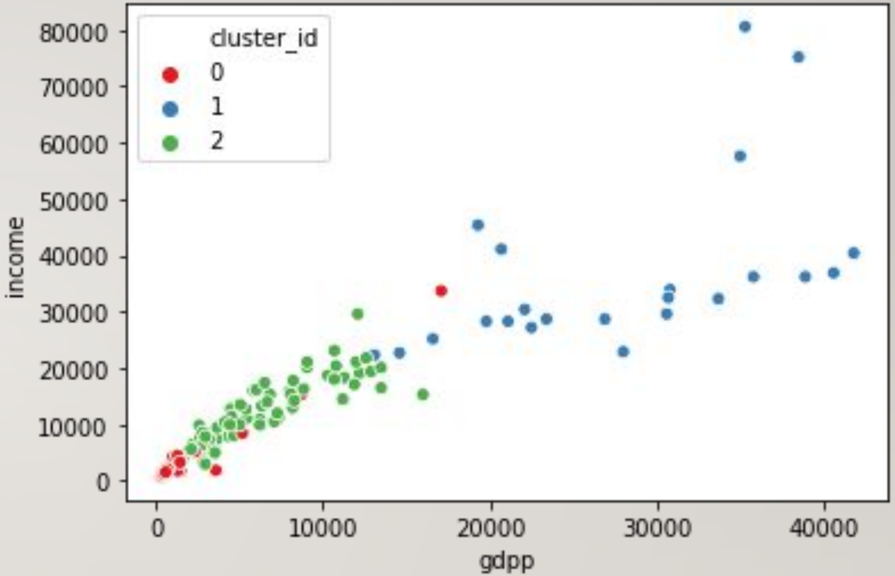
Sum of Squared Distances

By looking silhouette analysis, we see the highest peak is at k =3 and in sum of squared distances graph , we see that the elbow is also at 3 , so we are going ahead with k as 3.

K-means clustering

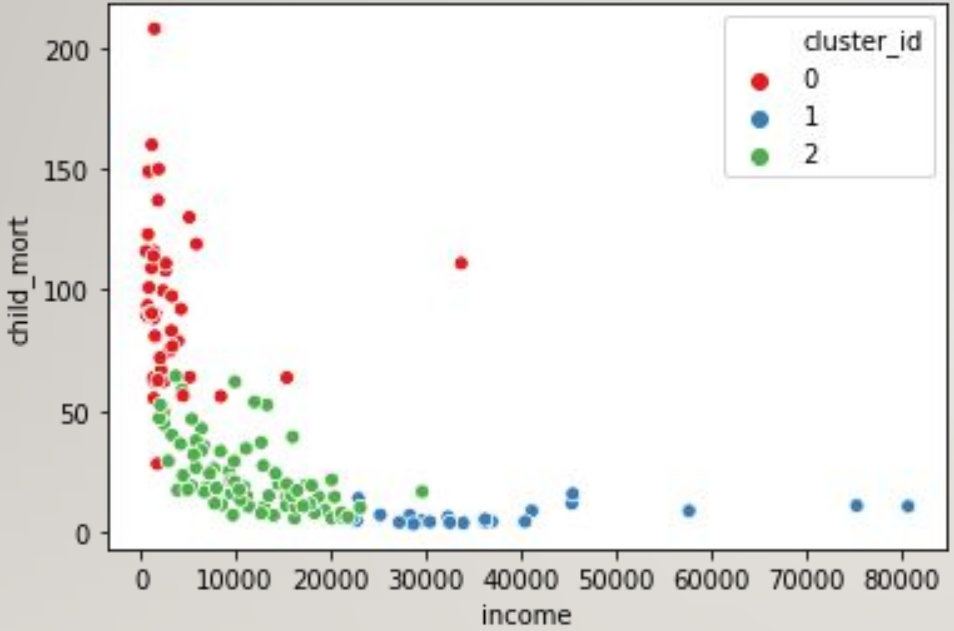


Scatter plot of gdpp and child_mort for various clusters. We see that for cluster 0 , gdpp is low and child mortality is very high.



Scatter plot of gdpp and income for various clusters. We see that for cluster 0 , both gdpp and net income per person are very low.

K-means clustering



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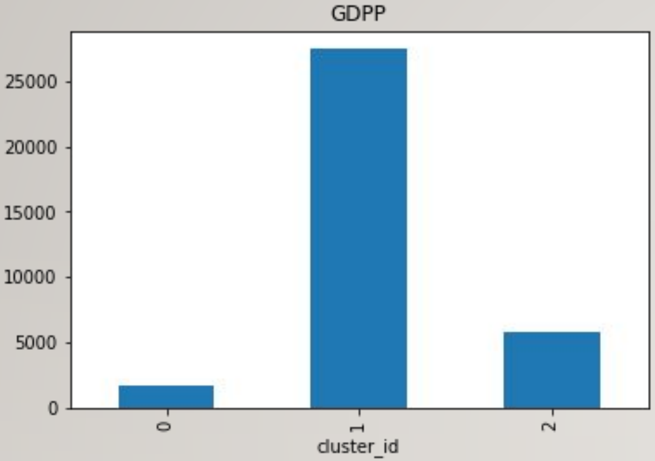
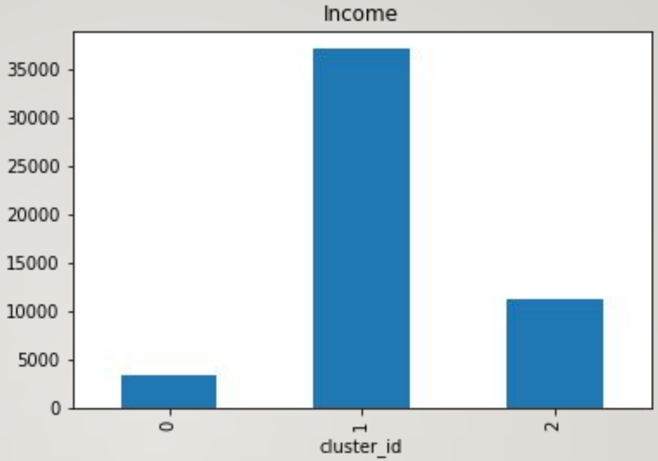
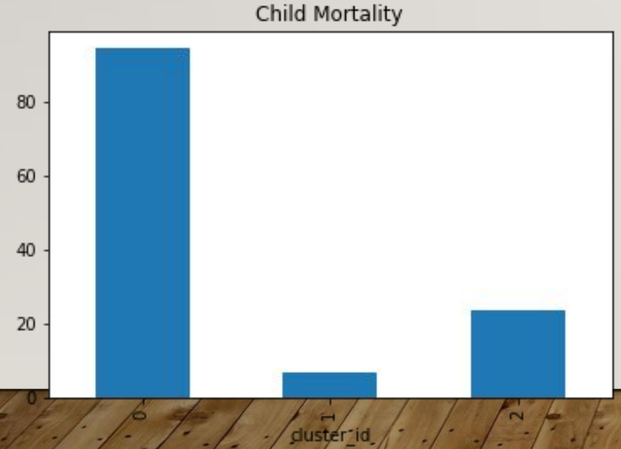




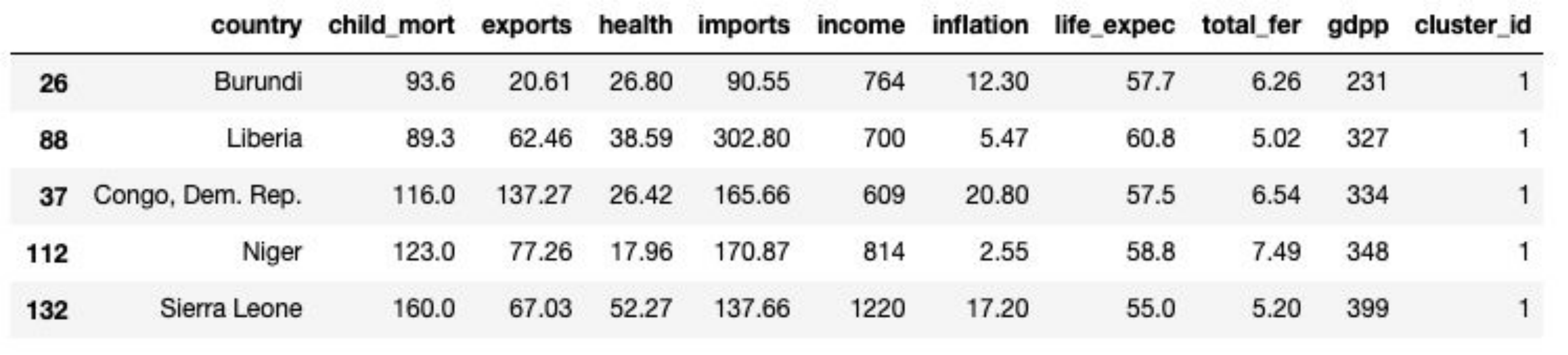


As per K- means cluster algorithm Cluster 0 is in need of help due to

- Low gdpp
- Low income
- High child mortality

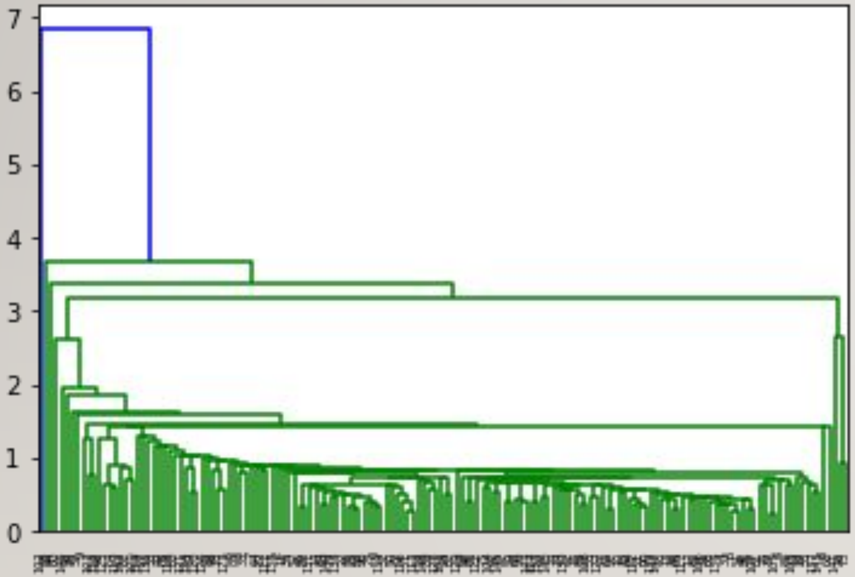
K-means clustering

5 countries under cluster 0 which need help are:

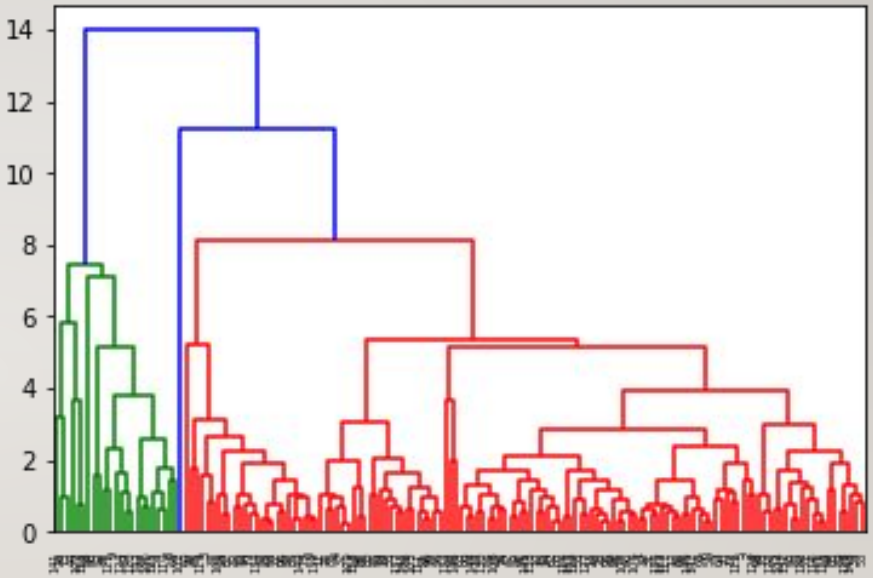


	country	child_mort	exports	health	imports	income	inflation	life_expec	total_fer	gdpp	cluster_id
26	Burundi	93.6	20.61	26.80	90.55	764	12.30	57.7	6.26	231	1
88	Liberia	89.3	62.46	38.59	302.80	700	5.47	60.8	5.02	327	1
37	Congo, Dem. Rep.	116.0	137.27	26.42	165.66	609	20.80	57.5	6.54	334	1
112	Niger	123.0	77.26	17.96	170.87	814	2.55	58.8	7.49	348	1
132	Sierra Leone	160.0	67.03	52.27	137.66	1220	17.20	55.0	5.20	399	1

Hierarchical clustering

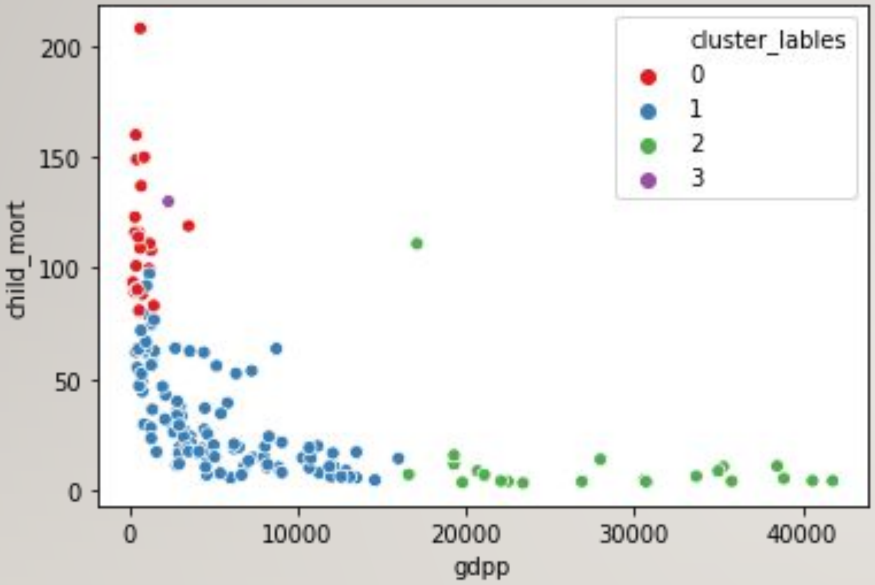


Single method hierarchical clustering



We are going for **Complete method hierarchical clustering** as single method clustering is not clear. By looking at this dendogram taking n-clusters as 4.

Hierarchical clustering



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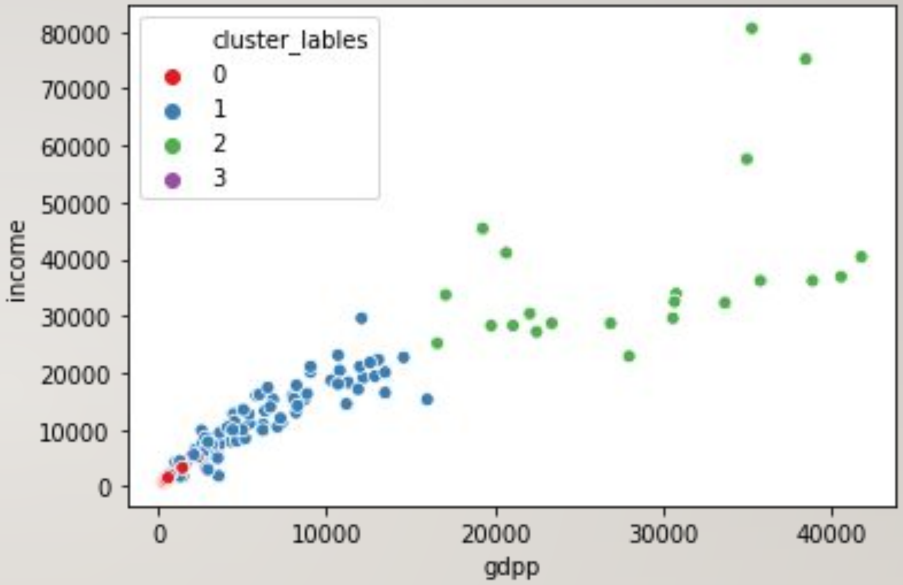

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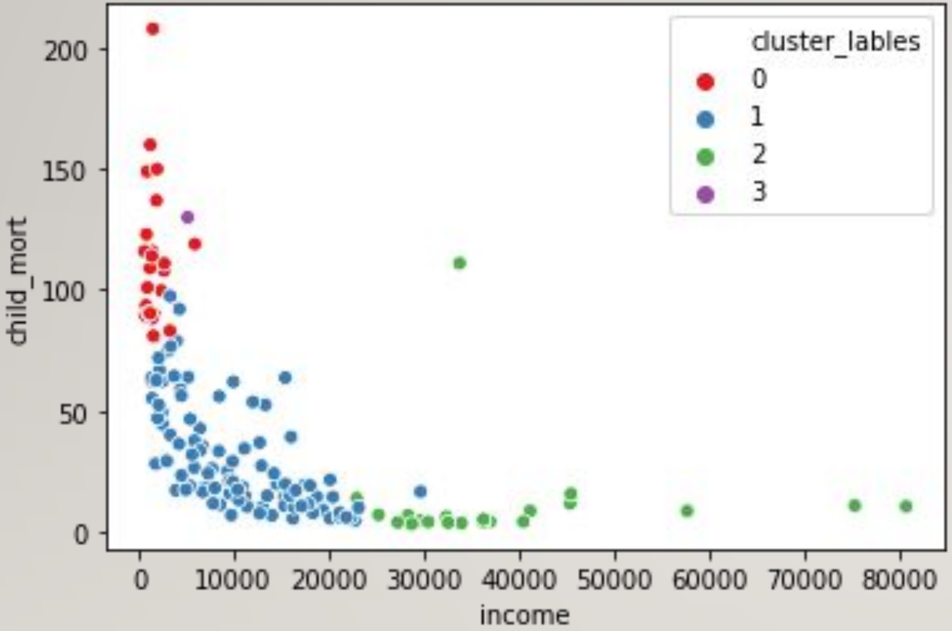

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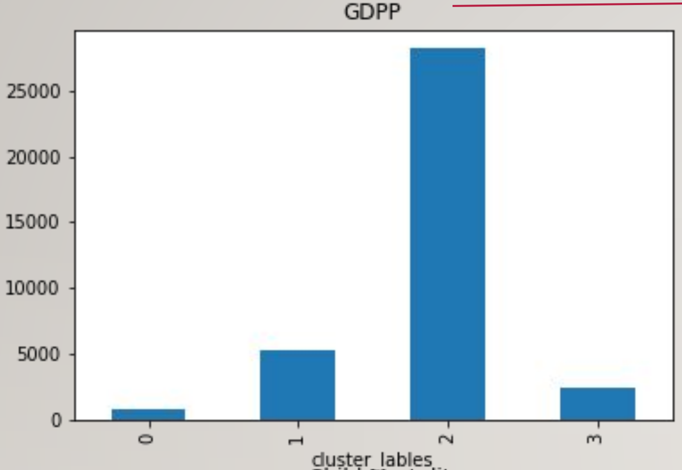

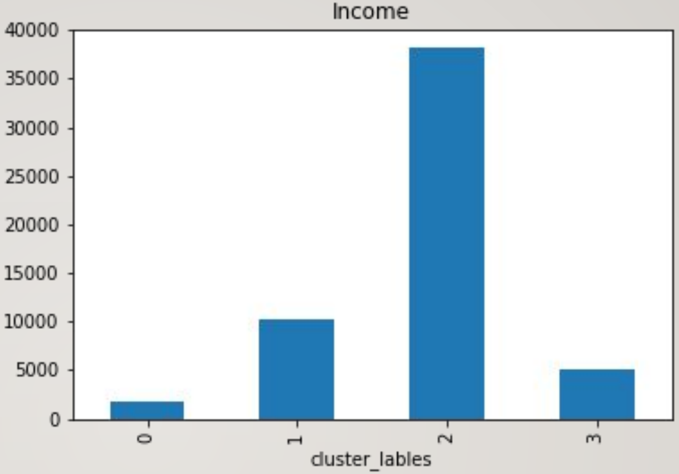

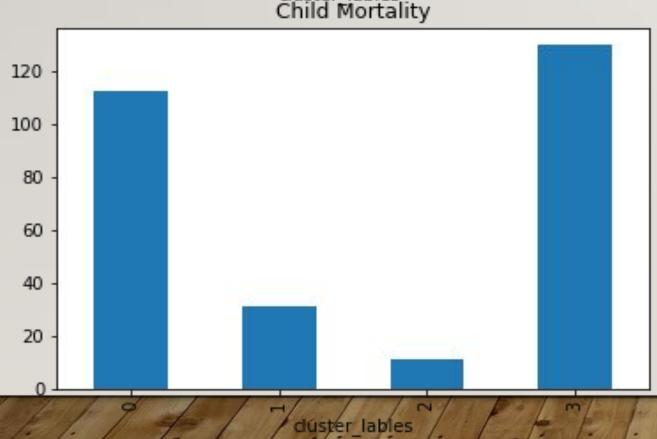

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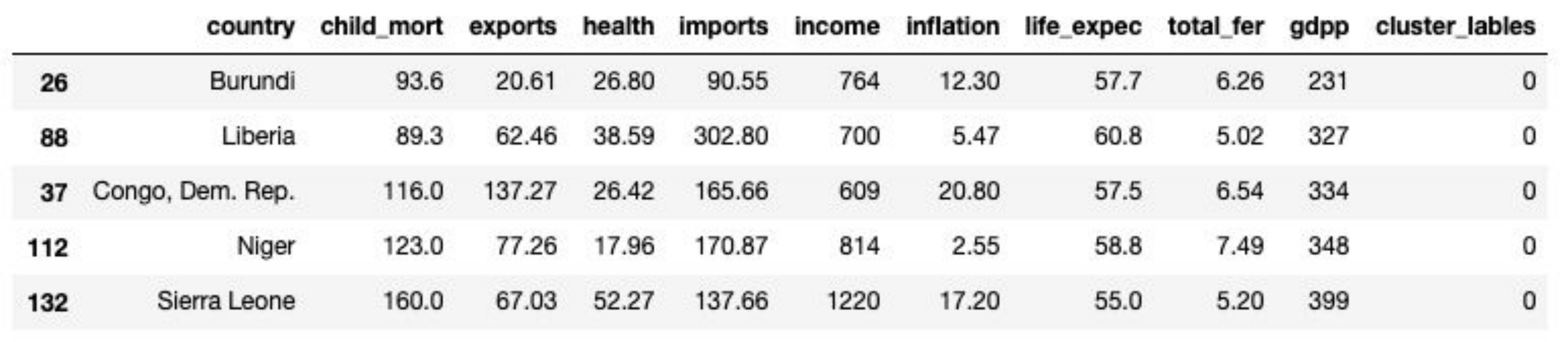

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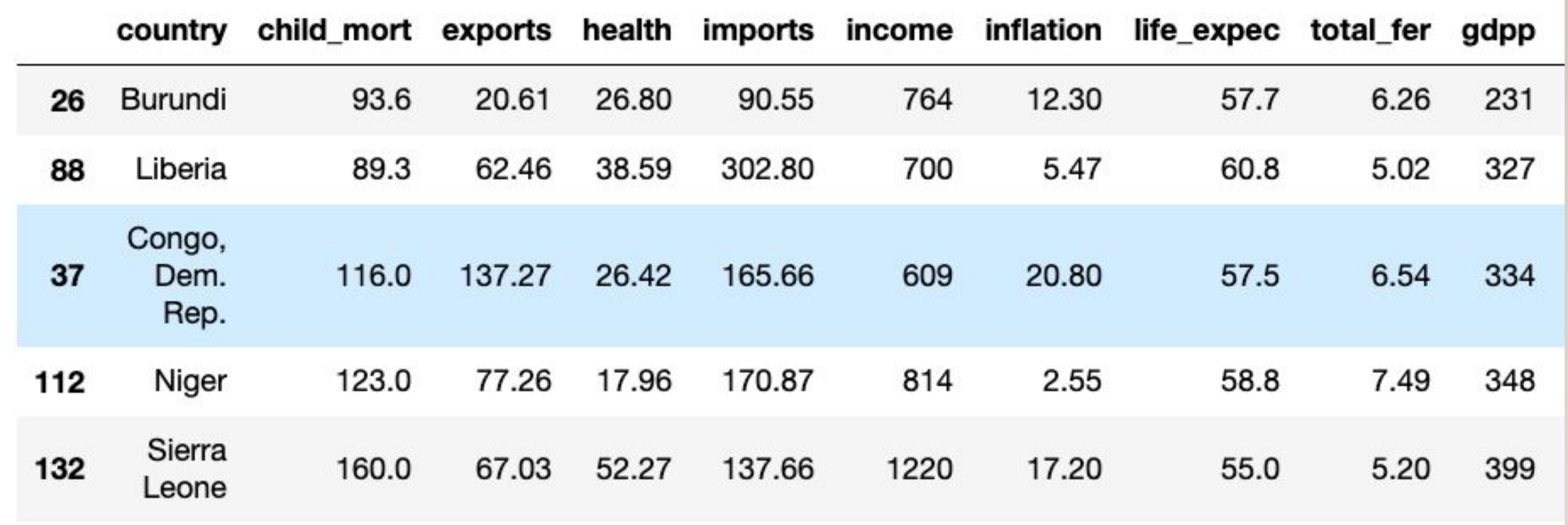
Summary

As by both K means and Hierarchical clustering method - we have got same countries which requires aid. The following are the countries which are in dire need of aid by considering socio – economic factor into consideration:



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Thank You