SAVING THE WORLD FROM FOOD SHORTAGE CRISIS

The world food shortage crisis has been on the increase over the years. As at 2020, the United Nations (UN) estimated that "nearly one in three people in the world (2.37 billion) did not have access to adequate food". Population has also been on the increase despite food shortage. The UN website predicted that by 2030, the world population may have increased to 8.5 billion persons. The World Food Program (WFP) confirmed that "as many as 783 million people are unsure of where their next meal is coming from". Reports show that the three factors mentioned below are the major causes of food shortage.

Factors that contributes to world food crisis.

Insecurity

Ukrain_Russia war
fueled food shortage

Climate Change

Many lands are no longer
good for farm produce due
to climate change

Image Credit: ImageFlow/Shutterstock.com

Pandemic

Covid-19 pandemic
increased food shortage

Despite the challenges mentioned, one clear fact is that there must be food made available for consumption in order to sustain life. A close examination of the current Africa's food production and consumption records from 2004 to 2013, can give insight on how Africa can perform in tackling the world food crisis. The two datasets have been gathered from Food and Agriculture Organization (FAO) resources. The first dataset is on food production in Africa (2004 -2013) and the second is on food supply/consumption (2004 -2013).

The main objective of this technical report is to harness the feasibility of tackling the world's food shortage crisis based on Africa's food production and supply (2004 - 2013). To this end, the trends of food production and supply/consumption will be examined over the years (2004 - 2013). The average and median values, the outliers, Quartile and interquartile ranges of food production from 2004 to 2013, will be cross examined for great insights on Africa food production. Furthermore, a comparison between average food consumption and production for each year will be carried out.

Trends of Food Production in Africa (2004 - 2013)

Deep knowledge of the trends of food production in the given dataset can show how food production in Africa has been from 2004 to 2013. Have there been increase or decrease over the years? Increase in food production will simply suggest that there should be food available for consumption or supply, while decrease will suggest the opposite.

Its only realistic to expect population growth over time, and that means that only increase in the trend of production will mean hope for world's food shortage crisis. The image below will show the food production trend in Africa.

TREND OF FOOD PRODUCTION OVER TIME
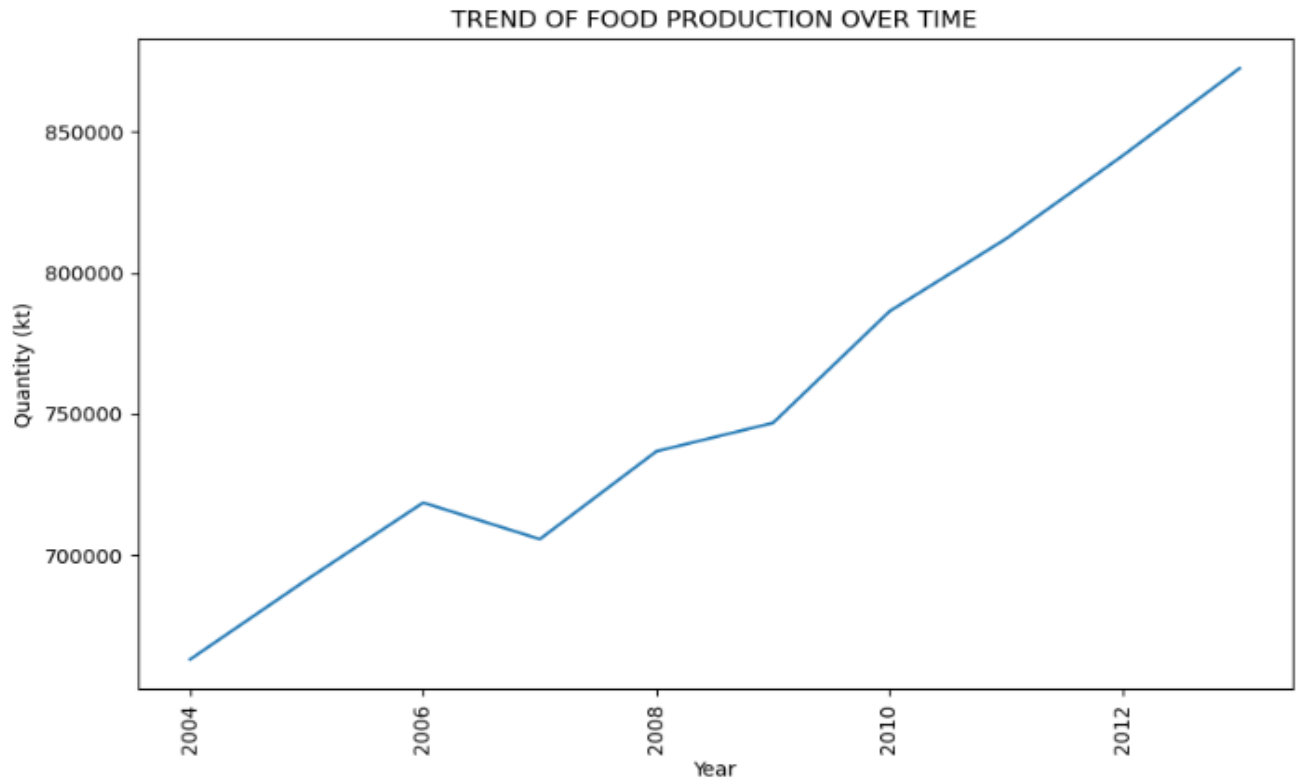
Looking at the line graph above, Food production was generally on the increase over the years. From a little over 600,000kt (kilo tones) in 2004 to as high as about 860,000kt in 2013. The only year that experienced a decrease in food production was 2007 food production which was lower than 2006 production.

Looking at the chart, one can expect that it is only population explosion that exceeds food production that can lead to food shortage since obviously there has been significant increase in food production over the years.

It is only reasonable to check countries that had the highest productions during these years for more insights. A bar-chart visualization is fine tool that can be used to achieve this.

Countries total production over the years (2004 to 2013)

COUNTRY FOOD PRODUCTION CAPABILITY FOR THE PERIOD
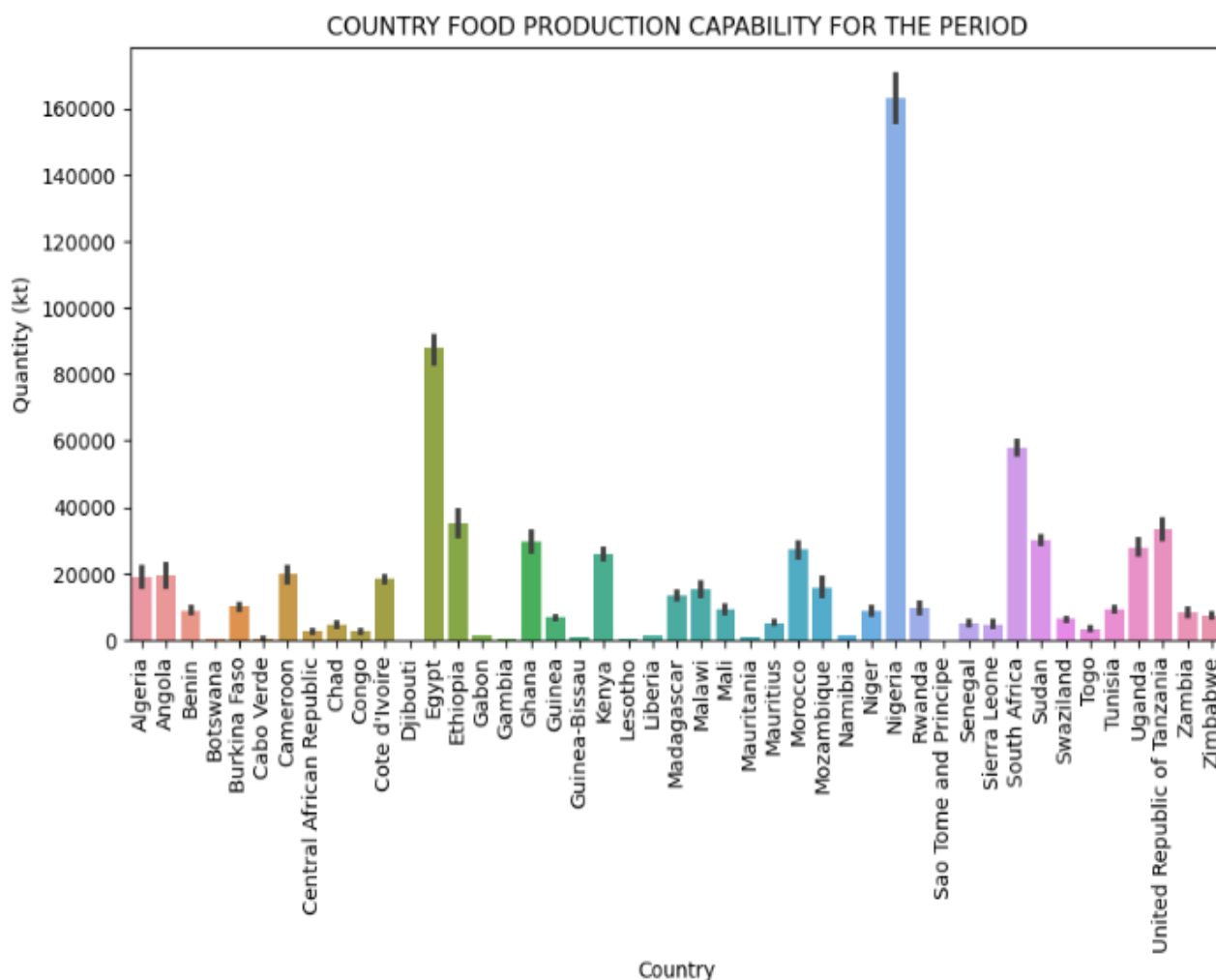
Analysis revealed that 45 different countries were captured in the food production dataset. The "Country Food Production Capability for the Period" bar-chart above shows each country's total food production capability from 2004 to 2013. The top three producers are Nigeria, Egypt and South Africa.

Nigeria produced the highest volume (1,628,030kt) of food for the period, so one can expect that Nigeria should have a great input in reduction of world food shortage if all produce are properly handled without waste. Djibouti on the other hand, has the least food production capability. This is not surprising as they are rather known for geologic treasure trove and not agriculture. They are not to be discouraged though as every input in food production matters despite the quantity.

Top Food Producing Countries for the Period

Varieties of Food Produced by Countries

NUMBER OF VARIETIES OF FOOD FOR EACH COUNTRY
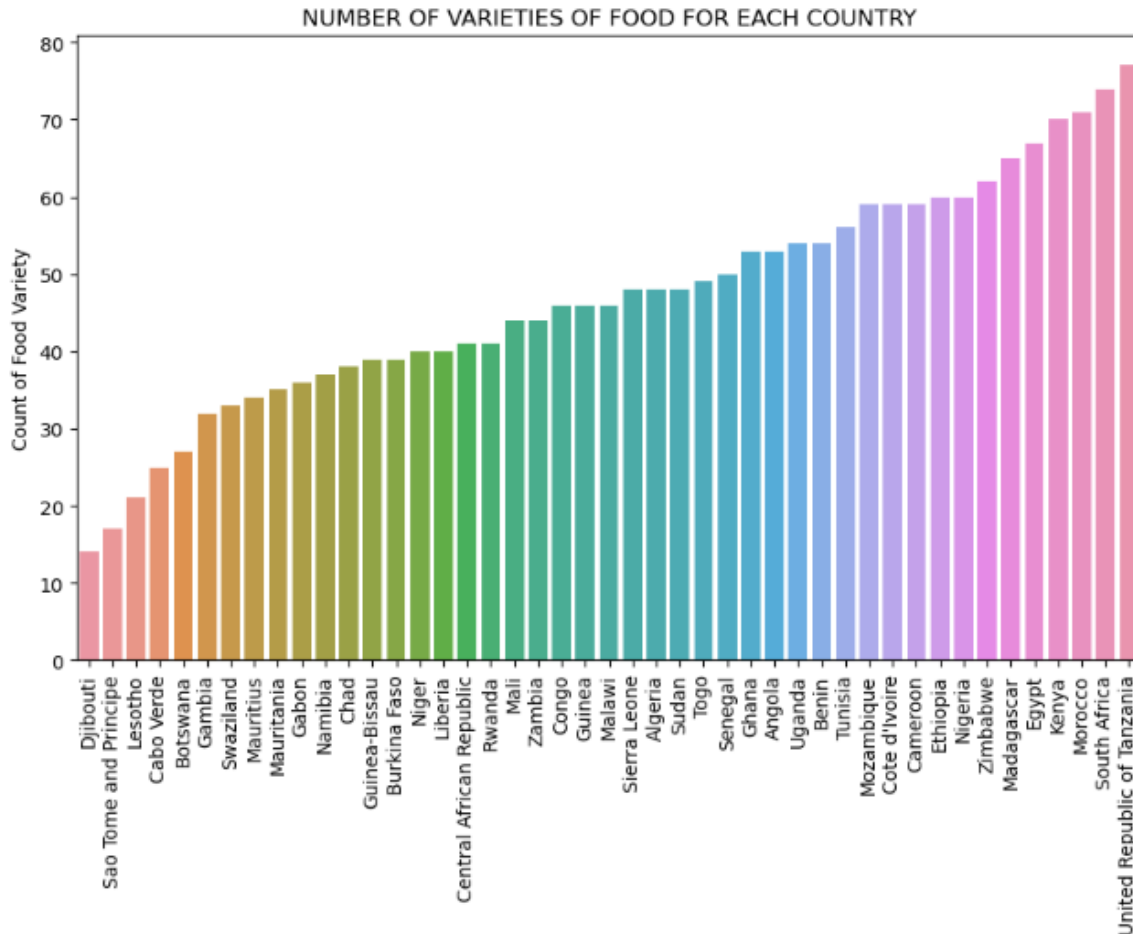
Although Nigeria produced the largest quantity of food, they did not fall among the first 10 countries that produced varieties of food. Although the United Republic of Tanzania was number 5 in terms of quantity of food production, the country produced 79 varieties of food. This also means that Tanzania produced the highest number of unique food items

Trends in Food Consumption/Supply
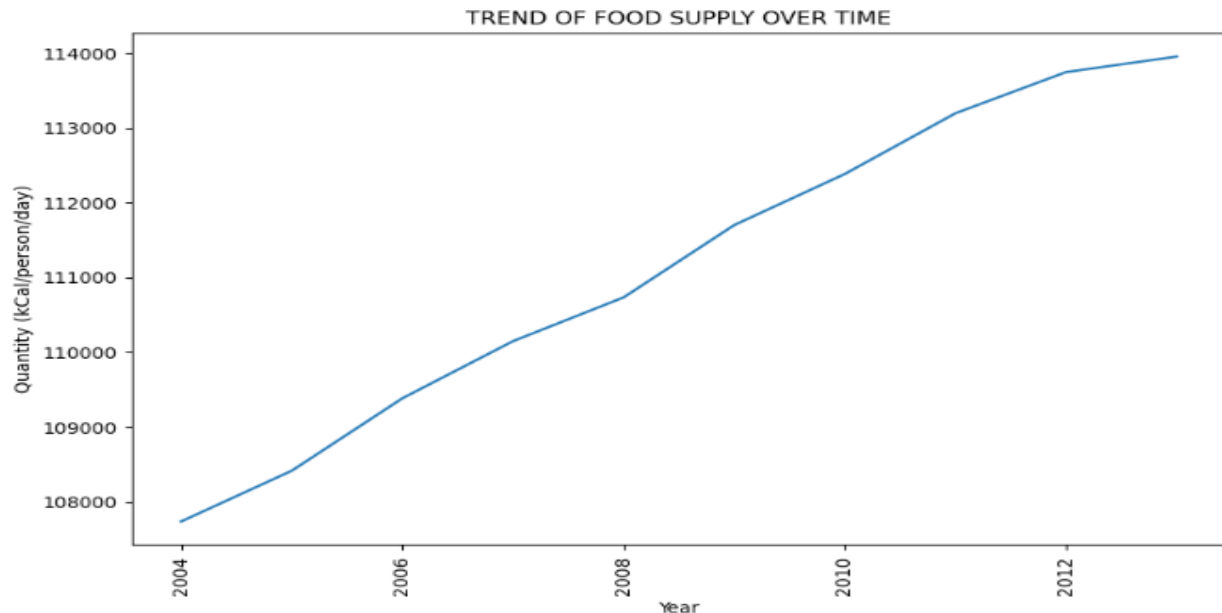
The "Trend of food supply over time" line graph shows the trend of food consumption/supply over time. The graph showed that food consumption increased over the years just like food production. Increase in consumption suggests that there is also an increase in population. This is true because it is the number that added to the population that increased consumption. This suggests that in years to come, production must increase to meet up with possible increase in population. A boxplot may show some hidden detail of the supply trend.
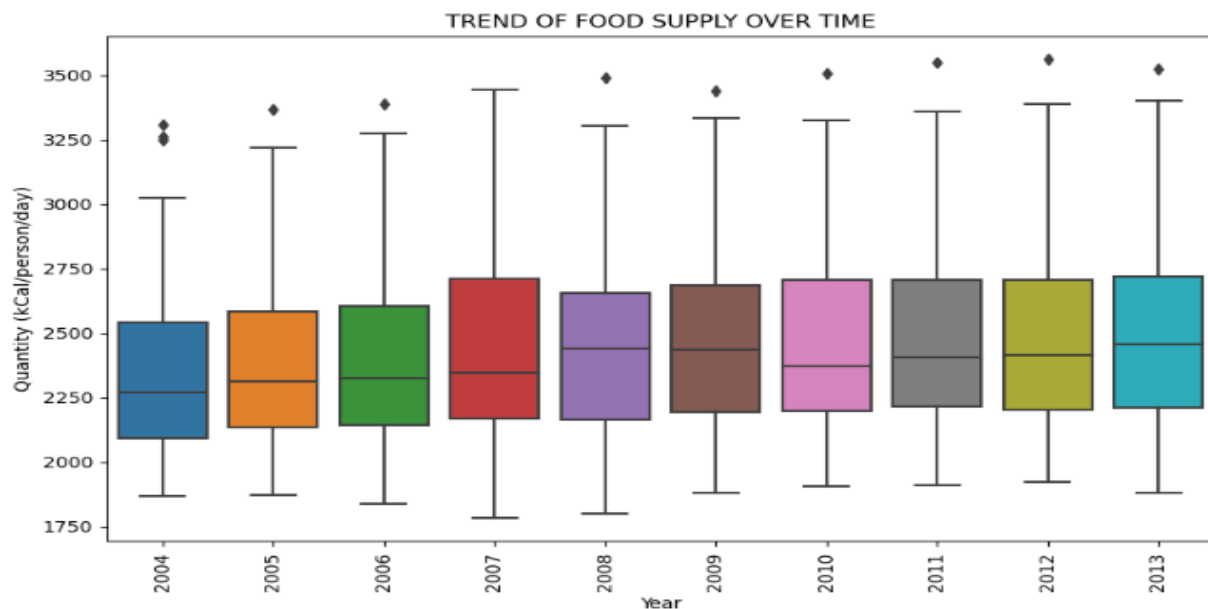
The box plot showed that in 2012 a particular country had an all-time pick food supply/consumption record. Finding this country will help to relate the country that had the highest food supply/consumption record throughout the 10 years period.

Some python codes were used to analyse the dataset for the year 2012 and the following ouput was shown.

	Country	Year	Value
128	Egypt	2012	3561
408	Tunisia	2012	3390
278	Morocco	2012	3366

So the outlier in 2012 which was the pick food supply of all time was Egypt with supply of 3561 kCal/(person day)

Average and Median Food Production, the Outliers, Quartile and Interquartile ranges

Food Production in Africa from 2004 to 2013
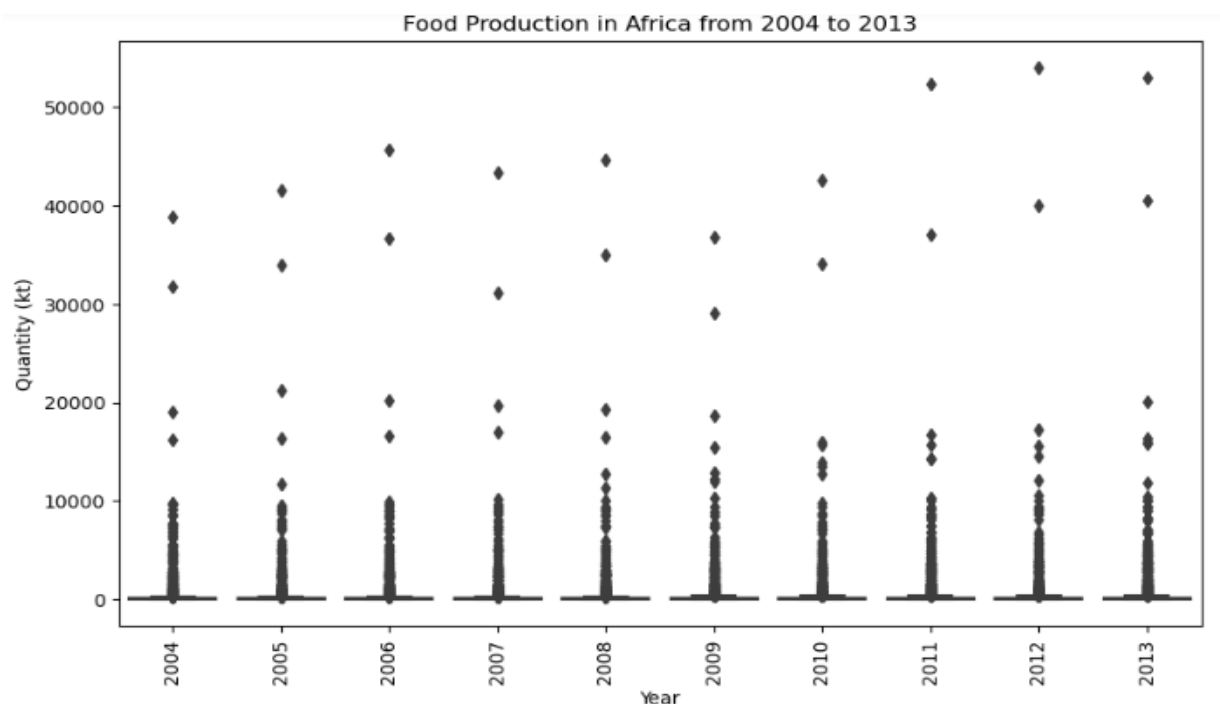
The "Food Production in Africa from 2004 to 2013" boxplot above displays food production outliers, quartile and inter-quartile ranges. The boxplot looks strange because over 1500 values happen to be outliers (Values that are totally outside the quartile ranges and the entire boxplot). Zooming the boxplot by 1000% will help to show a better view.
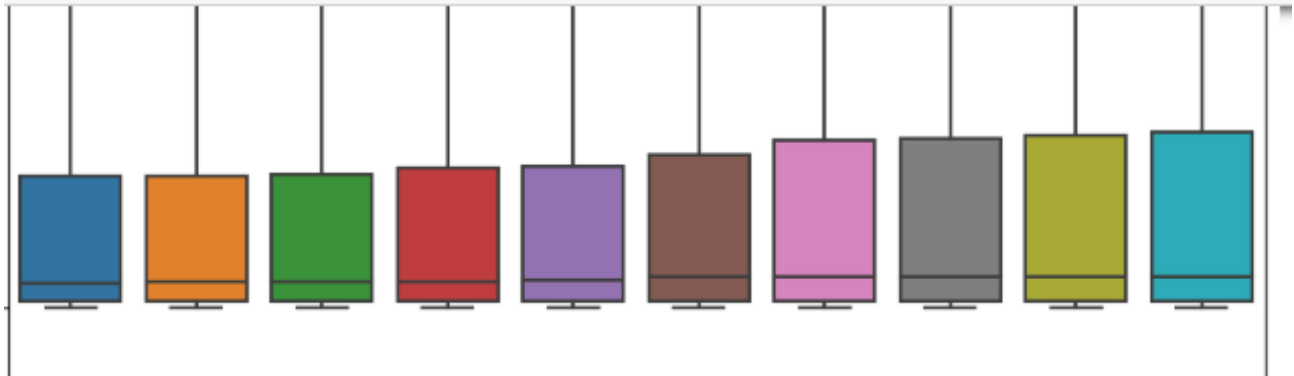
Magnified Boxplot of the Food Production

The zoomed boxplot gives a better picture of food production for each year. It is almost impossible to tell the exact values of the median and quartile values from the boxplot considering the range of the values, so a deeper analysis of dataset was done to get the exact values of the mean, median and quartile values for each year as in the table below

Mean, Median, 1st Quartile (Q1), 3rd Quartile (Q3) and Interquartle Range(IQR) Values (kt) of Food Production (2004 -2013)

Year	Mean	Median	Q1	Q3	IQR
2004	329.198610	24	6	123.75	117.75
2005	341.530138	25	6	125.0	119.0
2006	354.515047	25	6	125.5	119.5
2007	346.590864	25	6	131.25	125.25
2008	360.471624	26	6	132.75	126.75
2009	366.292300	29	6	144.5	138.5
2010	384.391984	30	6	157.75	151.75
2011	396.395315	30	6	160	154.0

2012	408.973275	30	6	163	157.0
2013	424.402237	30	6	165	159.0

From the table shown and the magnified boxplot, it is crystal clear that all the years had a 25% of food production value at 6kt. It can also be seen that the frontiers of 50% (IQR) of food production in Africa are for 2004 and 2013, which were 159kt and 117.5kt respectively. Can these quantities be put together to meet the world challenge? That may be unrealistic.

Since none of the food production within the quartile range was up to 10,000kt, a further analysis was done to find out how many food productions exceeded 1,000kt among the over 20,000 recorded food productions. It was discovered that only 1592 food production was from 10000kt to 54000kt. Majority of the productions are below 1,000kt.

A closer look at "Food Production in Africa from 2004 to 2013" graph will show that 2012 has the highest outlier – about 54000kt of food production. This means that this particular country has the highest food production from 2004 to 2013. It is essential to know which country made a great effort to achieve that fit.
Analysis showed that the following countries were the top five 5 producers in 2012, going by Country and Item produced. It can be seen that the same country came first and second consecutively with high production in *Cassava and products* (54000kt) and *Yams* (40000kt).

| Country	Item	Year	Value	CODE
Nigeria	Cassava and products	2012	54000	NGA
Nigeria	Yams	2012	40000	NGA
South Africa	Sugar cane	2012	17278	ZAF
Egypt	Sugar cane	2012	15550	EGY
Ghana	Cassava and products	2012	14547	GHA

So Nigeria is the country that produced most in the year 2012 with a peak production record of 54000kt followed by South Africa and Egypt. Earlier Analysis showed that Nigeria was the highest food producer in Africa throughout the 10year period. One can easily assume that following the existing trend, Nigeria can be depended on for food production to combat global food shortage.

2012 can further be examined to see how Nigeria can be compared with other countries in terms of cumulative food production for the year.

Top Cumulative Food Producers in 2012

| Country	Year	Qauntity
Nigeria	2012	178816
Egypt	2012	96139
South Africa	2012	59581
Ethiopia	2012	44142
United Republic of Tanzania	2012	38956
Ghana	2012	34860
Kenya	2012	28851
Sudan	2012	26373

The graph below shows quantity of food items each of the 45 African countries captured in the dataset produced in 2012
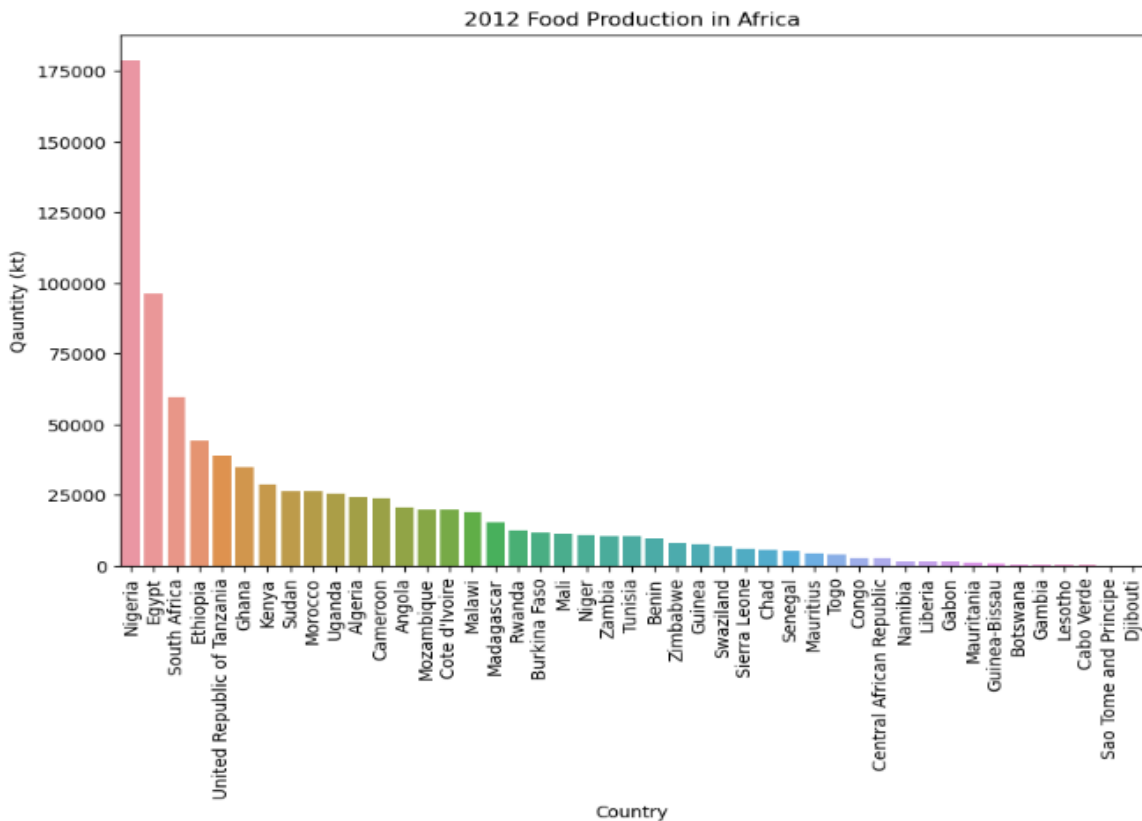
Egypt was next to Nigeria in food production for the year 2012. But the difference in the value between Egypt and Nigeria food production is massive. Nigeria's total production (about 178,816kt) was almost twice that of Egypt (about 96139kt). Of course Nigeria produced about thrice what South Africa which was next to Egypt, produced (about 59581kt) in 2012. If other nations should produce like Nigeria, Egypt, and South Africa, Africa may be able to largely contribute in tackling the food shortage crisis.

Food Items produced from 2004 to 2013.

Quantity (in kt) of food Top Food produced from 2004 to 2013 in Africa
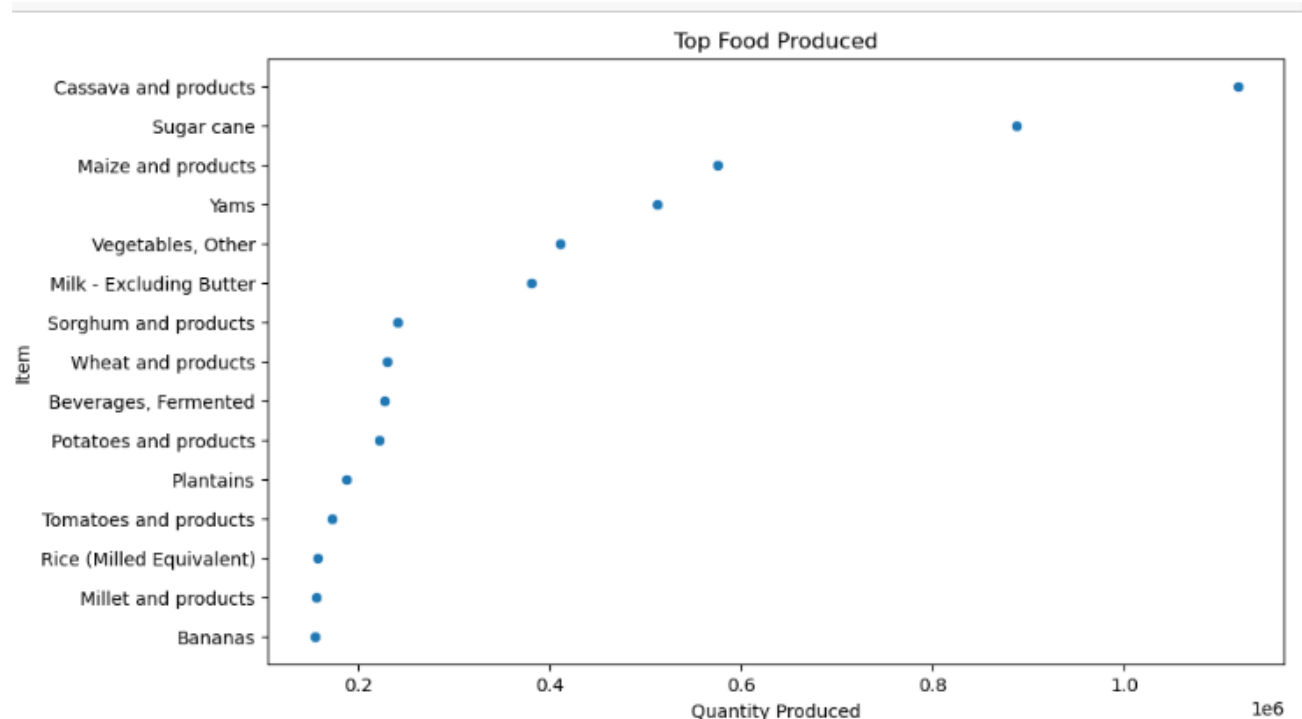
Top Food Produced

The top food products are Cassava and products, Sugar cane, Maize and products, Yams, and Vegetables in quantities of 1,118,948 kt, 887,008kt, 574,948kt, 511,523kt and 410,403kt. A cross examination will show that most of the produce from Africa are African food. A European or an American may not be able to make out much from Cassava and products like an African man will. So if Cassava and products, which are Africa's top products, are distributed around the world, how many people will really have choice-meal available food from it? Well

humans will adapt somehow. And if all around the glide do adapt then Africa's top product will go a long way in reducing food shortage.

Notice too that there are no proteins among the top productions. If the world depends on Africa's top product, malnutrition may become another challenge to deal with soon.

A Comparison between Average Food Consumption and Production for each Year

The primary essence of comparing the average food production and average food consumption/supply is to determine whether production rate is meeting up with consumption rate.

Average food production from 2004 to 2013
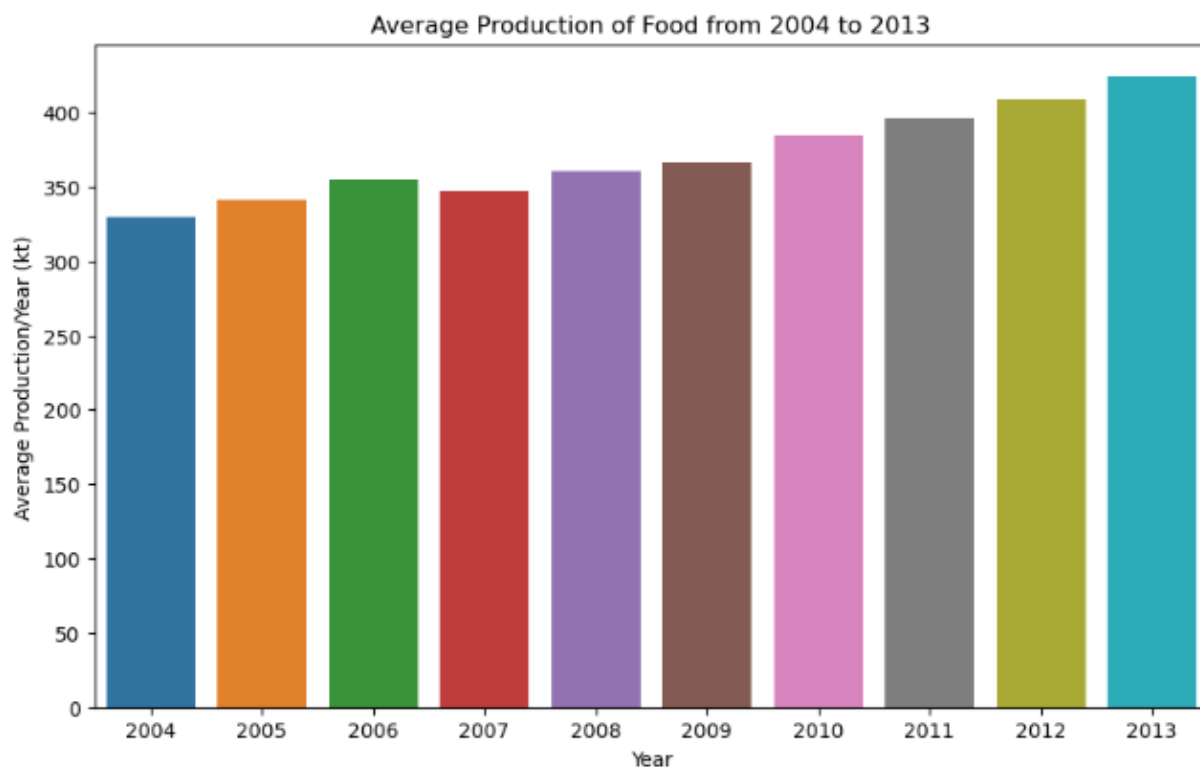
The average production increased over the years, with an upper limit of 424.402kt and a lower limit of 329.199kt. Production increase over years shows a general effort to meet the demand of the increasing population of the human race.

Average Food Consumption/Supply from 2004 to 2013
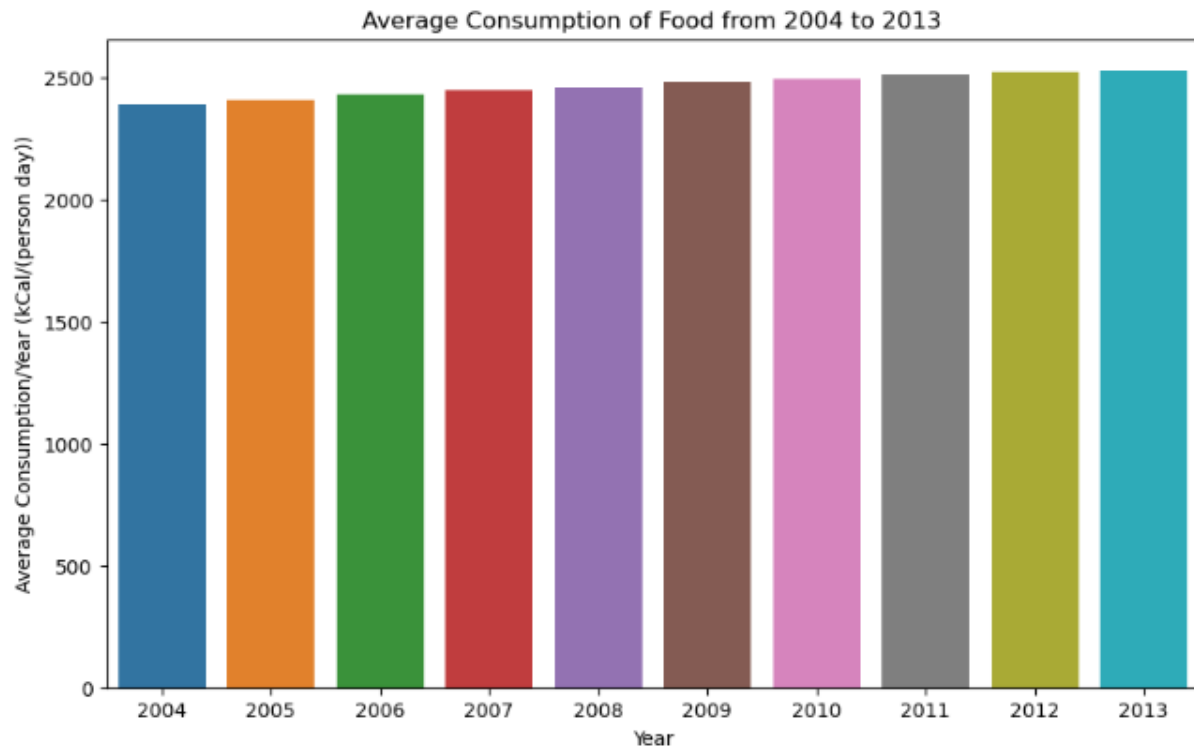
The visualization shows that food consumed a very slow increase in food consumed over the 10 years period. The least average consumption is about 2394 kcal/person/day while the maximum average consumption was 2532 kcal/person/day.

It may not be easy to compare food consumption with food production in terms of quantity because the units are not the same. Food production is measured here in metric tons or kilo ton, while food consumption is measured in kcal/person/day. But they can be compared in terms of rate of increase over time.

It is clear that rate of increase in consumption is less sloppy than rate of increase in population. This raises a question like, Are all produced food items actually used or do most of it waste after production? A straight answer may be no. We can suppose there may be wasted food production because we can't see a uniform gradient when we compare production slope to that of consumption. It is possible that a lot of food produced wasted as food items are generally perishable, hence leading to the observed variation. Else, one can expect that normally rate of

variation of production with time should be the same exactly with rate of consuming same food overtime.

We can as well check the likely number of people that the available food for supply/consumption can actually feed.

To do this, it will be necessary we first estimate the calories consumption requirement of a human. According to National Health Service (NHS) UK, a woman takes an average of 2000 calories per day (2kcal/day) while a man should take 2500 calories (2.5kcal/day).

For the purpose of this analysis let's assume that everyone takes average calories of 2000 calories/day (2kcal).
For 2004 consumption was 2394.222 kcal/day/year, which is the same as 2394.222kcal/day/365days since a year is 365 days.
To obtain the calories consumed for year, it will be 2394.222* 365 which will be equal to
873,891.03kcal/year. Breaking it down to calories per year will yield 873,891,030 calories/year.
Now if a person consumes 2000 calories per day, it therefore means that the number of persons to consume 873,891,030 calories in a year will be dividing the figure by 2000 which will give 436,945.52 persons.
It therefore means that 436,945.52 persons will consume the available 2394.223 kcal available in 2004.
But in that year the world population was estimated for 6,475,751,478. This means that the available food from Africa in 2004 will do nothing in handling the world food shortage as in 2004.

Now if the calculation is repeated for 2013, which was of course the year with highest available food for consumption it will be as follows.
Available calories for 2013 = 2532.244 kcal/person/day
Converting to calories per year = 2532.244*365*1000 = 924,269,060 calories/year
Number of persons to take the available calories = 924,269,060/2000 = 462,134.53

As at 2013, world population was estimated to be about 7,250,593,370

Looking at the ratio of the possible number of persons that will consume the available food in 2004 and 2013 in ratio to the populations of each of the years, it means that Africa need to make available 14,820 and 15,689 times what they have

currently have made available in 2004 and 2013 respectively before they can hope to feed the world.

Conclusion

So can Africa feed the world?
Based on the pattern in Africa's food production dataset, 50% of their production each year from 2004 to 2013 is within 159kt to 117.5kt. This will do nothing to meet the demand of 3.7billion metric tons required to meet the world food shortage crisis.
To solve the world's food problem, African countries need to imitate Nigeria, Egypt and South Africa in food production by consistently making high production.

Africa's top product is cassava and products, and this may not be a choice-food in many places around the world. Africa needs to improve in production of general food like Rice and Oaths. Oaths were not found among top 15 products and this means its production is low.

Comparison between food production and food consumption also showed that the trend of production is not exactly the trend of consumption. And this suggests that not all production is consumed. Therefore, another fine effort to solve the world food problem will be to reduce waste as much as possible so that most food produced will be consumed.

Based on the trend of food available for consumption in relation to estimated world population from 2004 to 2013, Africa total food production for the entire 10 years which is only 7,575,116 kt is gathered together, it is nowhere near 3.7 billion metric tons of food estimated to be the world's food consumption requirement for just one year.
In conclusion, to meet the world's food need, available food supply/consumption dataset from 2004 to 2013, may need to be increased between 14,820 to 15,689 times.