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## **Kenya: Irrigation**

Currently, in Kenya, 3.4 million people are food insecure, with large parts of several counties reaching “Crisis” levels of hunger, according to the Integrated Food Security Phase Classification system. This is only one step away from famine<sup>17</sup>. The agriculture sector is the largest employer in the Kenyan economy, employing 60%<sup>31</sup>. Even though this has been a problem since the 1990s, in 2008, the problem became severe, with a high proportion of the country having no access to sustainable and healthy sources of food<sup>17</sup>. This problem is only getting worse. By 2040, food consumption will exceed demand by almost 20 metric tons<sup>17</sup>. Rapid population growth, high costs of inputs, such as fertilizer, high global food prices, and high poverty levels are all contributing to the problem. However, there is likely another culprit: drought<sup>17</sup>. In Kenya, there are frequent and chronic droughts. For 7 of the past 10 years, there has been a chronic drought in the arid and semi-arid regions, leading the government to declare a drought emergency for 23 regions. A lack of water leads to farmers not being able to produce large quantities of food, leading to higher prices as supply decreases and demand increases. Through irrigation, farmers would be able to get enough water for their crops, thus increasing the food supply and dropping prices, making it more accessible to the public. Currently, only 4% of land is irrigated, with the primary source of water being irregular rainfall<sup>3</sup>. Rainfall is not an effective solution as it prevents the arid and semi-arid regions of Kenya from being used for food production to their full extent<sup>25</sup>. Those regions only contribute 30% of output despite making up 90% of all land in Kenya. If they could become as productive as the high rain areas which produce 70% of the food grown in Kenya, while accounting for 10% of land, the country would be in much better shape<sup>19</sup>. Additionally, with proper irrigation, crop yields would increase helping to solve Kenya’s food shortage<sup>25</sup>. Because of the large amount of land that is currently unused and reliant on rainfall, irrigation would make a drastic difference. Irrigation is the solution to Kenya’s food insecurity crisis.

Kenya has a population of 48,461,567 with 73.94% living in rural areas and 26.06 living in urban areas<sup>4</sup>. Kenya is a republic with a constitution and a bill of rights<sup>20</sup>. The executive branch is elected by majority vote, however, they can ban political parties<sup>22</sup>. There is a separation of the three branches, like in the United States<sup>22</sup>. The Judicial branch can hear and decide cases with absolute authority with no appeal<sup>22</sup>. Out of 100, Kenya has an economic freedom index of 54.7<sup>22</sup>.

In 2014, 48.55% of land was cultivated (5.4 million hectares), with only 4% being irrigated<sup>3</sup>. Their major exports are: black tea, coffee, cult-flowers, and vegetables all of which require a lot of water to farm<sup>19</sup>. The average cup of coffee requires 140 liters of water to produce and tea requires 34 liters<sup>9</sup>. They need to import: corn, wheat, rice, sugar, and cattle<sup>19</sup>. The average small farm is 0.53 hectares, or 1.3 acres, which is the size of a larger property in Ridgewood, NJ<sup>11</sup>. The larger farms are about 2.25 hectares or 5.56

acres<sup>11</sup>. Nationally, the average size is 0.86 hectares or 2.1 acres<sup>11</sup>.

Kenya sits along the coast of the Indian Ocean<sup>4</sup>. It has flatlands that then go into the highlands, which is divided by the Great Rift Valley, which is uninhabitable because of the land is desert, flat arid plains, cliffs, volcanoes, hot springs, and lakes<sup>4</sup>. The Tana River spans 440 miles from Aberdare mountains to the west of Nyeri then into the Indian Ocean<sup>4</sup>. Kenya has 570,000 square kilometers of land and 11,227 square kilometers of water<sup>4</sup>.

Kenya has three climate zones<sup>10</sup>. It is hot and humid by the coast, temperate in the West, and hot and dry in the North and East<sup>10</sup>. The high rain areas account for ten percent of arable land, however, produces 70% of the output<sup>19</sup>. The semi-arid areas produce 20% and the arid areas produce 10%<sup>19</sup>. It is warmest from February to March and coolest from July to August<sup>10</sup>. From November to March, the temperature is from 97 to 99 degrees Fahrenheit<sup>10</sup>. From June to August the temperature is 82 degrees Fahrenheit<sup>10</sup>. The hot and dry season is from October to March<sup>10</sup>. The cool and wet season is from April to September<sup>10</sup>. Before each season there is a short rainy season<sup>10</sup>. Along the coast, there are 31 to 79 inches of rain per year and in the North and East, there are 20 inches<sup>10</sup>. Rain is irregular and usually comes in large quantities in thunderstorms<sup>10</sup>.

The typical family in Kenya consists of 4.4 people per household<sup>1</sup>. In urban areas, people live in more modern housing with access to almost any type of food<sup>2</sup>. However, in the more rural areas people live in houses made of dried mud, and eat rice, fried doughs, cornmeal porridge, yams, and fruits, with a heavy emphasis on maize<sup>23</sup>. Food is obtained from markets or their own farms and cooking through boiling, mashing, or as a part of a stew<sup>23</sup>. People usually hold jobs as farmers, street vendors, sewage maintenance, or house help, however, these poor quality jobs leave unemployment at 40% with an average monthly salary of 6,498 shillings or 76 dollars<sup>24, 29</sup>. This lack of high-quality jobs can be partially attributed to the adult literacy rate being only 72.2% and the literacy rate for people aged 15 to 24 is 82.4% and primary school enrollment is 82%. 85% of people are immunized. On average, 56% of people have access to electricity, with 39.3% of people in rural places and 77.6% of people in urban areas. Very few people have access to improved sanitation facilities only 29.4% (31.1% urban and 28.8% rural) and only 60.9% have access to improved drinking sources (82.7% urban and 28.8% rural).

Food insecurity affects all types of people in many ways. In Kenya, 309,000 people have been internally displaced due to drought and food insecurity<sup>17</sup>. According to UNICEF, “Approximately. 280,00 children [are] affected by acute malnutrition,” causing many health problems. “food-insecure children are at least twice as likely to report being in fair or poor health and at least 1.4 times more likely to have asthma, compared to food-secure children (Health Affairs).<sup>14</sup>” Food insecurity does not just affect children, it also affects elders. In addition to making them more “prone to more grim illnesses like low blood pressure, diabetes, and heart disease, ... food insecure seniors are 60% more likely to experience depression. Fifty-three percent are more likely to report a heart attack. Fifty-two percent are more likely to develop asthma and 4% more likely to report an experience of congestive heart failure (moveforhunger)<sup>13</sup>.” Furthermore, hunger leads to a higher risk of obesity in women, and “Food insecurity during pregnancy has been linked with gestational diabetes, iron deficiency, and low birth weight (FRAC).<sup>17</sup>” In men, hunger has not been linked to obesity. Continuing, it affects urban and rural populations differently.

Urban populations, due to “near total market dependence for food and water (UNICEF)” are severely affected. Rural populations are also very affected because 80% make their living through agricultural activities. Due to the poor farming techniques and a lack of economic resources, “poor farmers may be forced on to less productive land possibly causing further environmental deterioration (UKEssays).<sup>7</sup>” Although, all people are affected by food insecurity, it is the most vulnerable in society, such as minorities and refugees, that have it the worst, since “A lack of food is a symptom of a lack of power in a system that privileges free market principles over social justice and the protection of human rights (Blay-Palmer).<sup>8</sup>”

There are many challenges that people face in trying to obtain food. One of those is government corruption. 45% of business income is spent on bribes, making businesses grow slower and increase their prices. Due to the high levels of poverty, people cannot buy these expensive products, going into the next challenge of high prices, caused by this corruption and the high cost of inputs, like fertilizer which is necessary for growing food in the Kenyan climate. The low productivity of the land, also adds to the issue, as the supply is less than the demand. Main causes of Kenyan poverty include lack of education, caused by absences due to malnutrition and displacement due to drought. Another cause of poverty is government corruption; people are unable to get well-paying jobs because of nepotism and the need to have the right tribal affiliations. Furthermore, since much of Kenyan food is imported, they are more susceptible to fluctuations in the global markets and increased national debt. Many of these obstacles could be fixed through irrigation.

There are many different ways to irrigate farms. One of those is sprinklers. They are good for many types of crops such as industrial crops, fodder, vegetables, flowers, spices, and fruits, mainly for small farms. However, they are more disadvantages than benefits. Sprinklers use a lot of water, which can waste a lot of water and money when improperly installed or for the wrong type of farm or crops<sup>5</sup>. They also require electricity, adding a cost that other irrigation systems would not require<sup>5</sup>. Additionally, many places, 60.7% of rural areas, do not have electricity so this would not even be a possibility. Installing sprinklers for all the farmland in Kenya would cost about 2.5 trillion shillings or 24 billion dollars<sup>5</sup>. This based on the fact that there are 5,184,000 hectares of unirrigated land in Kenya and that sprinklers cost \$4,700 dollars per hectares<sup>4</sup>. This price is too much to pay, especially since there are better cheaper options.

Drip irrigation is a better recourse than sprinklers. Unlike sprinklers, drip irrigation only waters the roots, not wasting any water, and therefore money, on watering the leaves, or soil where there are no plants. One disadvantage is that it has a high initial cost, about 240 billion shillings or 2.35 billion dollars<sup>5</sup>. However, after this initial cost, there is very little operation cost, since it can be gravity or pump driven<sup>5</sup>. It can be used in all areas, regardless of whether they do or do not have electricity. Furthermore, it can increase food yield. For instance, drip irrigation in Ghana and Tanzania has been able to reduce water consumption by 60% and increase yield by 17 times<sup>25</sup>. This is the best option.

There are many choices for where to find funding for this project. One option is through private investment, which would create jobs, help the economy, and be little or no cost to the government and the

people<sup>15</sup>. Also, companies have an incentive to make projects work because that is the only way for them to make a profit<sup>15</sup>. However, this is an unlikely option, due to the many obstacles involved. The main challenge is corruption<sup>21</sup>. Corruption leads to the government not picking the best option for the people, but rather the company that gives the leaders more money, which is costly and ineffective. Furthermore, it disincentivizes companies from investing in Kenya because they have to resort to bribery to get any deals which is illegal in the countries from where they originate and could be persecuted<sup>21</sup>. It is also harmful to businesses, making them grow slower, leading them to invest in other locations where they could make more money<sup>21</sup>. In addition to corruption there are many more reasons why companies do not want to invest in Kenya including:

- High level of corruption; - A slow judicial system; - High unemployment and poverty. - Recent security issues related to terrorism and crime; - Inter-ethnic tensions; - Costly skilled labor; - high costs of energy, instability of the electricity distribution system and poor infrastructure;
- Recent uncertainty concerning the capital constitution of foreign companies and administrative difficulties in obtaining work permits; - Foreigners are not permitted to own land in Kenya (they can rent land for 99 years); - Finally, in order to benefit from certain government incentives, foreign investors must invest a

minimum of USD 100,000 (Santander Trade)<sup>21</sup>. All of this makes private investment a difficult option for obtaining funding, but not impossible. Through efforts made by the public, companies can be encouraged to invest. Companies can run promotions donating a certain amount for every dollar they make, in order to increase their own sales as well as contribute to society.

The next option is government subsidies. Theoretically, it would drop prices until the market recovers and can stand on its own, but this is not what usually ends up happening<sup>28</sup>. According to Economic Nobel Prize Winner, Milton Friedman, ““There is nothing so permanent as a temporary government program’ [meaning] that once a pressure group starts receiving a subsidy, it becomes very difficult politically to remove that subsidy (economics help).<sup>28</sup>” It is also very expensive, costing a lot of money to the taxpayers, and taking away money that could be used for something else. Lastly, it “reduces incentives for firms to cut costs,” making them constantly need more money (economics help)<sup>28</sup>. However, even if they never get removed, they can still be helpful initially.

The government is another alternative. This would involve having to cut some of the government spending or finding the lost 130 billion shillings<sup>26</sup>. One downside is that government is often ineffective due to bureaucracy, red tape, and corruption, which would, like in private investment, make not the best person for the job responsible, but the one with the most money and connections. Lastly, it would involve using the people’s money. One benefit is that Kenya will not have to rely on anyone else to help them and would therefore not owe any debt, either monetary or social. They would also be able to find the solution that works best for them as no one knows a country better than the people that live in it. Even though government can be ineffective at times, with enough pressure from the people, they can make progress.

The last possibility are charities, such as UNICEF, the United Nations International Children's Emergency Fund, which is already “repairing[ing] and expand[ing] water supplies in most affected

areas.” In the 2017 year, they raised 512 million dollars<sup>6</sup>. There are also many other charities such as Charity:Water and Water.org, that do not explicitly fund irrigation but do fund clean water projects in Africa and may be willing to slightly branch out. Individual private donors could also provide funds. There are many benefits to using charities. One is that corruption cannot get in that way as long as the charities perform their work directly and not through giving the money to the government<sup>6</sup>. It would also be no cost to the citizens of Kenya and there would be no barriers like in the other possibilities. The only possible challenge is that there might not be enough money, as charities want to give to many different causes. Charity is the best possibility.

Using charity funding in order to install drip irrigation throughout the farmlands of Kenya is the best way to solve Kenya’s hunger crisis. Charities are a way to prevent corruption, without costing money to Kenya and its citizens. They do not have the same downsides of the other funding options, such as being expensive to the people, being vulnerable to corruption, and being ineffective. Despite charity being the best option, it will take a combination of the options to fully fund the project, so as to avoid resources being depleted. Everyday citizens can campaign for charities, companies, and the government to help Kenya in their struggle. Drip irrigation will cost 2.35 billion dollars (240 billion shillings) for all unirrigated land. It has a low maintenance cost and can be used in all areas since it does not need electricity. It will fix the hunger issue since drought is a common cause of the low agricultural productivity, which increases prices, preventing people from being able to afford food. Food insecurity affects all types of people drastically, so it is a problem in need of immediate fixing. Installing drip irrigation in all cultivated land in Kenya will fix the food insecurity crisis.

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7

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