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## **Introduction**

The country in Africa with the most food waste per person is Nigeria, according to the United Nations Development Program(UNDP, 2021). The report by the UNDP says that 187 kilos of food are wasted per person, per year. In total this amounts to 37,9 million tonnes of food waste in one year alone (Ripples, 2022). This essay is going to delve into the massive issue of food waste as it is now, specifically about the waste in between being harvested and being sold, and how to reduce food waste and increase food security in Nigeria.

## **Background**

Firstly, some core concepts will have to be discussed, mainly what is food security as well as what food waste is. Food waste is a problem that negatively affects food security, which is the topic of discussion in this essay. Therefore these two concepts are essential to understand what is going to be discussed later on.

Nigeria's population is 219,5 million(WorldOMeter, 2022). A typical family in Nigeria consists of 5,06 members, and this number increases in the rural areas, to 5,42 members per household. However, in urban households the number of members decreases to 4,50 according to Statista(2020). Primary education in Nigeria is compulsory and free. However, 10.5 million children of Nigeria, 5-14 years of age, are not in school(United Nations International Children's Emergency Fund [UNICEF], 2022). The average life expectancy in Nigeria is 61,33 years old (Statista, 2022), and there is government healthcare called National Health Insurance Scheme (NHIS). Nigeria spends 3,7% of GDP(Gross Domestic Product) on healthcare. 77% of Nigerians have to pay for their health care out of pocket even though they get paid miniscule amount of money. Additionally, the health care available is not affordable compared to their low wages according to Swiss Re Foundation(2022). Undernourishment is the major problem in Nigeria as 1 in 10 children dies before the age of 10 because of famine(Sahara Reporters,2022). The total percentage of undernourished people is 12,7% (Global Health Index, 2022) and the healthcare system is not able to handle the issue due to them being underfunded. Furthermore, this issue is exacerbated by the fact that Nigerians themselves do not have the money required to feed their children. The average Nigerian already spends around 85% of their income on food(This Day Live, 2022). According to The United Nations International Children's Emergency Fund (UNICEF, 2021), around 70% of Nigerians have access to water but half of it is estimated to be contaminated, and on average there are only 9 liters of water available a day per capita. Statistics from Statista(2022) show that 30% of Nigerians that live in rural areas have access to electricity compared to 91% of

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people that live in the urban areas, in total it is 62% that has access to electricity(Connecting Africa, 2021).

An average Nigerian family's diet consists of rice which is the most used product, yam, gari, honey beans, egusi(All Nigerian foods, 2019). They often eat soup and curries which they consume with fufu, which is a type of dough. Among the most common jobs are: factory workers , drivers, farmers and teachers. On average, the Nigerian wage is 170 dollars each month and minimum wage is 70 dollars(WageCenter, 2022). Additionally, the Nigerian minister of agriculture said that,“Nigeria is endowed with a total of 79 million hectares of agricultural land with only 44% being cultivated”(This Day Live, 2022). The average farmer owns 1 to 3 ha of land compared to Sweden's 36 ha of land (Land Links, 2022), showing that whilst farming is one of the most numerous vocations, each farmer only owns a fraction of land. Farmers in the north of Nigeria have more farmland than the ones in the south due to the fact that the south is more densely populated. Their major crops include cassava, maize, millet, rice, yam beans and guinea corn. Lastly, the main Nigerian export includes crude oil, petroleum gas and special purpose ships(The Observatory of Economic Complexity, 2020).

Food waste in Nigeria is the worst in all of Africa by millions of tons - the World Bank(2020) estimates that 40% of food in Nigeria is wasted. Most of the food waste comes from handling and transporting, showing that the crux of the issue is improper food storage. Any food that does eventually spoil leads to a direct hit on the farmers bottom line, which in many cases can lead them to bankruptcy. If this problem of food waste is solved we can not only decrease famine but also increase job security. Nigeria's roads are in bad condition as they are mainly made from grit, and this damages the food products whilst they are transported(Country Reports, 2022). This decreases the amount that can be exported/sold and the food products get bruised and go bad. Fixing the potholes and changing the roads could reduce this problem, though this solution is difficult as it requires a comprehensive update to Nigerian infrastructure.

Hunger affects especially children and women, thus the amount of food waste that can be saved would help decrease the number of undernourished children in Nigeria. Action Against Hunger(2022) reported that the most affected by hunger are children that run a risk of dying due to the fact that they are not able to fight diseases. Women are more affected by hunger than men as they often tend to feed the others before themselves - according to Action Against Hunger(2022) 150 million more women are left hungry compared to men. Anyone with not enough income is affected by the food waste problem, as the supply being reduced increases the price.

## **Suggestion**

The solution that will be presented can not meet all of the needs, as there are many causes and a solution that would assess all of them does not exist, however it is going to be a part of the overall

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solution to Nigerian hunger. Furthermore, fixing food security is essential and decreasing food waste will increase food security. In turn this will decrease the number of children dying from undernourishment as well as the overall number of hungry people. The implemented solution will aim at decreasing food waste between the steps of harvesting and selling, since it is there that most of the food waste in Nigeria stems from.

Firstly, analysis of other solutions that can reduce food waste is required, before the main solution is discussed. Fixing Nigeria's infrastructure can reduce food waste, as better roads means less food will be damaged and bruised during transport. Food products that would then be damaged in this process could be saved and greatly reduce waste, so it is critical to solve Nigeria's road situation. The root cause to the roads poor condition however is that they are over trafficked and under funded.

Another solution that would benefit Nigeria would be to have agronomists come out and educate farmers about proper handling and harvesting of produce. The educators can for example come from universities such as SLU that are focused on agriculture. Agronomists will teach proper handling of the harvest in all aspects like tools/machinery, timing, planning and limitations. This would decrease food waste from poor handling during the harvesting phase, thus somewhat mitigating the food waste crisis.

The main solution that will be promoted to solve the problem of food waste in the period between harvesting and selling is a three in one solution:

- Cold hubs
- Storage facilities
- Processing

All of these combined is a great solution to save the food before it gets wasted. The cold hubs would keep vegetables and fruit fresher for longer. Storage facilities would keep grain dry and would protect from adverse weather conditions. The grains would dry in the storage facilities so that they do not have to dry next to the roads(Zerwa, 2021), which is the current situation. Quick processing means that there would be reduced time for the products to deteriorate before they are preserved. Having all of these three solutions within a close proximity of each other would benefit the small towns and farmers greatly, as centralizing the inventory phase means that everything the farmers would need is close at hand. Furthermore this centralisation is also the reason as to why the three components make up one larger solution, as they are all required to effectively handle pre processed produce. This can then benefit larger cities as well since there is more food that can be transported in due to a reduction of spoilage, leading to an increase in welfare.

## **In depth analysis of the constituents of the three step solution**

### **Cold hubs**

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A cold hub is a relatively large box that is powered by solar energy, that in turn keeps produce cold, such as indicated by its name. The hub would be owned by the community as a whole and paid for by the amount of usage. Lastly, cold hubs mainly employ women to install and maintain their boxes.

The issue is that food spoils quickly because of the warm weather and the bacteria growing due to the heat. The heat makes the bacteria double in the span of 20 min according to the U.S Department of Agriculture(2020). Using cold hubs will keep the produce out of the heat, this will in turn keep the produce from growing bacteria. Using cold hubs will furthermore reduce 80% of post harvest loss, and increase the shelf life of the produce from 2 to 21 days according to Cold hubs(2022). This gives optimal chances of selling the produce as if it was just harvested.

Nigeria's electricity is unreliable and according to Nature Energi(2017) an average household suffers 19 h without electricity every day. Having a separated energy grid would prevent power outages, this is crucial for preventing food wastage. Cold hubs use solar energy which thereby prevents them being affected from power outages as it is a separate power system, compared to a normal fridge system that uses the public energy grid. Solar energy is the most sustainable option to use and it is also cost effective.

Lastly, it is cost effective for Nigeria to use. Currently Nigeria's economic status GDP per capita is 2,085.0 US dollars(World Bank, 2021), reflecting their economic situation as well as the fact that the average wage is only 170 dollars a month, as brought up earlier. To mitigate this issue, the cold hubs employ a pay per use model, which only credits the farmers by the amount that the cold hub is used. This way the cold hub is also an economically viable option for Nigerians to use. The effect of this is that there is a solution that can actually be used by the people that need them the most, that being impoverished farmers in rural Nigeria.

However, it is a small scale solution made for lower income farmers. This solution can at the moment not meet every farmer's requirements as it is a small scale project, exemplifying this is the fact that there are only 54 operational cold hubs(How We Made It In Africa, 2022). Furthermore, the cold hubs are intended for small-scale farmers, meaning that the solution is not for everyone. But the owner of cold hubs has stated their intent to expand the business in the near future, remedying most of the above concerns.

### **Storage facilities**

Storage facilities are larger metal squares with a roof and four walls, intended to keep grain and produce away from weather and vermin. Similar to cold hubs, just not cold.

Much like the cold hubs they keep the products from adverse weather. Storage facilities are cost effective as they do not cost much to install and do not need a great deal of maintenance, compared to coldhubs, that require constant maintenance. Using storage facilities will be beneficial as the grains can dry in the facilities instead of on the roads, meaning that no vermin will spoil the food.

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Storage facilities are not intended for all produce - mainly grains can be stored there. So they will not reduce food waste a great deal, but still a bit. However, since these solutions are meant to complement each other, what can not be stored in a facility can be stored in a cold hub, and vice versa.

### **Processing**

Processing is when the produce is preserved in some way, for example: canned, heat treated, salted or pickled.

As mentioned earlier, roads are in bad condition and if fixing them is not an option, processing the produce is a great alternative. This is because it makes the produce less sensitive, which is crucial because a lot of food is bruised during transport. Processed food can be transported safer because it has been put in cans, glass jars or other forms of storage containers, meaning that the content will not easily be damaged. Lastly, processed food also has a better shelf life compared to fresh produce, meaning that the produce can be transported longer distances.

Nevertheless, it has to be stated that this solution is not applicable to all produce. This is why there are three solutions to solve the issue of food waste, for the reasons that not a single one would work for all produce.

### **Funding and sustainability of solutions**

Suggested ways of **funding** of all the above suggestions:

United Nations Development Program(UNDP), United Nations International Children's Emergency Fund(UNICEF),World Food Program(WFP), International Fund for Agricultural Development(IFAD) and National support programs for example SIDA from Sweden. Additionally, all of the above solutions are very **sustainable**, since a relatively limited start-up effort will be transformed to a long term gain in multiple levels. For the cold hubs and the processing the energy must be supplied by a source that is sustainable for the area. Examples are hydropower or solar energy. When preparing the produce out of the above suggestions, plastic carts and containers made from recycled material can be used.

### **Conclusion**

Nigeria's food waste problem is extreme, and the suggested solutions adequately face it. Cold hubs will have an impact on fresh produce like fruit and vegetables. Storage facilities will be beneficial for grains, and processing makes food last longer. The three in one solution is a method that will work to prevent food waste, and decreasing food waste in Nigeria will in turn increase the food security in Nigeria. Compared to the alternatives, the three in one will have the biggest impact on decreasing food waste for a limited investment and quick results. Having nutritious food available is key for developing a healthy population. The devastating effects of famine can be resolved, using the three in one solution presented.

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