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Zimbabwe: Using technology to make agriculture insensitive to climate change

Zimbabwe is a beautiful country in the southern parts of Africa with a spectacular wildlife. This landlocked country borders South Africa, Botswana, Zambia and Mozambique. It also has a considerably young population, with more than 1/3 of the population under the age of 15 and 1/3 third is between the age of 15 and 29 (Britannica, 2021). This young population is unfortunately starving and food security in the country is worsening due to climate change. The country is suffering because of climate-related disasters such as long periods of drought affecting the harvest and thereby the amount of food produced and consumed in the country. However, the solution to improve food security in Zimbabwe is simpler than imaginable.

Zimbabwe is an African country located in the southern hemisphere with a population of approximately 15 million as of 2022 (Worldometer, 2022). 67.76% of the total population is rural and 32.24% is an urban population, as suggested by Trading Economics (2022). An increase in rural populations is seen clearly in the recent 14 years. Like many other African countries, the country has an agro-based economy that relies greatly on a climate-sensitive sector, agriculture. As a result, more than 50% of the population are farmers, mostly small-scale farmers, according to a report by the Food and Agriculture Organisation of the United Nations (Tekere, n.d.). The total land area of Zimbabwe is 39 million hectares of which 33.3 million hectares are used for agricultural purposes, which equals an estimated 85% (Tekere, n.d.). The major crops grown are maize, cotton, soybeans, wheat, tobacco and horticultural crops such as roses. There are 2 major subgroups in agriculture where it is based on the size of landholdings. The larger group consists of 7.1 million smallholder and communal farmers that occupy a total land area of 21 million hectares and the second group consists of large scale farmers, only 4000 farmers, occupying 11 million hectares of land, as specified by the Food and Agriculture Organisation of the United Nations (Tekere, n.d.).

The average household in Zimbabwe consists of 4 people, according to PRB's World Population Data Sheet (2022), with average monthly wages of around 217 000 ZWD (or around 673.91 USD), (Salaryexplorer, 2022), and this number may vary greatly according to different sources. Men earn an estimated 13% more than women across all career fields (Salaryexplorer, 2022), though there are no clear reasons for these differences.

An average family diet in Zimbabwe includes a plentiful amount of grains, specifically maize, as well as air-dried meat, fish and peanuts (Ettenberg, 2016). Maize is very popular and is used in many different dishes. Dry foods that do not need cooling (because many households do not have refrigerators), such as fish that is dried in the sun, is also common, according to Ettenberg (2016). For an additional source of protein in their diet during the dry season, they eat peanuts and dried insects, the most common one being *Gonimbrasia Belina*, a species of emperor moth that is locally known as the mopane worm (Ettenberg, 2016).

Farmers in Zimbabwe do not usually eat their harvest, but instead, buy most of their food supplies. That is due to the lack of diversity of the food grown on every farm. Farmers can not rely on only one crop to feed their families, they use their earnings instead to buy other grains and vegetables. Families in rural parts can spend up to 80% of their income on food (Dollarstreet, n.d.). The food prices in Zimbabwe are very unstable as they change rapidly. An example of that was when the prices saw an increase of 900% during only one year (2019), according to US Agency for International Development (U.S.AID, 2020)

Zimbabwe is, unfortunately, suffering greatly due to its hunger crisis caused mainly by climate change. It is one of the most affected countries regarding climate change and agriculture, and yet the practises to grow food have not developed and are not sustainable for the future. As the concentration of greenhouse gases is increasing in the atmosphere, the temperature of the earth is rising dramatically. The biggest cause of this problem is human activity, where the use of fossil fuels such as coal, oil and gas (World Wide Fund for Nature [WWF], 2020), lead to catastrophic consequences worldwide, most notably in Africa. The negative impact of global warming includes longer periods of drought threatening crops (WWF, n.d.), rising sea levels, shrinking glaciers, extreme weather and shifting rainfall (European Commission, n.d.). Zimbabwe and the majority of Africa are especially affected by climate change due to their geographical placement on earth, their overreliance on climate-sensitive sectors like agriculture that provide around 70% of all income in Africa and their poor land-use practices (Climate Change Management Department, n.d.). That can lead (and has led) to an estimated 25% decrease in agricultural productivity between the years 2003 to 2080 in many parts of Africa and Zimbabwe (Climate Change Management Department, n.d.). The landscape has faced significant damage due to natural disasters, most commonly drought (Adames, 2020). The country saw one of the worst droughts during December of 2019 which had hideous consequences on food security, limiting crop production and leading to the worst hunger crisis in a decade. The rural population is suffering significantly more than the urban population and drought seasons left millions desperate for food. Families had to survive on eating and selling wild fruits (Climate Change Management Department, n.d.).

1 in 3 children is suffering from malnutrition in Zimbabwe. It is estimated that a child dies every 10 seconds due to hunger and that is more than AIDS/HIV, Tuberculosis and Malaria combined, according to Josette Sheeran (Technology, Entertainment, Design [TED], 2011). Research also shows that if a child in its first 1000 days to 2 years does not get sufficient nutrition, they will suffer permanent brain damage. Josette Sheeran states that brain volume can decrease up to 40 % in children if they are malnourished (Technology, Entertainment, Design [TED], 2011). These statistics are clear evidence of the severity of the problem and its consequences that will be permanent. It is the reason that decisions need to be taken rapidly to stop this humanitarian crisis.

The political situation in Zimbabwe has had a long history of being very unstable and undemocratic. The Zimbabwe African National Union–Patriotic Front has dominated Zimbabwean politics for the past 42 years (since independence in 1980) and has done so by silencing any opposition (Freedom House, 2021). The irresponsible and undemocratic government has led to political uncertainty that caused severe inflation and a higher crime rate across Zimbabwe (*Zimbabwe - Political and Economic Environment*, 2022).

An unstable economy has a damaging effect on food security making food prices unaffordable. Earning a living in Zimbabwe is extremely hard because wages are exceptionally low compared to the price of basic food supplies such as sugar, maize, eggs and cooking oil (Hobbes, 2014). These basics are more expensive kilo for kilo in Zimbabwe than they are in Zambia, Botswana, or even South Africa where the average wages are 19 times higher than in Zimbabwe (Hobbes, 2014)

Zimbabwe therefore needs a reform in their agriculture to solve the problem of food insecurity. Many organisations are helping Zimbabwe by delivering food to the country, but that is not a sustainable solution for the future considering the fact that a functioning country has to be able to supply its population. To eliminate the unpredictable factor, climate, for providing nutritious food for the population, a sustainable solution is underground farming. The concept is relatively new and is one of the solutions proposed worldwide to combat hunger caused by climate change. Underground farms are, as the name suggests, farms built underground. The process includes using hydroponic systems and LED technology. The crops have a higher nutritious value because they are grown in a pesticide-free environment which is

much healthier than usual crops, according to Broom (2021). These high-technology vertical farms can be controlled using an automated tech network to control the environment underground, such as temperature, humidity and CO₂ levels (Moon, 2020)

There are many benefits to underground farming. The biggest advantage being that the climate on the ground level has no impact on the food grown underground, and as climate change is worsening this is a suitable solution for the future. Drought seasons will not lead to a hunger crisis and countries would be able to secure their access to locally grown food all year. By controlling the environment underground, it allows Zimbabwe to grow food that they previously have not been able to grow due to their climate, which will result in a wider variety of nutritious food. In addition to the system being climate insensitive, it is also space-efficient, because the farms are vertical. 33 million hectares are used for agricultural purposes as mentioned before, which can be utilised for other projects instead. Such as providing space for cities to be built for the ever-growing population. It is estimated that this way of growing food is 40 times more efficient than traditional farming, as stated by Moon (2020), and will produce enough food to supply the whole country if a sufficient number of underground farms are established. These farms also use 70% less water compared to usual on-ground farms, (Broom, 2021). The obstacle however to such a system being implemented is the high costs of the construction and the advanced technology.

To make underground farming a reality, international organisations need to make large donations and contributions to fix this problem permanently and give the starving population of Zimbabwe hope. Organisations such as Agriculture Organisation (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP), and the World Health Organisation (WHO) can all be part of the solution. The food prices will also be lower as a side effect of the food being grown inside the country and in large amounts, which also leads to better availability of food.

This system will risk more than half the population losing their job considering that a large portion of the population works in agriculture, which will dramatically increase the unemployment rate. Educating the farmers will be of high importance for this system to function properly. By offering free courses for these workers to help them learn to build and maintain these complex systems, the country utilises its labour for a greater cause that will ensure a safer future. The policymakers play their role in the development of agriculture by providing these courses for free considering that many would choose not to take them because of the cost. With improved use of the working population, the country's overall health and wealth will bloom. An effective agricultural system that (if used and maintained correctly) can generate enough food for Zimbabwe to consume and export to neighbouring countries, which can help the economy to grow. This will surely be a big investment for the Zimbabwean government, but the right vision in mind will drive the revolutionary change needed.

Other long term solutions include using drought-resistant crop varieties and genetically modified food. Farmers must substitute maize for example, with crops that can survive drought season. Good substitutes include sorghum, cassava, sweet potato, pearl millet, cowpea and groundnut who are all more drought-tolerant than maize, as specified by Moloney (2017). A different crop that is being researched and is being used on a small scale around the world is cowpea. This crop thrives in parched soils and drought-prone areas. Cowpea can survive with as little as 300 mm of rain each year. The stalks and stems are rich in protein and can therefore be used as fodder for livestock, (Moloney, 2017). Researchers are taking out the genes in cowpea that make it drought-resistant in order to produce other varieties of the crop. A similar research process is being done using chickpeas where drought tolerance is being enhanced (Moloney, 2017). Using these newly-developed techniques and modified crops will lead to a larger and regular harvest that will hopefully supply the whole of Zimbabwe considering the resources that are already put into agriculture, both the amount of land and labour used in this field.

The government of Zimbabwe should invest in modified and drought-resistant crops and support the research being done to improve them. The project can be funded by international organisations such as the Fund for Agricultural Development (IFAD) and other world leaders who would also benefit from the research by discovering how it can be utilised in another context. The investment will also prove the effectiveness of the project that can be implemented in their countries. The process begins with buying seeds, from seed companies, both genetically modified plants that are made to be drought resistant and naturally drought-resistant crops. By aiding small farmers financially and purchasing the seeds to grow in the country, the government is then looking ahead to a brighter future where food insecurity is non-existent. The seeds from the harvest each year can be saved and replanted, making the process very cost-efficient and sustainable economically and environmentally. This also means that farmers can reproduce at the same high rate each year without higher costs. That leads to a healthier economy and a stable food income.

In conclusion, Zimbabwe is currently facing many problems in its agricultural system due to the rising temperatures on earth and the changing climate that are limiting and affecting harvest. But there are effective long term solutions that can be implemented to reach the goal of having a stable food supply. The solution will revolutionise agriculture worldwide for generations to come. By utilising the technology available and the research being done, unbelievable results can be achieved. Combining the use of underground farms and drought-resistant crops will improve the effectiveness of growing food and will also help the economy grow considering agriculture plays a big role in Zimbabwe's economy.

References

- Adames, B. (2020, February 14). *How Droughts in Zimbabwe Affect the Hunger Crisis*. The Borgen Project. Retrieved March 22, 2022, from <https://borgenproject.org/droughts-in-zimbabwe/>
- Britannica. (2021, November 1). *Zimbabwe | History, Map, Flag, Population, Capital, & Facts*. Encyclopedia Britannica. Retrieved March 8, 2022, from <https://www.britannica.com/place/Zimbabwe>
- Broom, D. (2021, April 22). *World's first underground farm grows sustainable vegetables | World Economic Forum*. The World Economic Forum. Retrieved March 22, 2022, from <https://www.weforum.org/agenda/2021/04/underground-vegetable-garden-sustainable-farming/>
- Climate Change Management Department. (n.d.). *Climate Change and Agriculture: Issues and Recommendations*. Climate Change Management Department. Retrieved March 22, 2022, from http://www.climatechange.org.zw/sites/default/files/Agriculture%20and%20climate%20change_0.pdf
- Dollarstreet. (n.d.). *Antonio | families | Dollar Street*. Gapminder. Retrieved March 22, 2022, from <https://www.gapminder.org/dollar-street/families/antonio>
- Ettenberg, J. (2016, November 30). *Through the maize: Foods of Zimbabwe*. G Adventures. Retrieved March 22, 2022, from <https://www.gadventures.com/blog/food-zimbabwe/>
- European Commission. (n.d.). *Climate change consequences*. European Commission. Retrieved March 22, 2022, from https://ec.europa.eu/clima/climate-change/climate-change-consequences_en
- Freedom House. (2021). *Zimbabwe: Freedom in the World 2022 Country Report*. Freedom House. Retrieved September 2, 2022, from <https://freedomhouse.org/country/zimbabwe/freedom-world/2022#PR>
- Hobbes, M. (2014, January 6). *Zimbabwe Prices: Why Are They as High as New York City's?* *The New Republic*. <https://newrepublic.com/article/115925/zimbabwe-prices-why-are-they-high-new-york-citys>
- Moloney, A. (2017, March 6). *Factbox - From new beans to ancient plants, drought-busting crops take root*. Reuters. Retrieved March 22, 2022, from <https://www.reuters.com/article/us-drought-agriculture-crops-idUSKBN16D0ZG>

- Moon, K. (2020, July 24). *Is underground farming the future of food?* BBC. Retrieved March 22, 2022, from <https://www.bbc.com/travel/article/20200723-is-underground-farming-the-future-of-food>
- PRB World Population Data Sheet. (n.d.). *International Data*. International | PRB. Retrieved March 22, 2022, from <https://www.prb.org/international/indicator/hh-size-av/map/country/>
- Salary explorer. (2022). *Average Salary in Zimbabwe 2022 - The Complete Guide*. Salary Explorer. Retrieved March 22, 2022, from <http://www.salaryexplorer.com/salary-survey.php?loc=243&loctype=1>
- Tekere, D. M. (n.d.). *Zimbabwe[114]*. FAO.org. Retrieved March 8, 2022, from <https://www.fao.org/3/y4632e/y4632e0y.htm>
- Trading Economics. (n.d.). *Zimbabwe - Rural Population - 2022 Data 2023 Forecast 1960-2020 Historical*. Trading Economics. Retrieved March 22, 2022, from <https://tradingeconomics.com/zimbabwe/rural-population-percent-of-total-population-wb-data.html>
- U.S. AID. (2020, April 13). *Food Assistance Fact Sheet - Zimbabwe | Food Assistance | US Agency for International Development*. USAID. Retrieved March 22, 2022, from <https://www.usaid.gov/zimbabwe/food-assistance>
- Worldometer. (2022, March 8). *Zimbabwe Population (2022)*. Worldometer.info. Retrieved March 8, 2022, from <https://www.worldometers.info/world-population/zimbabwe-population/>
- WWF. (n.d.). *Effects of Climate Change | Threats | WWF*. World Wildlife Fund. Retrieved March 22, 2022, from <https://www.worldwildlife.org/threats/effects-of-climate-change>
- WWF. (2020). *Causes of Climate Change*. WWF New Zealand. Retrieved March 22, 2022, from https://www.wwf.org.nz/what_we_do/climateaction/causes_of_climate_change/
- Zimbabwe - Political and Economic Environment*. (2022, August 2). International Trade Administration. Retrieved September 4, 2022, from <https://www.trade.gov/country-commercial-guides/zimbabwe-political-and-economic-environment>