FOOD SECURITY THROUGH DISASTER PLANNING IN TANZANIA: HOW AGRICULTURE-BASED DISASTER PREPAREDNESS CAN IMPROVE FOOD SECURITY IN TANZANIA

by

Savannah A. Emerich

Helms School of Government, Liberty University

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Savannah A. Emerich

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APPROVED BY:

_____ Melissa Beaudoin, PHD

_____ Timothy O'Brien, PHD

ABSTRACT

In Tanzania, half the population lives below the poverty line and suffers from food insecurity. Of the population, women and children primarily suffer from malnutrition due to food insecurity. For Tanzania, the problem is so severe that some women do not name their newborns for weeks or months due to their unlikely survival. This problem worsens for those who have a significant reliance on agriculture and live in the nation's rural areas. These rural communities face more traumatic burdens when floods and droughts destroy crops, fields, and tools and ruin livelihoods. A solution has not been implemented thus far due to lack of funding, government priorities, and unavailable resources and education. However, the scope of this thesis identifies a solution to reduce food insecurity by establishing more available crops for food despite natural disasters. In creating a solution for this ongoing problem in Tanzania, this thesis aims to bridge the gap between food insecurity and disaster relief and provide a policy-based solution that supports the rural populations of Tanzania. The research derived from this thesis would suggest that there are multiple potential factors and solutions to food insecurity, *if Tanzania establishes policy-based solutions to prepare their crops for floods and droughts, they can mitigate the damages caused by these disasters, resulting in more available crops for food* which will yield positive results towards food security for generations to come.

Keywords: Food insecurity, agriculture, disaster relief, Tanzania, rural

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List of Abbreviations

African Union [AU]

Dar es Salaam Multi-Agency Emergency Response Team [DarMAERT]

Gross Domestic Product [GDP]

Global Food Security Index [GFSI]

Global Report on Food Crises [GRFC]

International Food Policy Research Institute [IFPRI]

Non-Governmental Organization [NGO]

United Nations Food and Agriculture Organization [UNFAO]

United Nations Office for Disaster Risk Reduction [UNODRR]

United Nations World Food Programme [UNWFP]

United States Agency for International Development [USAID]

United States Dollar [USD]

CHAPTER ONE: INTRODUCTION

Introduction

The United Republic of Tanzania[1],[2] suffers from being one of the least developed, food-deficient States in the world (United Nations Office for Disaster Risk Reduction, 2020; United Nations World Food Programme, 2015). For decades, Tanzania has demonstrated continued patterns of food insecurity[3]. Recent studies have revealed that over half the population has faced some form of food deficiency and that Tanzania has one of the highest malnutrition rates on the planet (Lokuruka, 2020; ReliefWeb, 2019). This food insecurity problem affects the rural population more than their urban counterparts. Specifically, 80% of Tanzania's population is rural, and 87% of the rural population suffers from food insecurity (Mayoke, 2017, para. 2; UNWFP, 2012, p. 4). Agriculture accounts for 77% of the population's employment and 95% of food crops (Nyoni, 2016, p. 3). The primary crops grown in Tanzania are maize, sorghum, millet,

[1] Due to the complexities and lack of information of the islands, this study will focus its efforts on mainland Tanzania. Based on the extreme weather diversity in the high mountainous regions, this study will focus on the flat savannas.

[2] To understand Tanzania's placement, depending on the source, Tanzania can fit into the categories of Sub-Saharan, Southern, and Eastern Africa. To understand the scope of the regions Tanzania falls within, the below information will focus on Southern and Eastern Africa. For this paper, Eastern Africa is defined as Eritrea, Ethiopia, Djibouti, South Sudan, Somalia, Kenya, Uganda, Rwanda, Burundi, Tanzania, Malawi, Zambia, Madagascar, Malawi, Mozambique, Seychelle, Comoros, Mauritius, and Zimbabwe. Southern Africa is defined as Mozambique, Malawi, Tanzania, Zambia, Zimbabwe, Botswana, Nambia, South Africa, Swaziland, Angola, and Lesotho. Sub-Saharan Africa is comprised of the states that are south of the Sahara (either entirely or partially).

[3] For Tanzania, the targeted a daily per capita intake is 2,137 calories (Cochrane & D'Souza, 2015).

rice, wheat, beans, cassava, potatoes, bananas, and cashew nuts (Bank of Tanzania, 2020; Mitawa & Marandu, 1996).

Food insecurity is defined by the 2020 *Global Report on Food Crises* (GRFC), produced by the United Nations World Food Programme (UNWFP), as "the lack of secure access to sufficient amounts of safe and nutritious food for normal human growth and development and an active and healthy life" (2020a, p. 11). Food insecurity can have numerous causes, among them are poor governance, economics, conflict, and natural disasters (The Economist Group, 2020; United Nations Food and Agricultural Organization, 2021b; UNWFP, 2020a). Specifically, in Tanzania's agriculture-based food sector, annual shortcomings are primarily caused by natural disasters, which can cause irregular rainfall and soil degradation (Lokuruka, 2020). These disasters may result in damaged or destroyed farming equipment, structures, fields, crops, seeds, and reduced resources. These problems are exacerbated by a lack of education on sustainable farming practices, resources to secure farming prior to a disaster, and funding.

While the problems of food insecurity are vast and complex, this thesis will focus on mitigating the damages from floods[4] and droughts[5] as the two primary reoccurring natural disasters which can contribute to the problem of food insecurity through agriculture-related damages. The "areas affected by floods produce about 0.45% of the national gross domestic product (GDP) which corresponds to about 215 million United

[4] The United Nations Office for Outer Space Affairs identifies a flood as "the overflow of water from a stream channel into normally dry land in the floodplain (riverine flooding), higher-than–normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as ponding of water at or near the point where the rain fell (flash floods)" (n.d., para. 1).

[5] The United Nations Office for Outer Space Affairs defines droughts as "a consequence of a reduction over an extended period of time in the amount of precipitation that is received, usually over a season or more in length." (n.d., para. 1).

States dollars (USD) per year" (Rudari et al., 2018, p. 11). At the same time, droughts in Tanzania impact an average of 5.5 million people and about 12% of the total GDP, which is about 5.6 billion USD per year (Rudari et al., 2018, p. 15). Since a large percent of the population is impacted, natural disasters can create negative economic shifts. These shifts can lead to job loss or lower wages, and increased food prices. These issues can further lead to food deprivation, such as poverty, reduced income, and economic weakness (Tirivangasi, 2018).

Currently, the government of Tanzania appears to have a lack of interest or knowledge in how natural disaster preparation contributes to poor agriculture performance (Makoye, 2017; Silas & Wolff, 2002). Tanzania's disaster management[6] policy, The *Disaster Management Act of 2015*, does not currently emphasize disaster-preparedness strategies. As a result of the lack of disaster preparation, the process of mitigation after a disaster negatively impacts the farmers and their crops and fields. Although preparing agriculture and its corresponding practices and structures can play a significant role in resolving food insecurity, the State continues to keep the same actions and policies without addressing the problem.

This thesis hypothesizes that food insecurity is directly correlated to the lack of natural disaster preparation. Therefore, this thesis asserts two primary notions:

[6] Disaster management for this thesis will focus on the preparation for a disaster and is defined as the management of goods and resources in addition to the responsibilities of the government, organizations, and citizens to ensure the safety and wellbeing of each region in preparation for a disaster (Center for Excellence in Disaster Management & Humanitarian Assistance, 2021).

1. If Tanzania were better prepared for natural disasters through policy and reform of agriculture-based disaster management, it could be better equipped to achieve food security, and

2. If long-term disaster management strategies were put into place by the communities of Tanzania, it could encourage long-term development and growth within the rural, agricultural communities.

Therefore, this thesis will propose a solution to rural Tanzania's food security challenges and make a policy recommendation that Tanzania develop a solution that focuses on the underlying issues of food insecurity, specifically in preparation for natural disasters. Creating this policy will provide the opportunity to support rural farmers and their families in a manner that is appropriate for them. For the people of Tanzania, this study could provide the missing component of research and provides a significant opportunity to improve livelihoods and reduce food insecurity.

The international community should consider the food insecurity problem for Tanzania because achieving food security is essential for survival. Food insecurity can lead to malnutrition and can cause many citizens to struggle with daily survival. Numerous organizations, such as the United States Agency for International Development (USAID) and the United Nations Food and Agriculture Organization (UNFAO), work to create food security in Tanzania (UNFAO, 2021b; USAID, 2021a). However, few pay attention to how disaster management preparation can be applied to the agriculture sector. Disaster preparation is defined as the events used to mitigate damages during a natural disaster (International Federation of Red Cross and Red

Crescent Societies, 2000, p. 7). Therefore, this policy may also provide an implementation and resource that could be followed as a model for other States to achieve food security.

Public policy scholars can and will disagree on policy positions and solutions, however, they would be challenged to deny the many moral justifications of the proposed solutions. Viewed through a biblical lens, all should understand the importance of this question and how it impacts fellow human beings. While this study does not resolve wars or political conflicts, the Lord admonishes that He does not forget anyone or anything, including the sparrow (Luke 12:6 ESV). If the Lord cares about a sparrow, he cares for the souls that live in rural Tanzania.

Research Problem

The research question for this study is: What policy should be established to mitigate the impact of crop damage sustained from natural disaster events? This question seeks to address the broad overarching problem of food insecurity in Tanzania, at which the agriculture sector is of particular focus.

For example, in 2015, Tanzania experienced an El-Niño, a "climatic phenomenon linked to [the] warming of the ocean surface in the eastern Pacific that causes unusual weather patterns across many parts of the tropics and further afield" (Keane, 2021, para. 1). For Tanzania, the 2015 El-Niño created heavy rains and flooding that destroyed crops and fields, leading to a decreased yield of approximately 41% for rice, 57 % for maze, 30% for cassava, 58% for sorghum, and 38% for millet, respectively (Barelli & Mollet, 2016, p. 12). In addition, "57% of respondents report[ed] loss of seeds, 27% loss of

fertilizer, 12% loss of hand tools, 16% loss of shelter and others report[ed] on the loss of food and inputs storage facilities" (Mollet & Barelli 2016, p. ix). In the Rapid Agriculture Needs Assessment, Matthias Mollet and Daniele Barelli (2016) of the UNFAO identified that El – Niño demonstrated how flood and drought damage increased food insecurity through crop and seed destruction during a natural disaster. Due to these connections, combined with the lack of preparation for natural disasters, the citizens remain in a constant cycle of food insecurity.

Methodology

To answer the research question and other questions, a qualitative research method is employed. Since the issues surrounding food insecurity and agriculture-based disaster management are complex and often difficult to interpret, this thesis will use secondary source analysis by reviewing multiple current scholarly sources to develop conclusions. Due to the complex nature of agriculture, natural disasters, and disaster management strategies, the theoretical underpinning for this study will be "Complexity Theory." Complexity Theory adequately addresses this thesis as it seeks to explain and to understand systems and the relationships between the actors within the agriculture and natural disaster systems (Sammut-Bonnici, 2015). To fully comprehend the issues surrounding how and why rural Tanzania has arrived in its current state and to determine what policy implementations can be used to establish food security, it is necessary to design a study that will assess and answer the research question posed by this thesis.

Design

This thesis will develop a policy-based solution that focuses on disaster preparation for the agricultural sector to achieve food security in Tanzania. The five phases of a natural disaster are:

- preparedness and mitigation[7],
- acute response[8],
- recovery[9],
- reconstruction[10], and
- transition[11] (USAID, 2009).

While each phase of a natural disaster is important, Tanzania needs the most support in disaster preparedness and mitigation. Many organizations (internal and external) and governmental entities focus their disaster support immediately after natural disasters, however, the lack of disaster preparation may be the primary cause of loss. Therefore, this thesis will focus on long-term disaster preparation since it is an underdeveloped area of research.

[7] "Preparation involves developing plans to save lives, minimize damage, and enhance crisis response, while mitigation aims to reduce the probability of crises or reduce their effects" (USAID, 2009, p. 4)
[8] Acute Response involves "immediate assistance to save lives, alleviate human suffering, and reduce the social and economic impact" (USAID, 2009, p. 4).
[9] Recovery involves restoring the "basic needs and livelihoods and the infrastructure that supports them" after a natural disaster has occurred (USAID, 2009, p. 5).
[10] Reconstruction involves the "efforts to rebuild vital infrastructure [that was] destroyed or damaged by the disaster or emergency" and is undertaken in the aftermath of the natural disaster (USAID, 2009, p. 5).
[11] "The transition phase of a crisis may fully or partially overlap with the reconstruction phase. The transition phase addresses critical windows of opportunity to lay a foundation for longer-term development, through such activities as promoting reconciliation, jumpstarting local economies, supporting nascent independent media, and fostering peace and democracy" (USAID, 2009, p. 5).

This thesis will identify best practices, including building structures, land preparation, seed preservation, storage, and other actions better to prepare the farmers of Tanzania for natural disasters. As in all policy implementations, the proposed policy should have an identified timeframe, ensure actions are complete, and farmers are prepared.

CHAPTER TWO: BACKGROUND INFORMATION

Introduction

This study is an examination of the food insecurity problem in rural Tanzania. Achieving food security is complex; therefore, this study will focus on preparation for natural disasters, specifically floods and droughts in Tanzania. A review of the existing literature provides background information to examine food insecurity and how it is affected by natural disasters.

As a part of this study, this background information will:

1. Demonstrate the importance of establishing food security by determining the reasons for and context of the study, and
2. Provide a scope of the global, regional (Sub-Saharan Africa), and national level (of Tanzania) to comparatively illustrate Tanzania's food security and disaster preparedness.

Global Food Insecurity

Food insecurity is a global problem that more than one billion people experience regularly (Peace Corps, n.d.; UNFAO, 2021a; UNWFP, 2020a). The 2021 *GRFC* identified that 155.3 million people in 55 States were in crisis or worse conditions[12] (UNWFP, 2021b, p.14). These conditions were an increase of 20 million from the

[12] This report, crisis levels mean that the population has "food consumption gaps that are reflected by higher or above-usual acute malnutrition; or are marginally able to meet [the] minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies" (UNWFP, 2020a, p. 14).

previous year (UNWFP, 2021b, p.14). The most undernourished States are found in Asia, the Pacific Islands, and Sub-Saharan Africa (Peace Corps, n.d.; Ritchie & Roser, 2019).

Paul Collier (2007) from the Blavatnik School of Government (Oxford, UK) and The Economist Group (2020) identified that the primary causes of increased food insecurity globally result from a range of challenges: conflict, economic shocks, and extreme weather (Collier, 2007; The Economist Group, 2020; UNFAO, 2021a; UNWFP, 2020a). Authors such as Lisa Smith and Doris Wiesmann, from the International Food Policy Research Institute (IFPRI; 2007), agreed and further identified that some of the determinants and measures of food insecurity in these regions are poverty, daily caloric intake, and education. Alison Misselhorn from the University of the Witwatersrand (South Africa) adds that the core causes of food insecurity can lead to the contributing factors of: hunger, malnutrition, and a decreased quality of life (Misselhorn, 2005; Smith & Wiesmann, 2007). Of these issues, the UNWFP notes that "disasters are amongst the main drivers of hunger and malnutrition in the world" (2021a, para. 1). The UNWFP (2021a) further asserts that preparing for a natural disaster is essential in establishing food security.

Global Agriculture-Based Disaster Preparedness

On a global scale, natural disasters displace up to cause 22 million people each year (UNWFPa, 2021, para. 1). Between 2010 and 2018, natural disasters caused $159 billion in economic losses (UNWFPa, 2021, para. 1). From 1970 through 2019, 91% of storm-related fatalities came from low- and middle-income States, and these States experienced just 32% of storms (World Bank, 2021a, para. 1). For example, in Asia,

Africa, Latin America, and the Caribbean, continents and regions that are composed of poorer States or have extreme poverty[13] are those most impacted with long-term negative impacts from natural disasters (Ritchie & Roser, 2014; United Nations, 2021; UNWFPa, 2020; World Bank, 2021a). Natural disasters have caused people to lose their lives, homes, businesses and have depleted resources such as food and water (Ritchie & Roser, 2014; Rudari et al., 2018).

Natural disasters impact food security through destroyed crops, fields, farm equipment, seeds, and structures (UNWFPa, 2020). In the least developed States, the United Nations identified that droughts create the most agriculture loss, causing a 34% loss of crops and livestock (United Nations, 2021, para. 8). These losses result in 6.9 trillion calories per year (the calorie intake of seven million adults; United Nations, 2021, para. 11). From 2005 to 2015, 332 medium-scale (half were to floods and droughts) disasters caused 96 billion dollars in crop and livestock loss (UNFAO, 2021c, p. 26). The loss of crops and fields may also result in the loss of farm-related jobs that left farmers unable to purchase or have enough food for their families and seeds for the next harvests (World Bank, n.d.). Other factors may include but are not limited to the natural disasters affecting livestock, transportation of goods, and availability of resources (World Bank, n.d.). Each item destroyed on a farm can lead to more work for the farmer, causing them to change production methods and increase costs (World Bank, n.d.). Often, the increase in the price of produce is caused by the lack of availability and costs associated with

[13] Extreme poverty typically means someone who lives on less than $1.90 a day (Schoch & Lakner, 2020, para. 1; United Nations World Food Programme, 2021b; p. 23).

covering farmers' losses (Behlert et al., n.d.). The more frequent the natural disaster, the more vulnerable farmers become (UNFAO, 2021c).

Many States realize when a natural disaster occurs, organizations like the International Committee of the Red Cross (2018) have provided aid, prompting them to expect that future aid will be forthcoming. For some States, organizations like the United Nations and the World Bank Group provide blueprints to support efforts towards disaster planning (Hallegatte et al., 2017; United Nations, 2015). For example, Stephane Hallegatte, Adrien Vogt-Schilb, Mook Bangalore, and Julie Rozenberg from the World Bank Group (2017) created the report *Unbreakable*, which identifies financial inclusion strategies, insurance plans, and social protection systems that they believe can improve resilience for communities. Other States, like the United States, have established their emergency management organizations or centers and have realized improvements with disaster mitigation (United States Federal Emergency Management Agency, n.d.). Despite these efforts, natural disasters will still occur because they cannot be prevented regardless of the number of resources and funds available.

Africa

African Food Insecurity

The 2020 *GFRC* identified that approximately 73 million people in Africa were affected by food insecurity in 2020 (UNWFP, 2020a, p. 20). The 2021 *GRFC* identified that 97.9 million people in Africa faced crisis or worse conditions (UNWFP, 2021b, p. 16). According to the UNFAO who published the *Africa Regional Overview of Food*

Security and Nutrition 2020, "in Eastern Africa, 35.2 million were in urgent need of food assistance, the largest number of any region" (UNFAO, 2021a, p. 15).

The IFPRI's *Global Nutrition Report of 2016* identified that global malnutrition rates declined in every continent except Africa (IFPRI, 2016). In 2021, UNFAO reported that nearly 20% of the chronically undernourished are in Africa (UNFAO, 2021a, p.xii). Over 15.6 million people in Northern Africa and 234.7 million people in sub-Saharan Africa (UNFAO, 2021a, p.xii). In Africa, from 47 million to 58 million people have seen significant increases in stunting[14] due to undernourishment caused by food insecurity (IFPRI, 2016).

African States share the same global contributors to food insecurity which directly and indirectly affect "food availability, access, utilization, and stability with grave consequences for immediate and long-term food security and nutrition outcomes, especially for children" (UNFAO, 2021a, p. 6). For example, while most of the world's food per capita has increased, Sub-Saharan Africa has decreased to 12% lower than in 1961 (Leathers & Foster, 2009, p. 133). The prices for food in Sub-Saharan Africa are 30 to 40% higher than in comparable income States (UNFAO, 2021a, p.3).

African Economics

Economic shocks[15] can play a significant role in food insecurity through macro and microeconomics (UNWFP, 2020a). On the macroeconomic scale, food insecurity is impacted by hyperinflation, substantial decline(s) in the currency, poor trade (decrease in

[14] "Stunting is the impaired growth and development that children experience from poor nutrition, repeated infection, and inadequate psychosocial stimulation" (World Health Organization, 2015, para. 1).
[15] Economic shocks are defined as an event that occurs which can significantly impact the economy and can be brought on by extreme weather conditions, political actions, war, or pandemics (UNWFP, 2020a).

investments, exports, and investments), high unemployment, and income loss (UNWFP, 2020a). Macroeconomically, food security is impacted through increased food prices, specifically for basic needs such as grains and oils, and decreased food availability and incomes, reducing citizens' access to purchase food (UNFAO, 2015; UNWFP, 2020a).

In 2018, Sub-Saharan Africa accounted for two-thirds of the global population living in extreme poverty, with 433 million people in extreme poverty (Schoch & Lakner, 2020, para. 1). Collier (2007) identified that 70% of the world's economic "bottom billion" are in Africa(p. 195). In Eastern Africa, Sudan faced economic shocks as the primary driver of acute food insecurity affecting 5.9 million people in 2019 (UNWFP, 2020a, p. 30). The economic shocks led to inflation, currency depreciation, decreased consumption and investments, GDP, shortages, and increased fuel prices (UNWFP, 2020a). Similar patterns of challenges caused by economic shocks are seen throughout many African States and result in a wider gap for food insecurity (IFPRI, 2016; UNFAO, 2021a; UNWFP, 2021b).

While these economic effects may occur for various reasons, one of the areas that cause the economic shocks to worsen is severe weather, which can lead to worse conditions for food insecurity as opposed to only economic struggles (Sleet, 2020; UNFAO, 2016). For example, in 2019, Zimbabwe faced its worst hunger crisis in a decade, caused by abnormally high or low rainfall and Cyclone Idai (UNWFP, 2020a, p. 35). These natural disasters caused severe damage to crops and agricultural infrastructure and created a 640% price increase in food (UNWFP, 2020a, p. 35). The economic crisis was "characterized by acute foreign exchange shortages, hyperinflation, lack of fuel and

prolonged power outages that crippled industry and work opportunities" (UNWFP, 2020a, p. 35).

Tanzanian Economics

Tanzania's economy, as of 2020, has improved from a low-income State to a lower-middle-income State (World Bank, 2021b, para. 1). In Tanzania, agriculture accounts for one-third of its GDP and employs 75% of its population (USAID, 2021a). Two positive contributions to Tanzania's economy have been creating the Tanzania Mercantile Exchange and Tanzania Mortgage Refinance Company, which have helped improve foreign and domestic trade and raise capital (Bank of Tanzania, 2017). Tanzania is ranked ninth out of 28 States regionally for their reduction in average food costs and appears to be continuously improving (The Economist Group, 2020). However, according to the Global Food Security Index, published by the Economist Group (2020) Tanzania has a negative contributor which is a decrease in the number of resources available to businesses. To make improvements, Tanzania created a *Country Partnership Framework 2018-2022*, which seeks to "(1) enhance productivity and accelerate equitable and sustainable growth, (2) boost human capital and social inclusion, and (3) modernize and improve the efficiency of public institutions" (World Bank, 2021b, para. 2).

African Governance

Poor governance can be examples of corruption, political instability, the government not representing the people, or governing with impunity. Food insecurity can be worsened due to political instability, regime changes, or uncertainty with political

actions or policies (Smith, 1998). In areas with political instability, the poor are often served last, leading to food riots and other actions demonstrated by those who do not have a political voice. Smith (1998) suggests the correlation between families and non-democratic political systems, are more prone to food insecurity due to their political systems' lack of accountability.

Eastern African States are often recognized as corrupt and lacking good governance (Laibuni et al., n.d.; Uchendu & Abolarian, 2015; UNWFP, 2020a). In Southern Africa, ruling elites' political interests, inadequate policies, set food prices, corruption, and nepotism are contributing factors to food insecurity (Bird et al., 2003). For these Southern African States, even agricultural policy is based around serving the elites and gaining political support instead of supporting the local farmers and people who consume the food (Bird et al., 2003).

Tanzanian Governance

Tanzania appears to be making strides towards establishing democratic structure and ranks above neighboring States in transparency, accountability, and civil rights (USAID, 2021b). Comparatively, Tanzania is slightly better in rank (55) in political stability than the world average (45.9) and better (nine out of 28) than other States in the East African region (The Economist Group, 2020). Concerning political and social barriers, Tanzania ranks better at 49.4 compared to the world average of 60.4 (The Economist Group, 2020). Tanzania is also less corrupt than the world average. It ranks three (out of three) compared to the global mean of 2.4 (The Economist Group, 2020).

However, despite these efforts, Tanzania still lacks functional technologies, has limited infrastructure, high transportation costs, inadequate market access, high taxation rates, and non-tariff trade barriers (Lokuruka, 2020). Many of Tanzania's challenges for achieving food security stem from weak policies and the lack of access and support from investments and other financial resources, often resulting in a weak infrastructure (USAID, 2021a). The lack of support is often caused by "limited access to long-term capital, low levels of capacity and business skills, and policies which discourage growth" (USAID, 2021a, para. 8). Additionally, despite the data, the government continues to deny that many Tanzanians are burdened by food insecurity (Makoye, 2017).

African Conflict

In 2019, Eastern Africa faced political unrest, armed conflicts, intercommunal violence, extremism (often religious or political), and other localized tensions that continued to affect the region's peace and security, particularly in South Sudan, Ethiopia, Kenya, and Burundi (Bird et al., 2003; Sleet, 2020; UNWFP, 2020a). For States like Uganda and South Sudan, enduring political and violent conflict are primary contributors is the primary reason for acute food insecurity for 8.5 million people as it disrupts food value chains (UNWFP, 2020a, p. 30).

About half of the violence against civilians has led to obliterated villages, destroyed fields and harvests, and stolen herbs (UNFAO, 2016; UNWFP, 2020a). Since the end of the Cold War, there has been a marked increase of targeted violence against civilian populations in Africa resulting in the destruction of villages, fields, and crops as competition for limited resources (land and water) increases. (Straus, 2012). Not only

does this disrupt agricultural activities as civilians abandon their crops as they flee for their lives (forced migration), refugees fleeing violence also damage crops as they seek safe havens (Davenport & Beaudoin, 2020; Iqbal & Zorn, 2007).

Tanzanian Conflict

Tanzania is a relatively peaceful State. It has been involved in only one State-to-State war and has had no large internal wars. Terrorist organizations are quickly banned and crimes are minor (The Economist Group, 2020; UNWFP, 2020a). Compared to the rest of Africa, Tanzania continues to improve its low-conflict record despite minor conflicts such as inter-tribal and political conflicts (The Economist Group, 2020; UNWFP, 2020a). Tanzania ranks number 1 out of 28 regional African States for the least armed conflict (The Economist Group, 2020).

African Extreme Weather Conditions

In 2019, Africa had the most people in the world who needed assistance after extreme weather events (UNWFP, 2020a). Many of these States also have "limited social protection coverage and policies that do not support equitable growth or poverty reduction," which increases their recovery time after a natural disaster (UNFAO, 2021a, p. 2). In 2020, Eastern Africa faced extreme rainfall, floods, mudslides, and record dryness due to Tropical Cyclone Idai (UNWFP, 2020a). As a result, crops were burdened with germination failure, crop wilting, and in some cases, irreversible damages (UNWFP, 2020a). In Ethiopia, Kenya, and Uganda, Tropical Cyclone Idai led to depleted food stocks, increased prices, and restricted access to food (UNWFP, 2020a).

Since 2012, Southern Africa has only had two favorable agricultural seasons and has not fully recovered from the 2015-2016 El-Nino (UNFAO, 2016). In 2019, the region experienced additional negative weather conditions and warmed at about twice the global rate (UNWFP, 2020a; World Bank, 2018). Further, in the same year, droughts caused Angola, Botswana, Namibia, and Zimbabwe to declare states of emergency (UNWFP, 2021b). Angola, Lesotho, Southern Mozambique, Northern Namibia, Central-South Africa, Zambia, and Zimbabwe-experienced dry conditions, and Malawi faced floods, all of which impacted food production in 2019 (UNWFP, 2020a). Mozambique also faced flooding and displacement due to Tropical Storm Desmond (UNWFP, 2020a).

The region was also hit by tropical cyclones Idai and Kenneth, leaving Malawi, Madagascar, Mozambique, and Zimbabwe with damage, destruction, and death (UNWFP, 2020a). These cyclones and floods have affected millions of people, destroyed hundreds of thousands of acres of crops, and lowered potential earnings for agricultural households (UNFAO, 2021a).

African Agriculture-Based Disaster Preparedness

Organizations such as the AU have made efforts to support States during the various phases of natural disasters (Beavogui, 2019; United States Federal Emergency Management Agency, n.d.). However, natural disasters continue to occur and affect millions of people. For example, from 2000 through 2018, Southern Africa faced 46 droughts that affected 74 million people and 198 floods that affected 16 million people (UNFAO, 2018b, p. 4). Within Sub-Saharan Africa, droughts and floods account for 80% of deaths and 70% of economic losses (Bhavnani et al., 2008, p. v).

Based on the effects of El-Nino, the UNFAO created a national and regional strategic approach to increase the resilience of agriculture-based livelihoods, which includes, but is not limited to, creating sustainable and risk-sensitive management of natural resources and strengthening farmers capacity to prepare for natural disasters (UNFAO, 2018b, p. 12). One of the outcomes of the plan is to have "disaster risks monitored and early warning information provided for potential, known and emerging threats" (UNFAO, 2018b, p. 13). The UNFAO believes that this outcome can help to "predict disaster risks, the likelihood of their occurrence, and their effects on agriculture and local food systems" (UNFAO, 2018b, p. 16). An output of this work would be that agricultural livelihoods would be strengthened through risk-sensitive technologies, good practices, and public-private partnership investments (UNFAO, 2018b).

Additionally, the previous cyclones increased awareness for "the Africa Regional Strategy for Disaster Risk Reduction and the Extended Programme of Action for the implementation of the *African Regional Strategy for Disaster Risk Reduction* (2006–2015), developed under the leadership of the African Union (AU), [have] provide[d what they believe is] a comprehensive regional framework to strengthen preventive, monitoring and mitigation measures, as well as regional and sub-regional capacities and coordination to reduce disaster losses in the region" (UNFAO, 2016, p. 1).

In the last two decades, Non-Governmental Organizations (NGO) have begun to produce more work in rural Africa since "most farmers in Africa [still] have limited access to government or mark-based risk management tools," insurance, and other forms of protection (UNFAO, 2016, p. 1). Financial institutions tend to avoid continents like

Africa due to the risks associated with crop failure, price uncertainties, and loan risk (Henning et al., 2019; UNFAO, 2016). For decades, these hindrances have held the continent back from potential disaster mitigation and achieving food security. However, as more research becomes available and individuals, organizations, and States see the potential in Africa, specifically its agriculture sector, research developments and ideas for improvement in these sectors have begun to emerge.

Individual States are also working with NGOs like the Red Cross and their national governing bodies to create opportunities through disaster relief (International Federation of Red Cross and Red Crescent Societies, 2000). This collaboration is demonstrated in a project such as the Malawi and Mozambique *Mainstreaming Disaster Risk Reduction*. This project assists in "national policy and strategy development, institutional development of its national disaster organization, short-term multi-sectoral disaster preparedness planning, analysis of lower Shire River flooding, awareness-raising at various levels, training of district-level civil protection committees through the Red Cross and a study of disaster recovery financing and economic impact of a disaster" (Bhavnani et al., 2008, p. 11). Each State has its unique ways of establishing food security and working with disaster relief, and they each play a central role in the lives of African citizens.

Tanzania

Tanzania's Food Insecurity

Tanzania has outperformed its other African States in many areas. This includes economics, governance, and conflict, it is in a less preferable position in terms of food

security, weather conditions, and disaster preparedness. Tanzania ranks 89th on the Global Food Security Index out of 113 States, ranked best to worst (The Economist Group, 2020). A report by ReliefWeb (2020) identified that over 20% of the population in Tanzania had faced some form of food insecurity between November 2019 and April 2020 (p.1). Further, over 49% of its population lives on less than $1.90 USD a day, and many citizens remain malnourished, especially women and children (USAIDa, 2021, para. 1).

M.J. Altman (2015) of the UNWFP indicated that the lack of food security, and malnutrition leads to a third of the deaths in children under five years old in Tanzania. Due to the drastic fatality rate caused by malnutrition, many mothers in Tanzania wait weeks or even months to give names to their newborn children (Altman, 2015). If a mother does name their newborn, many name them "buyoya," a Kiha word meaning "breath." In addition to these fatalities, food insecurity also causes many Tanzanians to struggle mentally with depression and anxiety (Hadley & Patil, 2006). The mental struggles result from the uncertainty of their next meal, lack of nutrition for their brain, and general weakness due to lack of food.

To understand food insecurity in Tanzania, a survey by the Tanzanian think tank *Twaweza* stated that from December 2016 through February 2017, 84% of people who lived in the rural regions of Tanzania experienced a food shortage compared to 64% of the urban areas (Makoye, 2017, para. 2). This survey identified that drought-hit rural areas had the most severe food shortages, which led to fatal or life-threatening outcomes.

Food shortages often result from irregular rainfall, soil degradation, and inadequate farming equipment (Lokuruka, 2020).

Landscapes, Weather, and Climate

Tanzania has many unique landscapes that range from mountains and volcanoes to vast savannas. As indicated earlier, due to the extreme weather diversity in the high mountainous regions, this study will focus on the flat savannas. Savannas are known as grasslands that experience tropical wet and dry climates. The temperatures are typically warm year-round, generally around 64 degrees Fahrenheit and above, with annual precipitation between 30 and 50 inches (Foy & Woodward, 2019, para. 4). During the dry seasons, they experience less than four inches of rain per month in addition to a reduction in the number of sunlight hours per day (Foy & Woodward, 2019, para. 4).

As a result of weather diversity, these regions also experience extreme floods and droughts as their two most common natural disasters. In general, floods impact 150,000 people and droughts 5.5 million people annually (Rudari et al., 2018, p. 11–15). Floods and droughts also play a significant role in diminishing agriculture through excessive or extremely low water that destroys or halts the growth of the food-crop. Specifically, floods impact 0.19% of the agriculture sector and vary depending on the region (Rudari et al., 2018, p. 12–13). In comparison, droughts impact 1.9% of the overall agricultural sector (Rudari et al., 2018, p. 16). Due to climate change, both of these numbers are expected to continue to rise in the future.

Tanzania has a diverse geography with varying climates. Rainfall follows a unimodal[16] or bimodal[17] weather-pattern behavior with a total of about 1,000 mm of precipitation per year (Rudari et al., 2018, p. 9). Tanzania is the 26th most vulnerable state for climate risk and faces challenges: rising temperatures, longer dry spells, more intense heavy rainfall, and sea-level rise (USAID, 2018, p. 1). Based on the evidence provided across East Africa, Tanzania will continue to receive the impacts of climate change with more frequent and significant natural disasters due to global warming, natural hazards, and weather patterns (Makoye, 2015; Rudari et al., 2018).

Extreme Weather Conditions

The World Risk Report (n.d.) ranks Tanzania at 8.96 (out of 49.74), indicating that it is 54 out of 181 States (181 is the least severe) (Behlert et al., n.d., p. 59). This report further notes that it is rated 14.01 (out of 86.67) for exposure, 63.95 (out of 76.34) for vulnerability, 56.78 (out of 70.83) for susceptibility, 51.68 (out of 93.80) for lack of coping capacities, and 83.38 (out of 93.80) for lack of adaptive capacities (Behlert et al., n.d., p. 59). This data means that Tanzania is more at risk than over half the States globally for extreme weather conditions.

Environmental issues pose a significant challenge for Tanzania, specifically droughts, floods, rapid population growth, climate change, and other unpredictable weather patterns (USAID, 2021a). For Tanzania, evidence suggests that the impacts of

[16] "The unimodal type of rainfall usually from October/November to April, in the central, southern and southwestern highlands of Tanzania" (Rudari et al, 2018, p. 9)

[17] "The bimodal type is comprised of two seasons: the short rains (Vuli) fall from October to December, while the long rains (Masika) fall from March to June. This type occurs in the coastal belt, the north-eastern highlands and the Lake Victoria Basin" (Rudari et al., 2018, p. 9).

extreme weather conditions have had the most influence on hindering the State from achieving food security by increasing the vulnerability of agriculture (Amani, 2006; Lokuruka, 2020). An example of this occurred in 2018 through 2019 when there was a prolonged dry spell and erratic rainfall during the planting season (Reliefweb, 2020, para. 2).

As Tanzania's most common disasters, periods of droughts and floods significantly reduce the harvests (Cochrane & D'Souza, 2015). The UNFAO (2012) identified that droughts had a significant interference with the cultivation of crops, challenging the food security for farmers reducing the availability, stability, and quality of seeds and their varieties for years to come. USAID (2003) identified that increased droughts delay planting and increase moisture stress on crops and pastures, which can cause a 10% drop in food crop production within one year (para. 15). Other research found that droughts affected 94% of homes in some communities and were the most critical issue they faced (Afifi et al., 2014, para 22). Authors like Mollet and Barelli from the UNFAO, though, identified floods as the most devastating natural hazard as floods can be responsible for 26% of agricultural damages, and a third of disaster loss is within the agricultural sector (Mollet & Barelli, 2016; UNFAO, 2018a, p. 16).

Every time a drought or flood ruins a crop, Tanzania's farmers are forced to re-establish their farms, crops, and livelihoods rather than spending time to advance their agricultural practices. Many farmers experience the uncertainty that they will have enough food production for the season when a natural disaster occurs. In some cases, many farms already endure adverse conditions and must bear additional burdens from

disasters as they rely on their farm for income and as their primary food source (Dixon et al., 2021).

Agriculture

Agriculture accounts for 85% of the annually cultivated land under food crops (Makoi., 2018). Presently, only half of Tanzania's land can be used for agriculture, and of that, 23 % is under cultivation (Makoi, 2018, para. 6). The "agriculture is mainly rainfed and is dominated by smallholder farmers cultivating average farm sizes between 0.9 ha and 3.0 ha[18]" (Makoi, 2018, para. 6). These farmers cover about "8,000 villages with an average holding of less than 2 ha per family" (Mitawa & Marandu, 1996, p. 8). Women compose the majority of the agricultural workforce. The primary constraints for agriculture are poor technologies, unpredictable and irregular weather conditions, and natural disasters.

Alphonce (n.d.) from the Sokoine University of Agriculture (Morogoro, Tanzania), notes that Tanzania performs poorly in following areas: cereal[19] production, labor, investments and research, development, and access to financial-related agricultural activities. The impact of these factors are compounded by the lack of preparation for natural disasters due to climate change; misallocation of government funds; poor economy; lack of food, seed storage methods, and facilities; and education on disaster

[18] 'Ha' represents a hectare which is 100 ares, 10,000 square metres, and the equivalent of 2.471 acres (Cambridge, 2021).

[19] "Cereal farming, growing of cereal crops for human food and livestock feed as well as for other uses, including industrial starch and biofuel. Cereals, or grains, are members of the grass family (Poaceae) cultivated primarily for their starchy dry fruits. Wheat, rice, corn (maize), rye, oats, barley, sorghum, and some of the millets are common cereals." (Kent-Jones, 2017, para. 1)

preparedness strategies makes it extremely challenging for communities to establish food security.

Soil

Andrew Foy and Susan Woodward (2019) from Radford University (Virginia) identifies that the region's soil varies "according to bedrock and edaphic conditions" (para. 5). Foy and Woodward (2019) continued that "lateralization is the dominant soil-forming process, and low fertility oxisols[20] can be expected" (para. 5). Some areas of Tanzania, like the Serengeti Plains, have droughty but nutrient-rich volcanic sands. Soil types vary across ecological zones, though. According to Dr. Makoi (2018) fom the Tanzania Ministry of Agriculture Food Security and Cooperatives, there are six soil types in Tanzania:

- **"***Volcanic soils*: These soils are of high agricultural potential. They predominate in Arusha, Kilimanjaro Regions, southwest Highlands, the Kitulo plateau. At high and medium altitudes, the zones are of importance for the production of dairy forage production.
- *Light sandy soils*: predominate in the coastal areas. They can be used for grazing during the rainy season, but thereafter, these soils dry out rapidly, and forage production becomes low and has poor quality.
- *Soils of granite/gneiss origin*: are poor and occur mainly in the mid-west, especially in Mwanza and Tabora.

[20] Oxisols are highly weathered soils that contain few weatherable minerals and rich Fe and Al oxide minerals (University of Idaho, 2021).

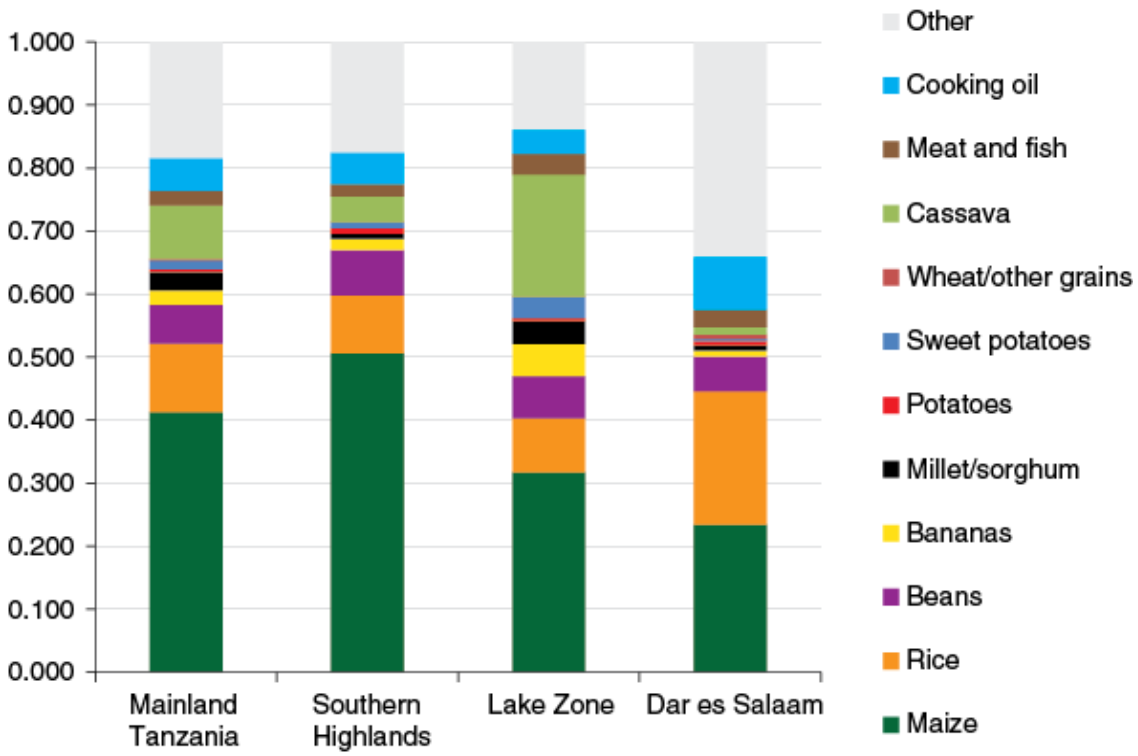
- *Red soils*: occupy most of the central plateau. They produce good forage in the short rainy season, and the quality of forage is maintained into the dry season.
- *Ironstone soils*: are found in the far west, mainly in Kagera, Kigoma, and Sumbawanga regions. They have poor inherent fertility and are acidic, but they can be made more productive with nutrient inputs, mulching, and/or manuring.
- *The mbuga black vertisols*: These soils are widespread and are important for supplying forage during the dry season." - (Makoi, para. 11)

Crops

Tanzania produces a vast array of food crops (see Figure 1 and Table 1 below) that grow depending on the season. While other crops like cotton, coffee, tobacco, and tea play a key role within Tanzania's agriculture sector, this thesis is focused on crops for food. The agricultural sector is also comprised of livestock, fish farming, and many other animal-based farming practices. Through related and an important aspect to the complexity of Tanzanian agriculture, animal husbandry will not be evaluated in this study.

Figure 1

Calorie Share and Crops



Note. Adapted from *Measuring Access to Food in Tanzania: A Food Basket Approach*, by Nancy Cochrane and Anna D'Souza, 2015, para. 8 (https://www.ers.usda.gov/amber-waves/2015/march/measuring-access-to-food-in-tanzania-a-food-basket-approach/). In the public domain.

Table 1

Crop Type

Type of Crops	Crops
Staple crops	Maize, sorghum, millet, rice, wheat, beans, cassava, potatoes, bananas, and plantains
Cash and Export crops	Coffee, cotton, cashew nuts, tobacco, sisal and pyrethrum, tea, cloves, horticultural crops, oilseeds, spices, and flowers

Note. Adapted from *Tanzania*, by J. Makoi, 2018, para. 9

(https://www.yieldgap.org/tanzania). In the public domain.

Systems and Practices

Depending on crop type, Tanzania has worked with ~~a~~ few varying agriculture systems (see Table 2 below) and equipment over the centuries. The majority of farmers practice subsistence[21] agriculture (Mitawa & Marandu, 1996). Within these farms, "it is fairly common to find cereal crops grown in association with legumes although monocropping of rice, maize, and wheat" (Mitawa & Marandu, 1996, p. 8). Mitawa and Marandu (1996, p. 8) of the UNFAO noted that "most cash crops are grown by small scale farmers" and "plantation crops such as sisal and sugarcane and grown in large farms." "About 70 percent of Tanzania's crop area is cultivated by hand hoe, 20 percent by ox plow and 10 percent by tractor" (Makoi, 2018, para. 6).

[21] Subsistence agriculture is practiced throughout most of Tanzania and tends to focus on traditional varieties over a long period of time (Mitawa & Marandu, 1996).

Table 2

Farm Systems and Locations

Farming systems	Location of the systems	Remarks
Banana/Coffee/ Horticulture system	Kagera, Kilimanjaro, Arusha, Kigoma and Mbeya Regions	Tree crops, high intensive land use, volcanic soils with high fertility, land scarcity
Maize/Legume system	Rukwa, Ruvuma, Arusha, Kagera, Shinyanga, Iringa, Mbeya, Kigoma, Tabora, Tanga, Morogoro, Kahama, Biharamulo	Land not scarce, shifting cultivation, maize & legumes, beans and groundnuts intercropped, Arabic coffee
Cashew/Coconut/Cassava System	Coast region; eastern Lindi and Mtwara	Low rainfall, low soil fertility, cassava, coconut, and cashew, the land is not scarce, shifting cultivation
Rice/Sugar cane system	Alluvial river valleys	rice and sugarcanes
Sorghum/Bulrush millet/Livestock system	Sukumaland; Shinyanga and rural Mwanza	Sorghum, millet, maize and cotton, oilseeds and rice, intense population pressure, declining soil fertility
Tea/Maize/Pyrethrum system	Njombe and Mufindi districts in the Iringa region	Tea, Maize, Irish potatoes, beans, wheat, pyrethrum, wattle trees, and sunflower
Cotton/Maize system	Mwanza, Shinyanga Kagera, Mara, Singida, Tabora and Kigoma, Morogoro, Coast, Mbeya, Tanga, Kilimanjaro and Arusha	cotton, sweet potatoes, maize, sorghum, and groundnuts, intensive cultivation, livestock kept

Farming systems	Location of the systems	Remarks
Horticulture based system	Lushoto district; Tanga region, Morogoro rural; Morogoro region and Iringa rural in Iringa region	Vegetables (cabbages, tomatoes, sweet pepper, cauliflower lettuce, and indigenous vegetables) and fruits (pears, apples, plums, passion fruits, and avocado), maize, coffee, Irish potatoes, tea, and beans
Wet – rice and irrigated system	river valleys and alluvial plains, Kilombero, Wami Valleys, Kilosa, Lower Kilimanjaro, Ulanga, Kyela, Usangu and Rufiji	
Pastoralists and Agropastoralist System	Semi-arid areas, i.e., Dodoma, Singida, parts of Mara and Arusha; Chunya districts, Mbeya and Igunga district in Tabora	Deep attachment to livestock and simple cropping system , shifting cultivation of sorghum millet, moderate population density 30 per km^2, limited resource base, and poor and variable rainfall

Note. Adapted from *Tanzania*, by J. Makoi, 2018, para. 11 (https://www.yieldgap.org/tanzania). In the public domain.

Traditional Ways

Tanzania has a wide variety of cultures composed of more than 120 tribes (Mitawa & Marandu, 1996). Each tribe having unique customs that impact their agriculture practices (Mitawa & Marandu, 1996). These differences are often based on environmental conditions, regional geography, and climate. One of the primary ways that agriculture is impacted is by using traditional crop varieties that are often exchanged freely with regional ethnic groups. However, the information on these traditional varieties

and practices is shared orally, often by the elders, and minimal written information or research is available.

Many farmers prefer to continue using traditional seed varieties. This is because they feel that traditional varieties are superior to newer seed types, despite the government's encouragement to use newer seed varieties. These farmers believe newer varieties require other resources that the traditional ones do not, such as fertilizers and pesticides, which they do not want and often cannot purchase. When creating a policy for Tanzania, these traditional aspects should be included to promote inclusion within the tribes.

Tanzanian Agriculture-Based Disaster Preparedness

There are few known efforts (tried or existing) around disaster preparedness that are intended to secure or protect Tanzania's citizens and infrastructure within the rural communities. The United Nations Office for Disaster Risk Reduction (UNODRR), in their report, *the United Republic of Tanzania Risk-Sensitive Budget Review*, noted that while Tanzania's *Disaster Relief Act of 2015* had been created, it was not yet fully operational due to inadequate resources and the need for more localized government involvement (2020). Further, the 2008 *Report on the Status of Disaster Risks Reduction in the Sub-Saharan Africa Region* identifies that Tanzania's legislation deals only with disaster relief (Bhavnani et al., 2008). Ahmed Slaim (n.d.) from the Society for International Development indicates that this lack of disaster services ultimately causes some of the State's long-term struggling which could have been prevented.

Historically, disaster management in Tanzania has been focused on the aftermath of a natural disaster (Fisher & Mwase, 2011; Makoye, 2015). Currently, Tanzania has minimal significant indication for disaster mitigation or evaluating future disaster preparedness measures. Without an indication for disaster mitigation or measures such as community surveys and farm reports, which could measure impact, it is difficult to ascertain what has and has not worked for the State. This lack of understanding was unrecognized until a few years ago when external organizations brought the importance of disaster preparedness to light, even in some of the most impoverished areas (Kalugendo, 2015, p. 44).

Rural vs. Urban

More than two-thirds of Tanzania's population is rural and any form of disaster preparedness is currently focused on urban areas (United States Central Intelligence Agency, 2021). As the urban areas of Tanzania expand, tribes including the Makuleke and Maasai are in danger of losing their land and resources (Wojtkowski Barbeau, 2017). These and many other tribes rely heavily on the land to meet basic needs and cultural and religious aspects. As floods and droughts continue to harm the land, these tribes lose many aspects of their culture, including hunting and gathering methods and resources, cattle practices, and living conditions (Wojtkowski Barbeau, 2017). Without a pre-disaster strategy, these tribes will continue to have depleted resources and remain at risk for collapse.

Tanzania's urban focus is due to their economic benefits, where government officials live, accessibility during a natural disaster, and more government accountability.

Fanuel Kalugendo (2015) from the Prime Minister's Office, Disaster Management Department, demonstrated that rural areas are often the last to be informed of impending disasters and protocols, causing the concern to be much more significant in times of a disaster.

The rural populations face problems of inadequate infrastructure, funding, education, technology and other necessary resources essential for living, stability, and potential development (2015). The lack of appropriate public policy (locally or nationally) and misallocation of funds often leads to poor infrastructure development and low investment in agriculture, preventing the transportation of food and water either from rural to urban areas or vis-versa (Concern Worldwide US, 2019). This problem reduces the opportunity for farmers to sell their produce to markets and limits the rural areas from receiving support from the urban regions.

Existing Policy and Systems

This thesis will also consider elements that already exist for its development. For example, the UNWFP is working to "include soil and water conservation, the development of flood protection and drainage infrastructure, the construction of communal ponds and reservoirs, and the terracing of slopes that are prone to erosion and landslides" (2021a, para. 5). The UNFAO (2016) is developing cross-border collaboration, partnerships, and interventions to combat and manage risks. Other organizations such as USAID (2019) seek to understand the disaster risk, strengthen governance, invest in disaster risk reduction, and enhance preparedness. While organizations like the USAID and its partners (who are a wide variety from NGO's to

Intergovernmental Organization's) work to build local business partnerships and the economy while also helping to provide seeds and refine agricultural practices, they do not have practices for the people of Tanzania to use to protect their crops against flood and drought seasons. The World Bank (2018a) addresses the importance of governmental stakeholders' in their disaster relief teams, Dar es Salaam Multi-Agency Emergency Response Team (DarMAERT), supported by the United Kingdom and World Bank-funded Tanzania Urban Resilience Program. While this research is essential, it gives little attention to leaving the State's rural populations and does not appear to have plans to strengthen food security during natural disasters.

Tanzania has kept governmental records of natural disasters since April of 1872, yet there has been little disaster preparedness reform of disaster management until the *Disaster Relief Coordination Act No. 9 of 1990*. This Act established the Disaster Relief Committee of Tanzania and the Disaster Management Department (formerly the Disaster Relief Coordination Unit) to coordinate all disaster management activities. In 2015, *Disaster Management Act No. 7* was enacted to replace *Act No. 9 of 1990*, developing an Emergency Operation and Coordination Center and the Tanzania Disaster Management Council to create further developments and manage activities. While this Act is an improvement for the State, it is lacking in some areas, for example, only servicing the mainland, primarily focusing on broad factors, minimal recognition for rural vs. urban populations, and does not adequately identify how to establish and maintain food security. The incomplete information further demonstrates the minimal focus on the rural

populations and agriculture regardless of any other challenges. These disaster management efforts remain primarily focused on the aftermath of a disaster.

One innovation that has worked to support floodplain farming in Tanzania is putting houses and other building structures on stilts (Dixon et al., 2021). Additionally, in Rufiji, Tanzania, citizens worked to intercrop maturing varieties of maize with rice in the deeper parts of the flooded depression. Further, depending on the impact of the flood, crops should also rotate through various dates to have a higher crop yield. If an entire crop is completely washed away due to the flood, then a new crop season would begin with crops that thrive in high moisture, such as pumpkins.

Conclusion

In conclusion, this background analysis demonstrates that the overarching problem of food insecurity is complex because of economics, poor governance, and weather conditions. A possible-solution exists to alleviate some of the food insecurity in the rural regions of Tanzania. Although numerous factors, extreme weather conditions play a disproportionate role in preventing Tanzania from achieving food security. Any proposed solution to resolve both food insecurity and disaster relief will come with challenges. Opportunities to serve the rural regions of Tanzanian in a manner that may provide greater relief from food insecurity than presently exists through agriculture-based disaster preparation.

CHAPTER THREE: POLICY RECOMMENDATION

Introduction

The international community should consider the following proposed policy as a necessary contribution to food security policy. The proposed policy derived from the study should be considered because Tanzania is one of the most food-insecure States in the international system. Additionally, food insecurity in Tanzania is an understudied area of the overall global food security problem. International food security policy remains completely misunderstood and underdeveloped, and this proposed policy could create a model for other States.

Upon examining the current literature, a gap in research revealed that Tanzania does not have a robust program to mitigate the impacts of natural disasters on food supply in the agriculture sector. As a result, this policy will support farmers across the State in their pre-disaster planning efforts. The policy would establish centralized hubs or "Hubs of Hope" within each district of every region based on that location's needs. For example, the needs could be specific farming practices, the impact of weather on their crops, population size, and cultural elements.

This policy should originate at the national level and be implemented within the districts and regions depending on each district's needs. Tanzania is composed of 20 regions, which are subdivided into districts. Each district is very diverse and contains multiple tribes. The current national policy demonstrates a lack of understanding for the

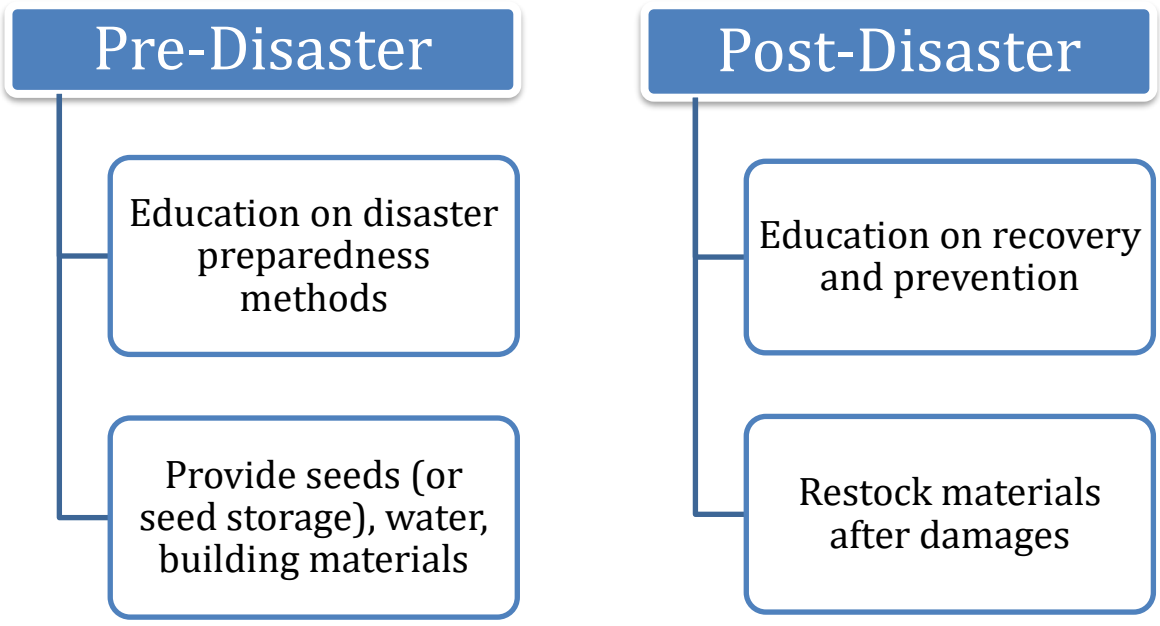
many rural regions' needs and concern for many tribal elements. Therefore, having the regions and districts independently implement the strategy could ensure that the policy is relevant to their specific needs and is culturally appropriate.

Additionally, since many of the regions are large and rural citizens lack transportation, having a centralized hub would be more beneficial to those in the rural areas and those further from the capital of Tanzania, Dodoma. To establish the initial and future hub(s), the national government would fund the base construction of the facility(ies). These funds would come from the national government as most localities do not have the funds to have the staff or funds to build and maintain large structures.

The hub's purpose would be to serve as a location (see Table 3 below) where farmers and their workers would be educated on agriculture-based disaster preparations while providing them with the necessary resources, such as seeds, water, and building materials, to help them prepare for floods and droughts. As a result, farmers would learn practices that would help them prepare for a natural disaster, preserving their crops, tools, and infrastructure(s). Farmers would also, be able to replenish agricultural items that may have been damaged during a natural disaster (seeds, water, and building materials) helping farmers recover from setbacks as they may have before the existence of the hub.

Figure 2

Pre- and Post- Disaster Actions



Success for this policy will be determined through the measures of increased crop yield, decreased amount of equipment damaged from a natural disaster, increased food security, increased seeds, decreased impact of structural damages from natural disasters, and decreased child mortality and malnutrition. The recommended process would begin with a singular hub and then expand once the hub demonstrates continued success. The measurement will be over a 5-year period. The test hub would be located in a region where it is most needed. Testing the efficacy and success of the program will involve the following steps:

- Monthly in-person surveys to measure the food security, conditions of the land, and farmer's needs. These surveys will help determine a decreased child mortality and malnutrition rate while also assessing the agricultural needs of farmers.
- In-person farm reviews to measure the structure(s) and equipment stability, crop, seeds, and food-crops status. These will occur quarterly and before and after a natural disaster. The reviews and reports will provide the necessary information to demonstrate increased crop yield, decreased amount of equipment damaged from a natural disaster, increased food security, increased seeds, a decreased impact of structural damages from natural disasters, and other information as need determines.
- Farmers who use the hub would be required to report data with each hub use, natural disaster, and crop season. This data would provide additional information on their crop yields to ensure that the crops are sustainable and producing, that farm equipment is properly running, that seed count is either the same or is increasing, and that built structures are secure, all despite weather conditions. The farmer would provide written data to the district representative, and the representative would visit the farmer's land for proof. This information helps the hub improve and understand the individual farmer's needs.

The aforementioned measures would be taken directly from the hub by the hub's representative and given to the regional and national representatives before and after the establishment of the hub. After the hub has been established, surveys would be conducted with every crop season and after each natural disaster, unless they are simultaneous. These surveys would be given by the district representative and will be developed further

based on the actual implementation of the recommended policy. These surveys will be modified as needed based on the actual implementation of the policy.

Research Question

One of the questions this thesis sought to answer is: why is there a continual problem achieving food security in the rural areas of Tanzania? Upon determining in the background information that the lack of preparation for natural disasters, namely floods and droughts, were the primary contributors to food insecurity, this study sought further investigation to create a resolution for Tanzania's rural citizens. The research question posed by this thesis: what food security policy should be established to mitigate damages to crops in a natural disaster? This question suggested if Tanzania established a policy-based solution to prepare crops for floods and droughts, then Tanzanians could better mitigate the effects of natural disasters, resulting in more available crops for food to yield positive results towards food security for generations to come.

CHAPTER FOUR: CONCLUSION

This study sought to address the following questions: why is there a continual problem achieving food security in the rural areas of Tanzania? More specifically, the Research Question for this thesis was: What policy should be established to mitigate the impact of crop damage sustained from natural disaster events? What food security policy should be established to mitigate damages to crops in a natural disaster? As a result of the research, the answer to this question is that by establishing a food security policy, Tanzania will be able to mitigate damages to crops in a natural disaster.

This research reviewed international and regional cases to understand why there is a continual problem achieving food security in the rural areas of Tanzania. In doing so, the research found that the top contributors to food insecurity internationally were governance, economics, and extreme weather conditions. For Africa, the top contributors were governance, economics, conflict, and extreme weather conditions. From this information, the research reviewed the same concepts for Tanzania and identified that Tanzania is improving in every area except extreme weather conditions. Specifically, of these natural disasters, floods and droughts had the most impact on food insecurity. The research showed that these natural disasters had such an impact on agriculture that they created a lack of food supply and increased food prices, contributing to food insecurity. These changes occur due to the disasters' significant burdens for the farmers, such as

destroyed crops, fields, equipment, and seeds. As a result of these continued burdens, Tanzanians remain in a food-insecure State.

To further examine the cause of food insecurity, the research then sought to determine why natural disasters create significant damages to agriculture. In reviewing the phases of natural disasters, it was found that Tanzania has minimal preparations for disasters. Since they have minimal preparations, disasters have caused significant damages to agriculture that could have been prevented. One of the key factors found in determining why this lack of preparation exists is that Tanzania's farmers have not had1 the resources or education to mitigate the damages that floods and droughts cause to agriculture. Research reveals that the lack of education and resources is partially due to minimal governmental recognition and funding allocated to this issue.

The research reveals that of the minimal resources available, most of the support given for natural disasters went to the urban areas and was for post-natural disasters. Other research identified that due to the rural areas' lack of technologies and transportation, there was little information disseminated to these areas to warn them that a natural disaster would occur. In these rural areas, there are also minimal processes and techniques for protecting agriculture, the corresponding tools, and other items associated with farming. Due to these conditions, the rural areas remain in a constant cycle of being food insecure. Without policy enacted to invoke change to mitigate the damages to the agricultural sector, Tanzania will continue to remain food insecure.

Once the cause was determined, the research sought to create a solution by reviewing cases implemented internationally and regionally to determine what food

security policy should be established to mitigate damages to crops in a natural disaster. While there were few cases found in the research, the available cases revealed that it is necessary to have another source of funding outside of government funding to support the project, and of the cases that were viewed, they had the support of the government. Additionally, the reviewed cases focused on particular areas or regions as they implemented their plans. The implementors made this a community effort so that after the implementation, the community could continue to use the skills or services after the research was completed.

Therefore, in developing this policy, it was important to include elements of funding, location, and community support, when expanding the policy and to best support the needs of Tanzanians. From the reviewed studies, this policy needed to have at least State-level funding, regionally implemented, and a community-based effort with long-term implications. In terms of expansion, even though there are urban farmers, the focus of this policy needed to remain on rural actors. The rural focus is due to the location of the majority of the farms and the need demonstrated by having the highest amount of food insecurity and receiving the least support.

Based on the research, the solution to achieving food security for Tanzania is through agricultural development and support of the reduction of agriculture loss through disaster management. To protect agriculture and have healthy, available food for the citizens of Tanzania, it is crucial to identify ways to prepare agriculture and its components for natural disasters. Having reviewed multiple options, this study identifies

that a hub concept to support agriculture is a primary option creating food security in Tanzania.

Additionally, as Tanzania is divided into regions, the suggested policy identifies that it would also be regionally based for its implementation. Since these regions are large, the policy includes a hub to act as a centralized location. These hubs would serve as resource centers to help the regions learn, replenish supplies, and enact preparations for natural disasters. These hubs would further help farmers learn new skills and fully equip them for disaster preparations. While this is a new concept to Tanzania, it is predicted to be accepted given the tribal history and the studies that demonstrate commonalities. Furthermore, as a hub, this policy will help the farmers maintain their current agricultural status and will help them expand over time to establish food security. This policy proposal is just the presentation of a concept. Subsequent efforts are warranted to develop this proposal into a viable policy option. Some examples could include designing specific management and agricultural practices, creating an educational curriculum, going into further depth on each natural disaster, covering more than floods and droughts, including Tanzania's islands, and discussing specific tribal relations and agriculture.

This study creates a foundation for establishing food security not just in the rural areas of Tanzania, but when successful, can be implemented globally. This thesis further creates solutions that have not been addressed in policy and should be considered in future approaches to food insecurity. The study further identified the impact natural disasters have on communities and their correlation with food insecurity. In addressing

these issues, the study recognized the importance of rural and often under-discussed communities and identified their needs while posing viable solutions to work with and for the community to create the Hubs of Hope for the future of the Tanzanian people.

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