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Timor-Leste, Climate volatility

Timor-Leste: Addressing Adverse Weather Effects Through the Adoption of Hoop Houses

Imagine having to ration your food to the point of near-starvation in order to survive for an extended period of time. People of Timor-Leste often experience this challenge and many more. Timor-Leste families usually sustain their basic needs by utilizing agriculture to meet their needs. However, due to climate volatility there that causes crops to not yield well, members of the family have to find a separate method of providing for the family. Many children in Timor-Leste often have to grow up with important figures in their life absent due to relocation for work. Although I am not from Timor-Leste, I have been in similar situations where my family did not have enough money to provide for food and shelter so I can understand their struggles. Furthermore, my father and brothers had to live separately from us to work and earn money to support the family. It is because of my painful history that I am so passionate about wanting to improve the condition in Timor-Leste.

Timor-Leste is an island country that is just north of Australia with beautiful beaches surrounding them. It has a population of about 1.3 million people, of which 30% is urban and the other 70% is rural. As of 2016, about 3,800 square kilometers of Timor-Leste's land is dedicated solely to agricultural use. This land is about 25.6% of the total land area available in the country (Knoema, n.d.). Their main exports are coffee, sandalwood, and marble, though the production of these exports is hindered by uncontrollable external factors such as climate. The average farm size in Timor-Leste is about .4 hectares (ha) per capita, which is just barely under one acre. 1 ha would equal about 2.47 acres. In total, they have about 165,000 ha for annual crops and about 60,000 ha reserved for permanent crops. (Lundahl & Sjöholm, 2012) We can compare this to the average farm size of 444 acres within the United States and can see that the farm size in Timor-Leste is considerably smaller and cannot produce enough crops to meet the needs of the people.

Timor-Leste faces many instances of food insecurity and hunger due to the shortage of crops being produced, and many of the residents are left suffering from moderate to severe stunting in growth. Many families in this country tend to be larger with an average household size of about 5.3 members, 41% of whom are under the age of 15. (General Directorate of Statistics et al., 2016) Rather than the traditional family structure of developing countries, families in Timor-Leste are often headed by women. To meet their basic needs, many families have to find jobs alongside farming. The men of the families often have to separate from the family to find jobs and bring home a source of income. Job opportunities are few and can include agriculture, sales and services, drivers, concrete placers, and finishers. (The General Directorate of Statistics & SEPFOPE, n.d.) From these jobs, the average monthly wage can be around \$278, but around a fourth of the workforce only make around \$181 per month. (The General Directorate of Statistics & SEPFOPE, n.d.) Because of this seemingly low wage, some children who are supposed to be learning at school, are also dragged into the adult world of work. While the adult men are working, the women and children have to tend to the farms that provide the crops that will eventually be their main source of food.

Education is available for all children, but after a certain age the attendance rate drops. (GPE & UNICEF, n.d.) The drop is mainly due to the need for extra hands within the home or the need to work for extra income. Healthcare services are also available for the people, with services designed such that everyone should have a health service within a 1-hour walk from them. Because the health services are financed by taxes, there is no fee for the service. However, this only applies to the fees from the service and does not help to pay for transportation fees. (Guinness, 2018) This, however, does not guarantee good treatment at these service centers, especially for those who are critically ill. So if a child of a family were to get sick, or a parent were to suddenly fall ill, many would still not have the funds to travel to the bigger service centers, as many live further away from the urban areas and farm to sustain themselves. Healthcare, in all, is reasonably affordable, with the only major problem being the cost of actually getting to the hospital and any other major medical needs. For the reasons of allowing students a chance of getting an education and people being able to get the healthcare services they need, people in Timor-Leste need a solution to producing higher yields of crops in an environment affected by climate volatility.

With harsh winds blowing in the central area, floods washing away crops in the south, and rocky land and mountains in the north, their weather and climate are their enemies. Timor-Leste is also hit by typhoons and other harsh weather, impeding on the citizen's livelihoods. With the destruction of their crops, families have to go through periods of starvation that can last up to months at a time. The country of Timor-Leste is bordered, in the north, by mountains and does not allow for many agricultural advances because of the harsh terrain and mountain weather. The north coast also receives less than 40 inches of rain a year in total, which makes it hard to give crops their necessities. From November to mid-May, Timor-Leste can be affected by tropical cyclones, which hinders the growth of their plants and these families' livelihoods (World Climate Guide, n.d.). Timor-Leste's extreme climate is also getting worse with climate change and global warming. These changes in temperatures and water all cause the weather to fluctuate even more so than it did before, creating more danger to both the crops and the people. Climate is an uncontrollable factor that can devastate fields, kill off animals, and even harm people. The root of the problem is the fact that they are not able to find an efficient way to grow their crops in a way that can stand against nature.

Timor Leste is already battling hunger and malnutrition with the help of USAID programs. USAID's Avansa Agrikultura Project works to increase agricultural productivity especially for vegetables, fruits, and legumes. They also focus on strengthening agricultural markets, food accessibility, and sustainability even with climate change going against them (Lemke, 2019). I believe that the introduction of a basic greenhouse structure called a hoop house may be of benefit to the current agricultural conditions, allowing for a controlled space that these farmers can monitor and modify. A simple hoop house with a gothic arch, also referred to as a polytunnel, is easy to make. It has large hoops or bows that can be made out of metal, plastic pipe, or wood, with a heavy plastic "skin" that is stretched tight over these hoops. Though Timor-Leste has rich forest lands, like many other places around the world, these forests have been nearly depleted of its resources. As a result, although available, it would be best to not use native wood to frame the hoop houses (Cocca & Davis, 2015). On the other hand, they are also rich in metal resources. They could use some of their metal to forge a metal frame for the hoop houses, which could also result in a more stable and longer lasting hoop house (Monteiro & Pinto, 2003). Hoop houses can keep the harsh climate of Timor-Leste out and let their crops thrive.

With all of these things that small farmers in Timor-Leste are already doing, adding hoop houses into the equation will benefit farmers in multiple ways. Incorporating hoop houses is a simple solution that does not add many additional requirements into the farmers' way of life. Hoop houses add a protective barrier around the crops, allowing for higher produce yields that could also result in a surplus. With higher yields, farmers would have more food to feed their family and potentially additional produce that could be sold. Farmers could also benefit from needing less time to grow the same amount or more (Upson, 2014). Hoop houses are not a permanent solution, but they will allow for income boost and increased yield of crops.

While the introduction of hoop houses is not the only method to address the challenges of agriculture in Timor-Leste, it does serve as a safer option when compared to others. One of the most common solutions to increasing yields is to introduce new crop varieties. When new varieties and/or entirely new crops are brought into a new location, there is always a chance of also introducing new invasive species to the country. Additionally, when new crops are added, farmers must learn how to grow these new varieties and new crops that may require years to perfect. The introduction of hoop houses avoids both of these potential hazards by allowing farmers to continue growing most, if not all, of the crops they are already familiar with raising. Another thing to emphasize on is that Timor-Leste's soil is low in fertility for plants because it is derived from limestone and metamorphosed marine clay, and their steep slopes are covered with only a thin layer of soil that is also not very suitable for planting crops (Dili, 2008). Additionally, the varying rainfall can be addressed through hoop houses. Because the land elevation differentiates so much, rainfall will tend to vary from as low as 20 inches/year to as high as 80 inches/year. With these irregular and torrential rainfalls, the topsoil often washes away in flash floods, causing Timor-Leste to be susceptible to erosion and unsuitable for a controlled crop cultivation (Dili, 2008). With the hoop houses, farmers would not have to worry about inadequate soil or about their crops potentially being washed away.

Together with the help of groups that the people of Timor-Leste are already working with, such as the U.N. Zero Hunger Challenge and the USAID programs, the possibilities and progress of these hoop houses would become more than just an idea. Distribution of the hoop houses could occur in many different ways, but one idea is to have them as "community hoop houses" at first, within each village. Depending on the population density within the villages, there could be more or fewer hoop houses erected in the area. With these groups that were mentioned prior, the groups that they have already worked with would be more willing to take the first step into implementing the hoop houses into their agricultural development. The U.N. Zero Hunger Challenge group may be able to help with the distribution of materials to build these hoop houses, as well.

Constructing a hoop house with the dimensions being 11' wide x 90' long x 8' high costs less than \$400 but can range from \$400 to \$600 depending on the materials used (Off Grid World, 2018). While some resources may already be accessible for building hoop house frames, some items like plastic, or poly film, may need to be sourced from outside of the country. These greenhouses are a quickly-made structure and if made with a strong frame and durable poly film, can last up to a few years. Hoop houses can also be expanded on later and can withstand wind, rain, and snow (Off Grid World, 2018). If this idea were to be implemented, they could also start to grow vegetables, such as tomatoes and lettuce, which will be

profitable for the country, in addition to those already being grown, such as rice, maize, sweet potatoes, and taro.

The area within the greenhouses is about 990 square feet. Per square foot in the greenhouse, they could comfortably grow one tomato plant each. With high yields, tomato plants provide about 20 pounds of produce per plant (Theresa, 2015). The tomato production is already growing in Timor-Leste and would bring in a supple amount of income for the farmers, even if they were to yield on the smaller side. One pound of tomatoes costs about \$1.02 and if we were to assume that the farmers only got half of that \$1.02, with how many plants they have, it would still bring in profit and the costs would pay for itself (Numbeo, n.d.). These vegetables also grow in different varieties, allowing the farmers of Timor-Leste to choose which plant would be the most beneficial to them. Growing plants with many different varieties and a lot of demand will allow for a bigger profit margin and can earn back more than what it cost to build and grow (Gothic Arch Greenhouses, 2017). Letting these plants grow inside greenhouses allows for not needing to constantly monitor their conditions and needs fewer hands to help work. With being able to grow enough food and achieving economic stability, families are allowed to come back together and grow up without the need for their parents to relocate for work. Also, from this increase in income and crop yield, the country could export more of its surplus crops and put more money into its reserves for future agricultural projects that can stimulate economic growth.

Timor-Leste has so much potential and grit and just needs a small boost to get where they, as a country, are sustained and happy. With the addition of hoop houses, it will implement a period of sustainability and growth in both the economy and the happiness of the people. It is a great chance for children to grow up happy and well-fed, and for families to stay together and become stronger. Finding a way to feed families, or helping them to find a way to better feed themselves, will allow the families to have more access to new opportunities and the children, brighter futures. Having food available will allow them to worry less about having food and will let these people develop more of their skills and join the workforce with these skills, which will further grow their economy and allow a happy and healthy lifestyle. The hoop houses will allow this to happen, as they would be a secure area to grow their crops which will, in turn, develop with more advancements being made. To start off with a simple hoop house and see the progress that it could allow, it may inspire the younger generation to come up with their own innovative ideas. The people of Timor-Leste can take this change and develop it into something of their own. With what they are already doing to develop the crops to withstand the weather, the hoop houses will allow them to thrive and have a better yield. To see the children full of energy learning and living is any family's goal, and I feel that this is one way to step closer to this goal, to this brighter future, to a better tomorrow for all ages in Timor-Leste.

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