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Timor-Leste, Malnutrition and Sustainable Agriculture

Improving Malnutrition in Timor-Leste Through The Introduction of Sunflower Farming

East Timor, also referred to as Timor-Leste, is a sovereign nation in Southeast Asia, with a population of approximately 1.38 million people. Timor-Leste has a land area of about 14,900 square kilometers and includes the eastern half of the island of Timor, the Oecussi region, and the islands of Pulau Atauro and Pulau Jaco (Government of Timor-Leste, 2004).

In the 16th century, Portugal conquered Timor and remained in control until World War II, when Japan occupied the island. Portugal resumed its control when Japan was defeated at the end of the war. However, in November 1975, Timor-Leste declared its independence from Portugal and its sovereignty as a nation-state. Yet this period of independence was short-lived and Indonesia occupied Timor-Leste only nine days after its independence from Portugal. From 1975 to 1999, Indonesian militias killed over 1,000 Timorese and forced over 300,000 others into refugee camps. In the process, most of Timor-Leste's infrastructure, irrigation systems, schools, farms and cattle, and electrical grids were destroyed. In 1999, a United Nations supervised referendum for Timor-Leste's independence was performed and, with overwhelming support, Timor-Leste was declared an independent state in 2002. However, a quarter-century of violent events has had detrimental consequences on Timor-Leste and its development today. These events are the main reasons for the country's slow urbanization process and why a much larger portion of the Timorese population lives in rural areas as opposed to urban areas (Central Intelligence Agency, 2018).

Prior to the quarter-century Indonesian occupation of Timor-Leste, only 20% of the population was Roman Catholic, and a much larger portion was influenced by the Portuguese beliefs in polytheistic shamanism and animism. This clashed directly against the Indonesian monotheistic belief system, and they sought to convert Timorese people. In 1989, Pope John Paul II visited Timor-Leste and "encouraged those fighting for independence to seek greater international support." He is considered to be a catalyst for the independence of Timor-Leste, and his words greatly influenced many Timorese people into converting to Roman Catholicism. By the end of the Indonesian occupation in 1999, 95% of the population was Roman Catholic (Head, 2005).

A typical Timorese family is slightly larger than the average American family, usually consisting of 5 to 6 people. Although poverty has declined in the last decade by 8%, the proportion of Timorese living at or below the poverty line is 42%, only slightly less than half the population (World Bank, 2020). Additionally, there is a clear correlation between poverty and area of residence, with poorer people living in rural areas and those with more money living in urban areas. Approximately 69% of Timor-Leste's families live in rural areas and over ¾ of the population heavily depends on the agricultural sector whether it's for work or food (UNESCO, 2018). 79% of the total Timorese population has access to improved drinking water. Families in urban households are more likely to have clean drinking water (at 92% of

those with access) than families in rural households (at 74% of those with access). Of the 50% of the total population with access to improved sanitation, urban households are 33% more likely than rural households to have sanitary conditions. Additionally, of the 73% total population with access to electricity, nearly all (98%) of urban households have electricity while only 66% of rural households do. In summary, Timorese families living in urban areas are much more likely to have access to vital technologies. Approximately 22% of Timorese women and 19% of Timorese men have no education. Women's education has shown a direct correlation to fertility: as women's education increases, their fertility decreases. On average, women living in rural areas will have 5 children while women in urban areas will have 3 children (Demographic and Health Surveys, 2016). This is notable as rural populations are already larger than urban populations and are growing more rapidly, despite having poorer sanitary conditions and less access to clean drinking water and electricity.

Agriculture is a large part of the economy. While 80% of the Timorese population is heavily dependent on the agricultural sector, 41% of the population's labor force is in agriculture. Despite the large portion of people that work in this sector, agriculture only accounts for 9.1% of Timor-Leste's total gross domestic product (GDP) (Central Intelligence Agency, 2017). Timor-Leste's economy is largely dependent on its oil sector. While only 13% of the population's labor force works in the industry, the oil sector accounts for 36% of the country's GDP, and approximately 98% of exports and 41% of imports on average in one year (Extractive Industries Transparency Initiative, 2017). Additionally, the oil and gas industries account for more than 95% of government revenue and the money is then consigned to a petroleum fund. At the end of 2018, the fund had \$16.93 billion dollars, all of which were solely from the oil sector. In the past, the assets have been used towards urbanization and building infrastructure. However, since 2012, oil production has decreased yearly as the BayUndan (BU) oil field, Timor-Leste's largest oil field and leading source of money, has seen its resources naturally depleted. (Index Of Economic Freedom, 2020).

With its leading source of revenue decreasing significantly each year, Timor-Leste has attempted to accommodate for its losses by growth in other sectors, such as agriculture. For example, Timor-Leste has attempted to reintroduce beef cattle and buffaloes into its farmland. Historically, this had happened once before during the 1970s, when Bali cattle from Indonesia were introduced to Timor-Leste but were violently massacred during the Indonesian militia attacks (De Paulo Correi, 2016). Due to the reintroduction, at one point, 87.2% of rural households raised livestock or cattle. Cattle and buffalo were slaughtered at a very slow rate of around 7.3%. At first glance, it would appear that the Timorese people were saving a portion of the meat for themselves, however, that was not the case. In fact, cattle were slaughtered at such a slow rate because a much larger portion was exported live, as it would export for more money. Timor-Leste's attempts to compensate for its oil losses worked minimally as, to this day, animal exports do not contribute nearly as much to the economy as oil exports do. Though the meat and livestock minimally benefited the economy, it did not benefit its people very much (Future Directions International, 2019).

In 2012, at a time when the BU oil field was beginning to decline in production, the government of Timor-Leste attempted to save its profit from the oil sector by challenging the Treaty on Certain Maritime Arrangements in the Timor Sea (CMATS). This treaty had been agreed upon by Timor-Leste and

Australia in 2006 and established a temporary boundary between the two countries, followed by a 50-year suspension of maritime negotiations. However, in 2012, Timor-Leste argued that the treaty should be invalid as Australia had allegedly spied on Timorese officials while the CMATS agreement was being reached. Timor-Leste pushed for the dissolution of this treaty, and the creation of a permanent boundary, in an attempt to gain access to more oil fields. In 2016, the UN Convention on the Law of Sea (UNCLOS) agreed that the treaty was invalid, and announced a new border in 2018. The treaty created a permanent boundary in the Timor Gap, a region that had previously been unused by both sides. The government of Timor-Leste believed that these oil reserves could produce \$1.5 billion dollars (Leach, 2019). Although this was a breakthrough for Timor-Leste, it ultimately only delayed the inevitable as once these oil reserves are depleted, the country will revert back to its original state, with no form of agriculture to sustain the economy. Ultimately, Timor-Leste must create some form of sustainable agriculture if it hopes to overcome malnutrition and poverty.

Although Timor-Leste produces animal products, livestock, coffee, seaweed, sugar beet, and sugar cane, a traditional rural household would almost never eat any of these products as they are exported after production (Observatory of Economic Complexity, 2018). Households often prioritize the sale of cattle and livestock over home consumption. The average Timorese person does not meet the minimum daily calories needed for survival and growth; however, these calories are largely filled by staple crops such as rice and maize. Both rice and maize are full of carbohydrates and sugar, and both are very low in protein. This level of malnutrition has had severe consequences, especially on children. A 2016 report by Demographic and Health Surveys indicated that 46% of children under 5 have stunted growth in Timor-Leste. Stunting is defined by the World Health Organization as “the impaired growth and development that children experience from poor nutrition...” (2015). According to a 2018 report by the United Nations, stunting is more prevalent among children living in rural areas than children living in urban areas. Additionally, only 13% of children between 6 months and 2 years old meet the minimum of what is considered an acceptable diet. On top of that, 40% of people aged 6 to 59 are anemic, a condition typically caused by iron deficiency. Foods that are iron-rich include meat, leafy vegetables, and nuts, and seeds, which are also examples of foods that are absent from a Timorese person’s diet. Overall, 25% of women and 27% of men aged 15 to 49 are underweight (Demographics and Health Surveys, 2016). Aside from emaciation, anemia, and stunting, malnourishment causes the body to be more susceptible to disease. The lack of sanitation, clean water, and electricity causes more diseases to be prevalent especially in rural areas. From 2000 to 2016, the percent deaths caused by communicable diseases out of the total number of yearly deaths decreased from 63.1% to 45.6%; however, this number is still very high (Index Mundi, 2019). The average lifespan in Timor-Leste is only 68 years, 10 years shorter than in the United States, and 3 years shorter than in Indonesia (World Life Expectancy, 2017). Additionally, the infant mortality rate has decreased from 56.6% in 2008 to 39.3% in 2018, a considerable decrease, yet still extremely high (Plecher, 2018). In short, the Timorese population, especially in rural areas, has improved over the last decade, yet even today, an unsettling portion of the population is severely malnourished and likely to die because of it.

The United Nations established a factory in Timor-Leste in 2010, in an attempt to create a World Food Programme. The factory produced 300 megatons of ready-to-cook packets of food, which could feed about 64,000 people (United Nations, 2010). However, though this has improved the hunger crisis in

Timor-Leste, a decade later the percentage of Timorese people not meeting the daily caloric requirement has not changed much. The effort was aimed towards children under 5 years of age, so this could be one reason for the lack of significant change. This year, a company called World Fish established the Partnership for Aquaculture Development in Timor-Leste Phase 2 (PADTL2) Project. Phase 1 of the project established tilapia farms in the country, while phase 2, scheduled to run from 2020 to 2023, will attempt to sell the fish to the public at affordable prices. The project aims to increase fish consumption from 6.1 kilograms per year to 15 kilograms per year per person by the year 2030 (The Fish Site, 2020). If the project succeeds, malnutrition will be significantly reduced. However, there are challenges involved with aquaculture. In Nicaragua, a small tilapia farm degraded the entire lake environment when waste from the farm polluted the ecosystem. Aquatic plants, such as charra, a plant that fish eat, disappeared, causing more harm than good (Rosenthal, 2011). Additionally, an increase in tilapia can cause weaker fish such as the rainbow bass, to disappear. The Timorese farms must devise some way to effectively remove waste from the tilapia farms without polluting the environment before this plan can succeed. Another project, the Sustainable Agriculture Productivity Improvement Project (SAPIP), received \$21 million dollars from the Global Agriculture and Food Security Trust Fund to “improve incomes as well as food security in Timor-Leste” (Global Agriculture, 2018). The project aims to improve public sector investments by improving agricultural productivity and boost crop production and status in global markets. The project began in 2016 and was given a 6-year time frame, so it will likely finish within the next two years. If the project is successful, it will improve agricultural productivity and food insecurity that was caused by poor soil and water management. Although the project works on the agricultural practices that already exist, Timor-Leste may benefit from an additional form of sustainable agriculture to improve the population’s health at a faster rate.

While the Timorese economy has sustained itself via the oil sector, a form of sustainable agriculture is necessary to ensure the population’s health and long term economic growth. An attainable solution would be for an organization such as SAPIP, UNICEF, or donor countries from the United Nations to donate startup funds to establish sunflower farms in Timor-Leste. Sunflower farms could flourish as Timor-Leste possesses many of the ideal conditions necessary for sunflower growth. Sunflowers optimally grow in temperatures above 70 degrees, and between May and November, the temperatures in Timor-Leste can range anywhere from 68 to 88 degrees (Encyclopedia of the Nations, 2020). Additionally, “sunflowers are tolerant of clay loam or silty clay loam soils, and perform well on sandy loam soils” (UMN, 2020). According to a map picturing soil texture throughout the country, most of the rural areas, especially near the outskirts of the districts of Manufahi and Manatuto, contain loam or sandy loam soil (Dos Santos). These same general regions also contain soil at the optimal pH, from 6.0 to 6.8, required for sunflower growth. Although Timorese soils have been known to be of generally poor quality, sunflowers can still produce blooms despite the nutrient deficiency (McCormick, 2020). This is because sunflowers have long roots that can access water and nutrients in areas where plants with shallow roots cannot. By this data, ideal growth conditions for sunflower growth in Timor-Leste are met. Timor-Leste’s neighboring country, Indonesia, has several large sunflower fields in Bali, which experiences very similar temperatures and conditions year-round, proving that Timor-Leste can also grow sunflowers.

Sunflowers have many proven benefits and can create a multitude of beneficial, protein-rich products. According to the US Department of Agriculture, sunflower seeds contain 29 grams of protein in 1 cup

(2007). Men need approximately 56 grams of protein per day and women require 46 grams of protein per day, assuming that they live a sedentary lifestyle (Gunnars, 2018). Only 2 cups of sunflower seeds would fulfill a person's daily protein intake requirement. Additionally, as stated before, 40% of the Timorese population aged 6 to 59 are anemic, and a cup of sunflower seeds contains 5.25 mg of iron, which can provide a highly beneficial added source of iron for anemic individuals (USDA, 2007). Sunflower seeds themselves are a valuable source of protein, fat, iron, and fiber, yet sunflower oil can also be extracted from the seeds. Not only are both seeds and oil rich in Vitamin E, but sunflower oil is also filled with vital fatty acids, like Omega 6, and antioxidants which can strengthen the body's immune system, a crucial benefit for the Timorese population as they face many diseases (JoyNature, 2016). Aside from the population's wellness, "diversifying crop lineup can improve soil health" (Mayer, 2017). This is likely because sunflowers have very long roots, and when the roots die in deep places, the organic content of the soil increases. This would benefit not only sunflower farms but also other crops already growing there such as rice and maize. Sunflowers are also generally cheaper to grow than most crops and flowers, and would not be economically strenuous once established.

While sunflowers can be planted as a cash crop, they also are cover crops. Cover crops "reduce erosion, increase organic soil matter content, improve air and water movement through soil, and reduce soil compaction" (Vollmer-Sanders, 2018). Sunflower farming is one form of sustainable agriculture as it creates a more nutrient-rich environment and can be planted on the off-season of cash crops in order to enhance their yield during the next cycle. Not only would it greatly benefit the environment and the population suffering from malnutrition and protein deficiency, but sunflower farming would also create jobs and could benefit the government long term. Sunflower farms require people to harvest and water the plants, extract the seeds, and convert the seeds into oil. The constant caretaking would likely become a full-time, paid job as sunflower seeds and oil are profitable exports. The leading exporter of sunflower seeds, Romania, earned \$733 million dollars in 2018, while smaller exporters, such as Australia, still earned \$928,000 dollars (Observatory of Economic Complexity, 2018). Also, the demand for sunflower oil is rising in countries like India, Iraq, and China, and this provides an economic opportunity for Timor-Leste to trade with larger countries (Business Wire, 2019).

Before this project could begin, there are a few obstacles to overcome. For example, for this project to work, a land area should be designated for the startup sunflower farms. The Government of Timor-Leste could allocate unused land near the Manufahi and Manatuto districts, which have the proper soil texture and pH for sunflower growth. The government could also allocate a small supply of money to allow a few families to make money in exchange for their efforts. An organization such as UNICEF could help cover the costs of starting the farm, by donating seeds, tools, and other necessary supplies to begin farming. UNICEF would be an ideal donor for this project as they are aware of the needs of the Timorese population and the project follows their goals to "reach communities with nutrition needs and to create community-led health action" (UNICEF, 2020). For the first harvest, expert volunteers could help demonstrate to the local people how to properly grow and take care of sunflowers. Another challenge is that sunflowers require lots of water during harvest time, but do not require nearly as much during growth. In order to overcome this, the sunflower farms could work with a non-profit organization like SAPIP, whose primary focus is to improve the country's water management. With the help of this organization, Timor-Leste could more effectively conserve and recycle water to grow the plants during

harvest season. A global advisory council could oversee the project's initial developments to ensure its success. The project could begin with 3 to 4 farms created across the country in the designated areas and would, in time, expand into larger, more sophisticated farms that are run solely by the local people. Hopefully, after initial success, the farms could then expand into factories where oil can be produced, opening more jobs. A part of the advisory council would oversee the sunflower product dispersal, to ensure that the local population is getting sunflower seeds to combat their malnutrition.

In conclusion, one of the largest problems in Timor-Leste is malnutrition due to the lack of sustainable agriculture. A large portion of the population is malnourished, underweight, or anemic, and these qualities are especially prevalent in rural areas. Timor-Leste does not have a lot of animal agriculture to make up for protein deficiencies since a large part of their cattle were slaughtered by the Indonesian militia after disagreements in 1999. The economy has suffered largely due to the lack of sustainable agriculture and has attempted to compensate through its oil sector. In recent years, however, the local oil fields have been depleted of their resources, and the economy solely depends on their success. The Timorese government has attempted to control the downward spiral of its economy by gaining more resource-filled land by breaking an invalid treaty with Australia. However, this has only slowed the rate of the downward spiral, rather than stopped it altogether. Timor-Leste requires a form of sustainable agriculture, preferably a protein, both to help the health of its people and to benefit future crop production and the economy. Sunflower farms would provide profitable job opportunities for the government and people of Timor-Leste. While animals are difficult to maintain with the limited resources available, sunflower oil and seeds contain a large amount of protein and iron which could greatly benefit the people at a much lower cost. Though sunflowers have the unique challenge of water required during harvest season, this obstacle can be solved through water management programs. Timor-Leste meets the ideal soil and pH conditions required for sunflower growth, and other countries have greatly profited from their exportation. Ultimately, sunflower farms could benefit the economy, improve malnutrition and anemia, and provide a source of sustainable agriculture for future generations in Timor-Leste.

Works Cited

- “Child Survival and Development.” *UNICEF Timor-Leste*, 17 June 2020, www.unicef.org/timorleste/child-survival-and-development.
- De Paulo Correi, Vincent, et al. “Analysis of the Timor Leste Beef Cattle Industry .” *UQ ESpace*, 11 Jan. 2016, espace.library.uq.edu.au/view/UQ:612981.
- Dos Santos, Juliberto, and Rita da Costa da Soares. “Country Report of East Timor.” *Timor-Leste Map of Soil Texture*, www.fao.org/fileadmin/user_upload/GSP/docs/asia_2015/Timor_Leste_Soil_Apresentation_1.pdf
- “East Timor - Climate.” *Encyclopedia of the Nations*, Advameg, 2020, www.nationsencyclopedia.com/Asia-and-Oceania/East-Timor-CLIMATE.html.
- “Food and Nutrition Security in Timor-Leste: Challenges and Prospects.” *Future Directions International*, 28 Nov. 2019, www.futuredirections.org.au/publication/food-and-nutrition-security-in-timor-leste-challenges-and-prospects/.
- “FoodData Central Search Results.” *FoodData Central*, U.S. Department of Agriculture | USDA, 1 May 2007, fdc.nal.usda.gov/fdc-app.html.
- General Directorate of Statistics, et al. “Timor-Leste Demographic and Health Surveys, 2016 - Final Report (English).” *Timor-Leste: DHS, 2016 - Final Report (English)*, 1 Apr. 2016, www.dhsprogram.com/publications/publication-FR329-DHS-Final-Reports.cfm.
- “Global Sunflower Oil Market 2019-2023: Demand for Sunflower Oil Imports Is Rising in Many Countries, Including Iraq, India, and China - ResearchAndMarkets.com.” *Business Wire*, 5 June 2019, www.businesswire.com/news/home/20190605005438/en/Global-Sunflower-Oil-Market-2019-2023-Demand-Sunflower.
- Gunnars, Kris. “Protein Intake – How Much Protein Should You Eat Per Day?” *Healthline*, Healthline Media, 5 July 2018, www.healthline.com/nutrition/how-much-protein-per-day.
- Head, Jonathan. “Asia-Pacific | East Timor Mourns 'Catalyst' Pope.” *BBC News*, BBC, 5 Apr. 2005, news.bbc.co.uk/2/hi/asia-pacific/4410917.stm.
- “How Tilapia Are Tackling Malnutrition in Timor-Leste.” *The Fish Site*, 6 June 2020, thefishsite.com/articles/how-tilapia-are-tackling-malnutrition-in-timor-leste.
- Leach, Michael. “After a Border Dispute and Spying Scandal, Can Australia and Timor-Leste Be Good Neighbours?” *The Conversation*, 27 Oct. 2019, theconversation.com/after-a-border-dispute-and-spying-scandal-can-australia-and-timor-leste-be-good-neighbours-121553.
- “Life Expectancy in Timor-Leste.” *World Life Expectancy*, 2017, www.worldlifeexpectancy.com/timor-leste-life-expectancy.
- Mayer, Amy. “Genetic Advances Hold New Promise For Sunflowers' Profitable Future.” *Harvest Public Media*, 9 Oct. 2017, www.harvestpublicmedia.org/post/genetic-advances-hold-new-promise-sunflowers-profitable-future.
- McCormick, Billy, et al. “How to Grow Sunflowers.” *Growing In The Garden*, 2 Jan. 2020, growinginthegarden.com/how-to-grow-sunflowers/.
- Ministry of Agriculture, Forestry & Fisheries*, Government of the Democratic Republic of Timor-Leste, 2004, gov.east-timor.org/MAFF/English/plant_production.htm.
- “Overview.” *World Bank*, www.worldbank.org/en/country/timor-leste/overview.

Plecher, H. "Timor-Leste - Infant Mortality Rate 2008-2018." *Statista*, 10 Feb. 2018, www.statista.com/statistics/807815/infant-mortality-in-timor-leste/.

"Policy Briefs on Internal Migration in Southeast Asia: Brief 9 Timor-Leste." *UNESCO Bangkok*, 24 Jan. 2018, bangkok.unesco.org/content/policy-briefs-internal-migration-southeast-asia.

Rosenthal, Elisabeth. "Another Side of Tilapia, the Perfect Factory Fish." *The New York Times*, The New York Times, 2 May 2011, www.nytimes.com/2011/05/02/science/earth/02tilapia.html.

Situation and Limits. www.ci.uc.pt/timor/geography.html.

"Stunting in a Nutshell." *World Health Organization*, World Health Organization, 19 Nov. 2015, www.who.int/nutrition/healthygrowthproj_stunted_videos/en/.

"Sunflower Oil- Nature's Way to Boost Your Immunity." *Joybynature.com*, 7 Feb. 2016, www.joybynature.com/blogs/healthy-happy/115003719-sunflower-oil-nature-s-way-to-boost-your-immunity.

"Sunflower Seeds (HS: 1206) Product Trade, Exporters and Importers." *Observatory of Economic Complexity*, 2018, oec.world/en/profile/hs92/21206/.

"Sunflowers." *UMN Extension*, 2020, extension.umn.edu/flowers/sunflowers.

"Sustainable Agriculture Productivity Improvement Project (SAPIP)." *Global Agriculture and Food Security Program*, 2018, www.gafspfund.org/projects/sustainable-agriculture-productivity-improvement-project-sapip.

"Timor-Leste (TLS) Exports, Imports, and Trade Partners." *Observatory of Economic Complexity*, 2018, oec.world/en/profile/country/tls/.

Timor-Leste - Cause of Death, Index Mundi, 28 Dec. 2019, www.indexmundi.com/facts/timor-leste/cause-of-death.

"Timor-Leste Economy 2020." *CIA World Factbook*, 2017, theodora.com/wfbcurrent/timorleste/timorleste_economy.html.

"Timor-Leste." *Timor-Leste Economy: Population, GDP, Inflation, Business, Trade, FDI, Corruption*, 2020 Index of Economic Freedom, 2020, www.heritage.org/index/country/timorleste.

"Timor-Leste: Overview." *Extractive Industries Transparency Initiative*, Timor-Leste EITI, Mar. 2017, eiti.org/timorleste.

"Timor-Leste: UN Helps Set up Local Factory to Produce Fortified Food || UN News." *United Nations*, United Nations, news.un.org/en/story/2010/05/339702-timor-leste-un-helps-set-local-factory-produce-fortified-food.

"The World Factbook: Timor-Leste." *Central Intelligence Agency*, Central Intelligence Agency, 01 Feb. 2018, www.cia.gov/library/publications/the-world-factbook/geos/tt.html.

Vollmer-Sanders, Carrie. "Sunflowers Enrich Soil Health and Communities." *The Nature Conservancy*, 8 Dec. 2018, www.nature.org/en-us/what-we-do/our-priorities/provide-food-and-water-sustainably/food-and-water-stories/sunflowers-enrich-soil-health-and-communities/.