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Indonesia, Climate Volatility

### **Indonesia: A Modern Approach to Agriculture**

World hunger and poverty are multidimensional issues constructed by numerous global challenges, including water scarcity, infectious diseases, and climate volatility. Each country encounters global challenges in varying severities, but every obstacle threatens the food security of that individual nation. Improving food security, or the ability to have, “physical, social, and economic access to sufficient, safe, and nutritious food,” is a vital factor to combating world hunger and poverty. (“Food Security”). By implementing practical, feasible, and executable solutions, individual food security will increase, thereby improving national and global food security.

Situated in Southeast Asia between the Pacific and Indian Oceans, the Republic of Indonesia is a developing collection of islands combating a multitude of issues, including environment exploitation, poverty, and hunger. With the fourth highest domestic population of roughly 270 million people, approximately 56% (151.2 million people) reside in urban locations, primarily on the island of Java. The remaining 44% (118.8 million people) populate rural areas, where most of Indonesia’s poverty and hunger is located. Led by President Joko Widodo, the lower middle-income republic generates income through the exportation of agricultural and energy supply products. Primary exportations include, “coal briquettes (\$18.9B), palm oil (\$18.2B), petroleum gas (\$8.99B), rubber (\$5.68B) and crude petroleum (\$5.34B)” (“OEC - Indonesia (IDN) Exports, Imports, and Trade Partners”). Globally, Indonesia ranks third in rice production despite a minimal 31% agricultural land available. The nation also ranks seventh globally in rice importation, as rice stockpiling is a common government contingency action to a poor growing season. On average, Indonesian farms are no larger than 1 hectare and profit from the tropical, hot, and humid climate of the country. Indonesian farmers also benefit from the surplus of fertile, volcanic soil found across any of the 17,000 islands.

The Indonesian population is unevenly distributed, as greater than half the population inhabits urban areas. Residential districts throughout the country are typically composed of kampongs, or bamboo homes with coconut fiber tiles, which house 3.9 people per structure. Unlike rural areas, urban locations pack kampongs into tight villages to manage the high population densities, such as the, “1,019 people/km<sup>2</sup> in 2009” within Java, (“Indonesia Geography, Climate and Population” 2011). In comparison, the national Indonesian population density of 2009 was 125 people/km<sup>2</sup>. In an ordinary family, a diet consists of staples, such as fish, coconut, and rice, which are cooked using Indian, Middle Eastern, Chinese, and European techniques. The Indonesian staples are grown by small farmers, who produce domestic food supplies. The primary employment sector is the service industry, specifically tourism and shipping, followed by the agricultural sector. The current national monthly minimum wage stands at 3.94 million Indonesian Rupiah (IDR), or approximately 290 U.S. Dollars (USD). As a developing nation, Indonesia also has limited access to complete basic utilities. While electricity and telephone access are nearly present throughout the country, only 89% of the population has access to basic service drinking water (“Indonesia”). At the same time, 10% or, “Nearly 25 million people in Indonesia don’t use toilets” (“Water, Sanitation and Hygiene”). Common transportation includes cabs and taxis for short distance travel and aircraft and boats for long distance travel. Finally, Indonesians sell their produce at kasars, or traditional markets found throughout the country but most commonly in the capital, Jakarta.

Located on the island of Java, Jakarta is one of the fastest growing cities in the world, with an annual growth rate of 3.6% (Jakarta population 2020). In fact, by 2030, Jakarta is expected “to reach 36.5 million” and become the world’s most populous city (De Haan). In comparison, Jakarta currently has a population of 10.77 million (“East Asia/Southeast Asia :: Indonesia”). Demographics show a large number of young people, mostly of Central, East or West Javanese origin, in the city. The smaller groups consist of Sumatran, Arabian, Indian, and European people. Jakarta experiences high immigration due to increased economic conditions, which accounts for the city’s rising population. The improved economic conditions are a direct result of trade at Jakarta’s ports and manufacturing in the city’s industrial hub. The city’s daily commerce is similar to the rest of Indonesia, with central city markets as the primary location for food and retail shopping. Traditional Indonesian culture also remains present through the “Taman Ismail Marzuki center” and “annual Jakarta fair” (Waworoentoe). Housing, alongside kampongs, includes *rumah gedongan*, or detached colonial urban houses (Waworoentoe). The Indonesian government is responsible for providing public utilities to these Jakartan homes. The capital faces traffic, infrastructure, and flooding problems, which leads to overcrowding in residential districts.

Over the past decade, Indonesia, both rural and urban areas, has been on an incline as the nation experiences an expansion in trade, increased water supply, and boost in tourism. Yet, a developing economic crisis, lack of increased human rights, and environmental issues prevent the nation from progressing forward.

Climate volatility is an escalating issue that poses a serious threat to the Indonesian economy, agriculture, and people. The likeliness of natural hazards in Indonesia, primarily droughts and floods, are at a higher rate due to an increase in global temperature. Currently, Indonesia stands as the fourth - largest emitter of greenhouse gases, which directly contribute to climate change. As Indonesia houses one of the largest rainforests in the world, deforestation, which releases carbon dioxide into the atmosphere, is a common practice. Carbon dioxide is a catalyst for climate change. Promoted by increasing deforestation and greenhouse gas emission, climate volatility is a growing challenge that establishes new, life-threatening issues in Indonesia.

Climate change, through various means, will lead groups in Indonesia towards poverty and food insecurity. As temperatures rise, weather patterns will become more unpredictable. Northern Indonesia is expected to experience a higher risk of flooding and storm surges while southern Indonesia will be more susceptible to severe droughts. An overall decrease in annual precipitation will affect the agricultural sector, as crop failure will inflate the prices of domestic produce and put farmers into debt. Rice, a staple food, will immerse the general population into hunger, as “for every one degree rise in minimum temperature, rice yields are likely to decrease by as much as ten per cent” (Dreierstad 2018).

Rural Indonesia will face some of the harshest obstacles. Currently, in rural areas, “46 percent of Indonesians live on less than \$2 a day” while “20 million Indonesians are malnourished” (McCarthy, Zen). These numbers are a direct result of unstable food security in rural Indonesia. Extreme climate events and an inability for government policies to choose between agricultural self sufficiency and foreign dependency can lead to millions of Indonesian natives starving in a poor growing season. Although most families participate in some form of farming, “landless workers and families... are the most insecure [in terms of food]” (McCarthy, Zen). The problem may seem temporarily limited to growing seasons, but climate change can lead to year round food insecurity. Rural locations, “where poverty is most prevalent,” will encounter an increase in financial hardship as, “agriculture is the main source of employment” (“FAO.org” 2015). In line with Indonesian culture, men will search for work in cities while women serve as primary caregivers. This influx of people into major cities, such as Jakarta, leads to the

steep rate of population growth and urbanization that Indonesia is experiencing, which puts “increasing pressure on available resources and systems” (“Indonesia”). The women left in their rural communities are likely to have “less socioeconomic power than men,” which increases their chance of poverty (“Indonesia”). A lack of socioeconomic power will indirectly insert their dependents, children and the elderly, into poverty.

Urban areas will also endure similar food security issues, as Indonesia’s agricultural self sufficiency agenda cannot be sustained. Although poverty is less present in major cities, families will still face food security and gainful employment obstacles. Researchers predict that “by 2035, 90% of the Java population will be urban” (Diwangkari). Extreme rates of urbanization will create job competition in cities learning to develop industries beyond just agriculture and manufacturing. Climate change will also lead to a food shortage, which can increase crop prices and poverty in city populations. These effects will not be temporary without sufficient action as the urban heat island effect, which raises city temperatures faster than rural temperatures, will accelerate climate change in Indonesia. Increased temperatures create a self reinforcing cycle that promotes further climate change and inconsistent weather events. Unpredictable weather will destroy businesses and homes, cause flooding, and create a food shortage in major cities, such as Jakarta. If climate change is not adequately addressed, it will cause agriculture failure, low-income cities, and a push Indonesia back towards a third world country.

With a growing Indonesian population, crop yield during growing seasons will become a priority for both the government and the general public. A possible decline in rice production threatens to extend Indonesia’s hunger crisis. Researchers suggest that “several important innovations outside of the politically stifling food security debate” are required to prevent a hunger crisis in Indonesia (McCarthy, Zen). Traditional methods, including uphill farming and paddy cultivation, require substantial amounts of water and fertilizer. New growing methods hold the potential to reduce Indonesian farmers’ resources consumption and yield more rice than before. Originally developed in Madagascar by Henri de Laulanié, a new method known as System of Rice Intensification (SRI) can serve as a solution to rice scarcity caused by climate change. While traditional rice cultivation incorporates flooding tightly packed seeds with water, SRI utilizes, “improved soil conditions through enrichment with organic matter,” and “reduced and controlled water application” (“System of Rice Intensification - SRI Methodologies”). Soil is treated with organic matter, or a fertilizer approved by the Indonesian Ministry of Agriculture. Young rice seedlings are then carefully spread out into the soil to provide adequate room for root growth. A thin layer of water is applied onto the mounds and water is not reapplied until the soil dries and cracks within 2 - 3 weeks. These alternations between wetting and drying the soil reduces the amount of irrigation water needed by half. Although this method requires more labor, SRI can double yearly rice yields without a reduction in quality. While not only countering the threat of food insecurity, a larger supply of rice will deflate the prices of these crops and allow for rural families to afford food. Unemployment will fail to increase as farmers will be able to grow crops and provide for their families. More citizens will also find employment as farmers because of the extra labor required for the SRI method.

In order to ensure the potency of SRI, the government must facilitate and provide aid to small farmers shifting to the method. Policies that limit the amount of deforestation and loss of agricultural land must be instituted. Rather than devote capital to rice importation, money must be used to push the Indonesian agricultural self-sufficiency agenda forward. Government aid also includes overseeing an initial test harvest, determining soil fertility, and assisting in affording needed fertilizer. These actions will provide data that can be used to adapt procedures. However, the majority of the labor must be performed by community members, primarily small scale farmers involved in the operation. Still, traditional culture and a need for employment ensure that sufficient labor will be provided. It is vital that the government

advocate the method to farmers. Currently, Indonesian farmers tend to farm based on a cultural norm known as Pranoto Mangso. Pranoto Mangso, translated from Indonesian, is, “dating related to the season according to the understanding of the Javanese, especially from farmers and fishermen” (NKI Bdg). This belief results in farming seasons revolving around solar calendars. However, as climate change results in distorted rainfall patterns, solar calendars may no longer be as accurate. The government must promote SRI to small farmers in accordance with the new monsoon season. So far, the Ministry of Agriculture is executing a plan to increase technology accessibility for farmers. An action to promote SRI and a new growing season while respecting the idea of Pranoto Mangso will merge perfectly into their agenda and aid farmers in adapting their methods.

SRI holds the potential to overcome Indonesia’s hunger and poverty crisis. The method does not require drastic changes in daily actions of farmers besides slightly additional labor. However, the technique preserves agricultural business and improves food security. As agriculture remains to be one of Indonesia’s primary economic sectors, the increased yields may result in an improved economy, thereby elevating the economic status of families out of poverty. The method will remain sustainable as the saved water will be inserted into future SRI uses. A shift from traditional farming to SRI would boost Indonesia away from hunger and poverty due to an increased rice supply.

Alongside reducing crop yields, climate change can cause flooding, as seen in northern Indonesia. Flooding and storm surges often contain saline water, which deteriorate soil fertility and reduce the success of crops. As flooding is typically unpredictable, this natural disaster can disrupt daily actions and life. Inspired by the Sawah Surjan System, there is a possible solution to the threat of saline water. Sawah Surjan is a technique for managing fields with poor drainage by lowering the elevation of the crop bed in comparison to the adjacent bed, which allows water to runoff and spread evenly among the various farm areas. The possible solution extends off of this system. Rather than lower the beds in a stair - like manner, the solution would alternate, with every other bed being raised to increase water drainage. With a difference of approximately 40 centimeters, the lower - elevation beds would contain halophytes, or plants that tend to be salt tolerant. The raised beds would continue to hold staple crops, such as maize. The saline water would drain into the halophytes, such as sea spinach, resulting in an adequate, healthy removal of the salt water. Any remaining water would be used by farmers to irrigate the raised crops in a controlled manner. This solution not only provides a greater food supply, but protects soil fertility and upholds the jobs of farmers. As the solution requires more agricultural space, the economy and crop yield may not experience an immense increase, but food security will be increased due to the crops grown. However, it is important to use facultative halophytes, as they, “have the ability to grow on the soil devoid of salt,” during times free of flooding. (Mishra and Tanna). Facultative halophytes similar to sea spinach are especially important as they provide a secondary source of food.

In order for this new technique to succeed, the Indonesian Ministry of Agriculture must not only push farmers to use this method, but must also actively assist them in modifying their farms. New policies that minimize the amount of agricultural land sacrificed to deforestation and architectural development must be instituted and those already existing must be further enforced. If needed, the government must also assist in providing community members with facultative halophytes through financial aid and transportation of the plants. The government must also find ways to merge the yields of facultative halophytes into traditional Indonesian cuisine. In order for these crops to be effectively used, citizens must be able to incorporate them into their cuisine. Overall, the Sawah Surjan System inspired method holds the ability to sustain Indonesian farms with a single start - up cost that would allow for farms to continue to function.

Food security and poverty are intertwined, dominant issues present across the globe today. Indonesia suffers from food insecurity and poverty as a result of climate volatility, specifically global warming. A decrease in agribusiness results in economic loss and an increased chance of poverty. Climate change prevents Indonesia from developing a consistent high national income and threatens to submerge the country into poverty. The SRI and Sawah Surjan System inspired methods hold the potential to revitalize Indonesia's agriculture and elevate their economic status. SRI will increase Indonesia's rice supply while lowered halophyte beds will protect against harmful saline water. Through the implementation of these methods and adequate government policies, Indonesia can protect their food supply while experiencing economic growth. Improved food security and expanded gainful employment within individual families will elevate the entirety of Indonesia and erase poverty from the nation.

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