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## **Palau: Investing in education, training and extension for improved implementation of agricultural research and technology**

Mahatma Gandhi was quoted saying, “The future depends on what we do in the present.” This quote can be applied to the current agricultural environment in The Republic of Palau. Throughout my research, I have analyzed the foundation of agriculture and food security in Palau and have come up with a logical solution to helping the people of Palau ensure a safer and brighter future.

The Republic of Palau is a small country located in the western Pacific Ocean. Palau is geographically part of the larger island group of Micronesia and Philippine areas. There are about 200 islands that make up The Republic of Palau with about eight of them having a large population. The most populous island in the group is Koror, with the capital city, Ngerulmud. Palau is known throughout the world for some of its touristic sites. Palau is home to Jelly Fish Lake, coral reefs, a long coast line, World War II wrecks and many other historic sites.

When Kate Krogh was just a year old on June 15, 1991, Mount Pinatubo erupted, producing the second largest terrestrial eruption. Ejecting roughly 15 tons of magma, the effects of the eruption were felt worldwide. Mount Pinatubo is located in the Cabusilan Mountains separating the west coast of Luzon from the central plains. The Krogh family was devastated when inches of ash bored down on their family home on Cebu. Cebu is located near Mount Pinatubo and has the same geographical features as Palau (about 200 islands). The eruption of Mount Pinatubo cost the Philippine and Micronesian areas millions of dollars in repairs to all of the islands. The Krogh family relocated to the United States where the father’s side of the family had relations. Mount Pinatubo also had a great impact on The Republic of Palau. Over four inches of ash fell upon Palau, leaving things a mess. Some places near Mount Pinatubo had over ten inches of ash that would fall because of the eruption. Krogh tells these stories and shares the information like they happened yesterday, a day that will always be remembered for the Krogh family. This goes to show how events that humans and technology have no control over, can devastate many areas of food security.

Before and after the eruption of Mount Pinatubo, Palau had many other global and local issues that would impact the society. The Republic of Palau does not produce enough food to support itself; this is because the cost of farming is higher than the cost of importing food. Jane Resture is eager to talk about the “Aspects of Palau” on her website dedicated to Micronesian culture. The main crops grown on the island are coconuts, bananas, root crops such as taro (similar to the potato), other vegetables, and fruits. The livestock include poultry, pigs, and dairy cattle. When Jane points out agriculture on her web site, you notice that agricultural practices in Palau are very different from the United States. Communal farming is initiated by a leader. When a high ranking woman in the community sees that the families will run low on food, she calls a special meeting of all the women in the community. She then makes everyone in the community aware of the situation and then assembles a team of women to work together. They set a date, decided on which family's farm to start planting and then begin working. When all the planting has been completed, each individual is responsible for the upkeep of her land. The crop is then harvested and will not be shared, but will become the property of each family. Communal farming is the most common farming practice among the Palauan community. The male population does help in the agricultural field as well; however their participation is focused more on the larger farms. The men that do not participate in an agriculture job, often work in the larger cities or small towns of Palau or go to seek offshore employment; usually in the fishery industry. Many families can often seek some produce, as they have

personal gardens and contribute to community gardens. After reviewing all of the aspects of Palauan farming that Jane Resture has on her website, it gives the impression that the Palauan way of farming allows community members to look out for one another, making sure every family has enough food to last the entire season.

The Republic of Palau is facing global and local realities that it has never experienced before. The harsh realities come from the destruction of local farming communities and overbearing new global practices not functioning well with Palau's delicate landscape. Agricultural productivity, food availability and quality, the present status of investing in education and training, current trends for helping the food security issue, and the impacts on climate change all play a great role when it comes to solving hunger issues that happen in Palau on a daily basis.

Agriculture, fishery and forestry accounts for nearly twenty percent of the Philippine and Micronesian economy. It may not seem to be a very large number, but for a small Philippine or Micronesian island, it means even more with the amount of jobs it creates and what it produces and brings to the island every day. Balisacan states in "Agriculture Growth and Rural Performance" that, "Ever since the 1960s, the direct share of agriculture in the GDP has fallen below one-third, and by 1981, the sector share had decreased to only 23 percent". Balisacan also mentions that agricultural output in the Philippines has been stagnant for the past couple of years. Agricultural productivity deals with how much the agriculture industry produces. Nearly two-fifths of Palau's employment is in the agricultural field. Balisacan also states with in his research at Manila University in "Poverty and Inequality," that nearly 70 percent of the country's poverty or poor-state comes from the rural areas where agriculture is the dominant source of livelihood and employment. Some hurdles that Balisacan describes specific to Palau are the lack of land that is available for farming on Palau and "lack of close resources" that are available to farmers due to its location. The government of Palau is noticing the struggle and a objective of the government is to evaluate the natural resources within the state and nominating additional sites to the national register in order to ensure their preservation. The research and man power is out there to better help Palau for the future of the country, so that upcoming generation can deal with the global and local realities that it never experienced before.

The present status of investing in education, training and extension for improved implementation of agriculture research and technology in Palau is what organizations are trying to increase on a local and global level. The Palau Conservation Society (PCS) has been looking at for a way to stop the severe lack of agricultural education and research. At the local level, PCS helps communities identify, protect, and manage key producing areas, such as Spawning and Aggregation Sites (SPAGs) for critical marine species. PCS also helps communities build resilience into their protected area networks by including areas that are resistant to the effects of climate change. With only a land mass of 458 square kilometers (176.8 square miles), everything from forests and farms, to harbors and reefs have been degraded because of the lack of education and training. The PCS at a global level is trying to increase outside organization involvement within Palau, trying to make sure that the future and current generations have what they need to make a secure and improved home. Investing in education and training for agriculture in Palau would only help further the country in sustaining enough food for all the inhabitants on the islands along with preserving them for the future.

Climate is something that education and training cannot change, but it can help farmers and every day citizens prepare for. Current trends in climate change in Palau are straining the agricultural and industrial industries. The Encyclopedia of the Nations has an abundance of information about climate in the Philippine and Micronesian areas; including an article in which The International Panel on Climate Change (IPCC) noticed that countries, particularly Small Island Developing States, much like Palau, are vulnerable to climate change. The future of many Pacific Island nations is already being shaped by the events of climate change. Tolentino explains in the "Post-Erap Reform Agenda" that the total replacement

costs for Cyclone Heta in Niue were estimated to be almost 200 percent of the annual GDP. Niue has a similar geographical makeup such as Palau and the information that is collected throughout neighboring islands and ones of a similar nature to Palau could help educate and train the farmers and workers of Palau into diminishing the severity of food security issues. Pacific island countries are among the most vulnerable nations in the world to the impacts of extreme weather events. Adaptation is something that researchers of Palau along with rural and urban families are constantly looking into for new trends to help lessen the impact of an ever-changing environment. The most substantial impacts of climate change include losses of coastal infrastructure and land, more intense cyclones and droughts, failure of subsistence crops and coastal fisheries, losses of coral reefs and mangroves, and the spread of certain diseases. Throughout the chain of catastrophic events that are due to climate change, it will danger both agricultural and industrial industries that hope to make Palau a better place. Tolentino explains how some of Palau's most beautiful tourist destinations are at grave risk in the long term if the current trends observed along the projected path within the next century continue. Tolentino explained how climate change can affect the agricultural side and how it can change another leading industry; tourism. Thankfully, noticing the climate trends and how it is affecting everything else in Palau at an early time is giving environmentalists most of the time they need. How the trends of the food security can improve would be to invest in education, training and extension for improved implementation of agriculture research and technology. This way the when catastrophes happen, the people of Palau will be better prepared to adapt and overcome the current trends.

Trends in climate change can also affect the economic part of Palau. Recent studies from the Palauan government and the Organization for Economic Cooperation and Development show that the annual and seasonal ocean surface and island air temperatures have increased from 33.08 degrees to 33.8 degrees C since 1960 throughout a large part of the South Pacific. This may not seem like a lot, but in Palau, that would affect the quality of the producible food and then introduce a chain reaction that would affect the income of the typical Palauan working family. Palau's climate is tropical with a mean annual rainfall of around 370 centimeters. The heaviest rains generally occur between the middle of June through August. Improving awareness through education of the continuous climate change would inform smallholder farmers or urban dwellers in Palau of focus. Focusing education on that the environment will have a great effect on the agricultural industry. Education about weather patterns such as the 250 days with rainfall greater than .24cm or the Typhoon belt that lies to the northern equatorial Pacific would help increase food quality, quantity and generate more income for families in Palau.

Other major issues such as population growth and water scarcity will affect the way that agriculture research and technology are sought out in Palau. These issues are subject to change from year to year without much warning. This makes it a crucial part that Palauan people have all the education they need to be prepared when population growth and water scarcity changes. These issues are also ones that not only deal with the present status of food security, but make for a tougher future in the agricultural industry.

Along with climate affecting the agricultural industry in Palau, water outlets, availability and management have also been an ongoing problem. Watershed practices are new management techniques that is trying to be started in Palau by the Integrated Water Resources Management (IWRM) that are proper watershed management practices. The promotion of proper watershed practices will reduce land degradation while preserving ecosystem stability, functions, and services such as soil and watershed protection, water purification and nutrient retention which have been an ongoing problem. Many people are not properly trained on the maintenance and management of critical water sources. Also, much deterioration has happened along the coast and in Palauan waters. The Oceanic Fisheries project, which deals with deep ocean fisheries management, hopes to extend the water movement so that water is not only safe for drinking, but safe to fish in as well.

Larson in “Intersectional Migration” states how the majority of population settlement and critical infrastructure in most of Palau is located in coastal areas. Along with the majority of the population, key infrastructures such as hospitals, schools, and power plants are also located in the coastal areas. Because of this, there is a demanding strain on hospitality settlements and residential areas. In an increasingly urbanized Pacific, with many people residing in informal settlements, under very crowded conditions, poor housing and limited access to basic amenities, the growing population could easily in the future place major burden on already stressed urban management. This would not only hurt the Palauan people, but also stress the agricultural industry. With a growing population, the demand for produce and other amenities are only going to increase as well, and with off shore employment, the government of Palau is seeking more off-shore agriculture. This is something that Palauan citizens do not want to see, as it was spoken greatly by Larson in “Intersectional Migration”. This is something that Palau must recognize and find a solution on how to keep the people of Palau working at Palauan jobs.

Given the research presented in this paper, the best way to improve food security within the rural and urban families of Palau, would be to invest in education and training for farmers that would improve the performance of agricultural. Investing in education would open the eyes of rural and urban families along with farmers on how other countries that are very similar to Palau are dealing with issues such as climate change and global practices. These new ways can be adapted to fit the Palauan way of life. Briones in “Agricultural Investments and the Pace of Land Reform” agrees that training Palauan farmers in improving the performance of agricultural would not only help current generations, but those new practices would be carried down throughout the generations for creating a better and more abundant product throughout agriculture. There are so many factors out in the world today that can affect the agricultural industry. With a population of about 21,000, Palau has to have all the citizens trained and educated for adapting to new ways of life.

Many of the local projects by the Pacific Adaptation to Climate Change (PACC) and the Palauan Conservation Society (PCS) work with national and local communities to develop policies and practices that ensure food security and help Palauan agriculture. Elbachel Sadang from PCS states in “Building Self Reliance through Food Security,” that the society helps communities identify, protect, and manage key producing areas. Land and resource use planning is a priority in Palau. Airai, a land and resource committee took control and completed a full land use plan in 2007- . The PACC, led by Rajdamri Putumwan ensures Palau that PACC is committed to assisting by providing alternative solutions to real problems faced by farmers. Those problems can deal with salt water flood on taro patches close to the sea and the impacts of warming waters and changes to the grouper fish, rabbit fish, clams and crab culture. These local projects help educate and train individuals on what is and will be facing Palau along with ways to help lessen the impact on the environment. Without these societies and associations Palau would be in far worse place it is today

The Millennium Development Goals (MDG’s) and associated policies, technologies, practices or investments that would help resolve the issue by 2015 would be changing agriculture practices and to educate farmers on environmental details such as fertilization and cultivation. Farming on Palau is characterized by communal planting, women farmers, and individual cultivation. This practice is mainly letting women attend to the farming on Palau and most of the food is raised for individual families. If this agricultural practice was changed so that people could take agricultural as just a main job to provide food for many families and villages, then more quantity of food would be produced and therefore it would lessen the demand on foreign food imported from countries such as China or Japan. It is not that common that Palauan farmers use machinery or other additives to their crops, because much of the agricultural work is done by hand. To have work done more efficiently, one could suggest using machinery such as automatic milkers for dairy cows, or cultivators that could be pulled behind horses or mules. All of these suggestions would increase the quantity of the produce along with the quality.

The role of communities, the national government, corporations and other organizations would help bring the severity of the food security down immensely. Through community organizations such as PACC and PCS, individuals will receive education and training they need. Some ways that the government of Palau could help would be to notice more that the country is not supported by agriculture, and therefore offering an incentive if someone would like to start an agricultural homestead. This would offer the Palauan people that bonus of creating food for Palau along with strengthening agriculture within Palau. Other organizations would be a great help to Palau, such as the United Nations and the World Bank. Mr. Butzer, Mundlak and Larson have been working with the World Bank in Washington, D.C to address problems in Thailand, Philippines and other surrounding Micronesian areas. Some ways they might want to consider helping would be to lowering fees and having more money available to Palauan agriculture. This would provide them with an incentive to change practices and more money to increase education, training and for new implantation of agriculture research. With help from the United Nations, they could better communicate with countries within their area and have the resources provided to them in order to have the proper education, training and extension for improved implementation of agriculture research and technology.

Resolving all of the issues stated would take an immense amount of time, energy, and cooperation throughout all of Palau. The important thing to understand is that it can happen, if local projects and outside organizations focus on training and educating farmers, it will not only then improve trends of agriculture in Palau, but raise the standard of living. The communal farming is another factor that might be reason why Palau is having some problems with the area of agriculture. The other factors recently stated are factors that some nations take for granted, such as surplus of food, water quality and quantity, and organized way of farming. Some factors may never be completely controlled or changed by citizens, such as climate. Changing the role of community and government is the key to lowering the severity of food security. With help from local and global organizations, they can meet Millennium Development Goals for short and long term solutions. When the Millennium Development Goals are met, they leave an opportunity for the upcoming generations to create even bigger and better goals when they have the technology and training they need. Investing in education, training and extension for improved implementation of agriculture research and technology would help that family described the beginning of the paper. As quoted earlier by Mahatma Gandhi, "The future depends on what we do in the present," if organizations, farmers, the business community, teachers, government and citizens focus one hundred percent on the present Palau, it will make for a much brighter future.

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