



## **FOOD SYSTEMS SOLUTIONS**

FSM R&D Division of Trade

Funded by the United States Department of Commerce  
Economic Development Administration



**Developing a Food Innovation System for Yap State:**

***Local Food Processing for Increased Health***

***Economic Growth and Job Creation***



# **Yap State Food Systems Solutions Framework**

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## FOREWORD

Food security is vital for Yap State. Our current dependence on imported foods and our increasing vulnerability to climate change threaten local crop production and our food supply. This Food Systems Solutions Framework provides a realistic path to address our urgent need to increase food production and processing as it embodies the voices and expressed goals of Yap's many stakeholders.

Our people have been living on our small islands for thousands of years. Yap has a rich, lived cultural heritage that connects us to our land and sea. Many Yapese traditions are central to our food production including values that guide agricultural practices, food preparation, social cohesion, and the transmission of cultural identity. While Western food imports have increased, traditional systems for growing our staple crops and fishing our waters remain central to our economy and social life.

This framework embodies Yapese efforts to promote sustainable agriculture and revive traditional food systems through farmer training and community-led initiatives to improve health and local food security. Increased local food production, processing and long-term food storage will benefit the Yap people in myriad ways, strengthening our economy, creating jobs, stimulating entrepreneurship, increasing food security, reducing transportation costs, and fostering community connections. Money spent on local food stays in our community and is reinvested in local businesses and services, while local food processing and sales create new opportunities for jobs.

As Acting Governor, I extend my sincere thanks to all members of our community who participated in the development of this Framework with specific thanks to our Traditional Leaders and Chiefs' Councils, Yap State Legislature and the Yap Catholic High School. I also extend my gratitude to the FSM Department of Resources and Development, the Rutgers Food Systems Science Team and the US Department of Commerce Economic Development Administration.

Let's begin this important work to strengthen Yap's local food system, promote traditional foods, and educate our younger people in farming and fishing techniques that strengthen our cultural heritage and our overall food security for generations to come.

A handwritten signature in black ink, appearing to read "Francis Itimai", written over a horizontal line.

Honorable Francis Itimai  
Acting Governor

Yap State, Federated States of Micronesia  
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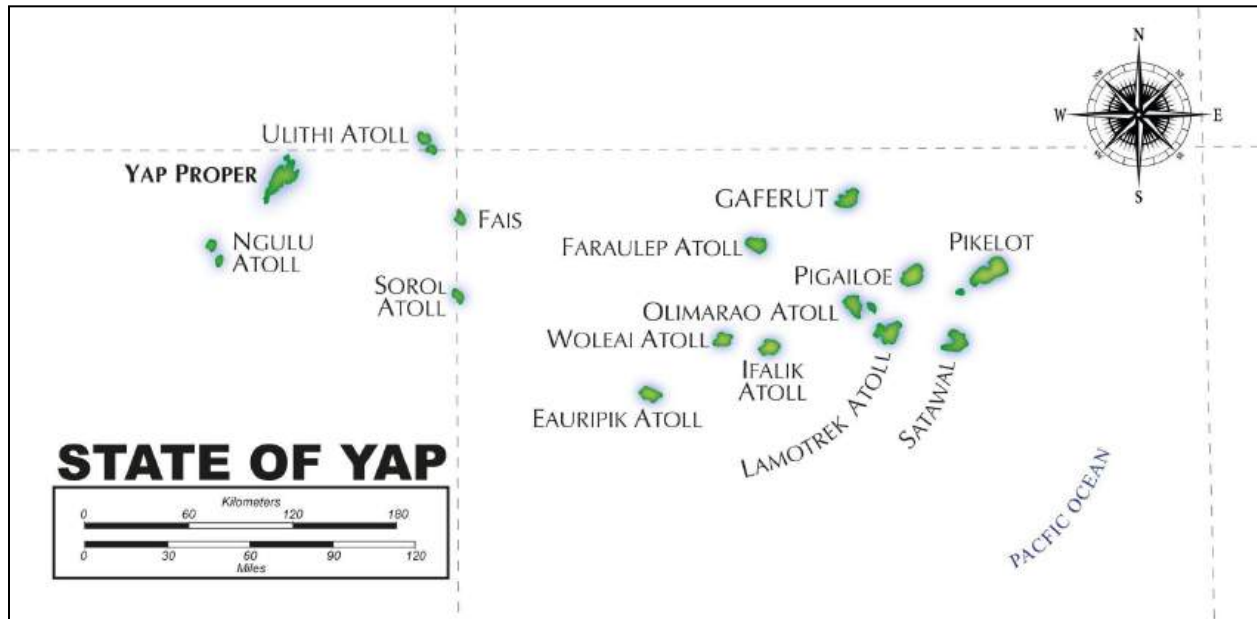
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# Executive Summary

## Food Systems Solutions Framework for Yap State, Federated States of Micronesia



*Map of Yap State, Courtesy of Yap Visitors Bureau*

Yap State, the westernmost region of the Federated States of Micronesia, is embarking on a transformative journey to revitalize and modernize its food systems while remaining deeply rooted in its cultural heritage. Known for its traditional culture, hierarchical social structures, and strong Council of Chiefs, Yap presents a unique context for food systems development. With a population of less than 12,000 people dispersed across high volcanic islands and numerous coral atolls, the majority of residents live on main island Yap. Here, traditional food systems have supported communities for generations, practicing agroforestry, taro patch cultivation, and reef fishing to maintain food security, ecosystem health, and social cohesion.

Despite Yap's cultural and ecological strengths, the state remains heavily dependent on imported foods. Infrastructure for processing and storage is limited, outer islands face freshwater scarcity, and farming is often undervalued as a source of income. Vulnerable to climate change, extreme weather events such as typhoons, droughts and king tides threaten Yap's fresh water resources, agriculture, and coastal fisheries.

To address these challenges, the FSM Department of Resources and Development, in partnership with Rutgers University and local stakeholders, and with the support of the United States Department of Commerce Economic Development Administration launched the Food Systems Solutions project, the nation's most comprehensive effort to date to strengthen overall food sovereignty. Building upon prior recent studies funded by the Green Climate Fund SAP020 examining FSM farming families impacted by climate change, as well as the 2021 FSM Food System Dialogue, this project engaged farmers, fishers, traditional leaders, entrepreneurs, civil society, and policymakers by way of surveys, focus groups, community convenings, and workshops to design a food processing framework rooted in community

priorities.

This **Food Systems Solutions Framework** thus embodies Yap stakeholders' expressed needs for climate resilience, import substitution, and sustainable livelihoods, while placing cultural preservation at its core. Though modern techniques and scientific inputs are introduced to support climate resilient food production, the emphasis remains on enhancing, not replacing, traditional methods. This Yap State Food Systems Solutions Framework thus offers a community driven blueprint to transform the island's food economy, redirecting millions spent on imports into local value chains that create enterprises, reliable markets, and steady employment in farming, fishing, processing, and distribution and strengthening shift from a linear to circular economy. This framework integrates Yap's ecological stewardship, cultural heritage, and traditional innovation through four identified enabling growth activities:

### **Enabling Growth Activity 1: Creation of Food Innovation and Processing Facilities**

Yap's innovative food processing model introduces a decentralized but integrated three-tier infrastructure designed to build capacity for value-added processing at multiple levels. Ten Tier 1 facilities, distributed across all municipalities, will offer low-level processing capabilities such as coconut dehusking, juice extraction, and basic aggregation of crops in small-scale 100–200 square foot centers. These will serve as vital entry points for farmers to begin engaging with markets.

Two Tier 2 facilities, strategically located at Kanifay and Tamilang elementary schools, will provide medium-scale, solar-powered processing of local staples like breadfruit, banana, taro, and coconut. These facilities (3,000–4,000 sq ft) will focus on creating high-demand products such as chips, flours, oils, and coconut milk. Schools will also function as educational hubs for food systems awareness, nutrition education, and youth engagement through weekly staple-crop lunches and recipe competitions aligned with events like Yap Day.

At the core of this infrastructure is the Tier 3 facility in Colonia: a high-capacity, multi-functional center spanning 5,000–6,000 sq ft. This hub will house food safety testing labs, teaching kitchens, solar and fire-powered ovens, and large-scale storage and processing equipment. Designed to serve not only domestic needs but also ecotourism and potential military provisioning, this facility will also support disaster resilience by storing shelf-stable foods for outer island distribution. Maritime food systems are also being strengthened through this activity. The existing Yap Fishing Authority (YFA), which houses Yap Proper's only ice-making facilities, will be expanded to include salting, drying, and smoking capabilities. Fish waste will be repurposed as protein-rich inputs for locally made chicken feed, supporting sustainable poultry production.

### **Enabling Growth Activity 2: Improved Information Systems to Support Decision-Making**

Given the geographic spread of Yap's islands and limited internet infrastructure, stakeholders have prioritized the creation of a Yap-specific mobile application to link producers, consumers, processors, and markets. Local telecommunications provider iBoom has been engaged to design the app with offline functionality to accommodate areas with low or no connectivity. New satellite technologies like Starlink and ongoing infrastructure improvements will help bridge these gaps. The app will serve as a digital backbone for organizing supply chains, sharing knowledge, and tracking market demand across the food system. Content for such an app can be housed for free public access on the Yap State's government website.

### **Enabling Growth Activity 3: Education, Training, and Technical Support**

A critical insight from past Yap development efforts is that infrastructure alone is insufficient if communities lack the skills to use and maintain it. The Framework therefore prioritizes training programs that are continuous, culturally grounded, and inclusive of both producers, trainers and educators. Capacity building in these areas will ensure that agroforestry knowledge is complemented by modern techniques,

enabling farmers to improve yields while protecting biodiversity. Training will also strengthen the ability of fishers and coastal communities to manage reef ecosystems sustainably, preserving resources for future generations. With a strong educational component already in place, including involvement from schools and agriculture instructors, the framework will expand training on equipment maintenance, food safety standards, nutritional labeling, and business development. In doing so, it aims to create a locally-led ecosystem of innovation and resilience.

#### **Enabling Growth Activity 4: Enhanced Community Management and Policy Advocacy**

Yap's society is characterized by a complex caste system and a hierarchical structure, where community leaders, elders, and heads of households hold significant influence in decision-making processes, including those related to food production and resource allocation. This framework focuses on strengthening the networks that connect community decision makers with local producers and consumers to empower community voices in food production and distribution. In Yap, local food is more often bartered than sold, and farming is not widely viewed as a source of cash income. However, stakeholder feedback shows growing recognition that local food processing can simultaneously preserve traditional culture and create new economic opportunities. By anchoring the food system framework in cultural values, the initiative strengthens traditional leadership, supports bartering systems, and reinforces the importance of staple crops such as taro, breadfruit, banana, and coconut. Community managers are confident that the establishment of larger processing and storage facilities will encourage revitalization of traditional growing practices, rather than replacing them.

This framework also addresses demand-driven gaps in the market. There is high consumer interest in products such as pickled vegetables, dried chips, coconut milk, and locally produced flour and sugar substitutes. These items not only support import substitution goals, replacing products like instant rice, cow's milk, wheat flour, and processed snacks, but also respond to the time constraints of modern cooking by offering convenient, nutritious alternatives in instant or pre-prepared form. With a total budget of \$8.8 million—\$5.75 million allocated to Tier 3, \$2.77 million to Tier 2, and \$62,000 to Tier 1—the Food Systems Solutions Framework is a scalable, culturally grounded, and climate-resilient model for food systems development in the Pacific. By blending traditional knowledge with appropriate technologies, Yap is laying the foundation for a food-secure future that empowers its people, strengthens its communities, and preserves its cultural identity for generations to come.



# FOOD SYSTEMS SOLUTIONS

FSM R&D Division of Trade

Funded by the United States Department of Commerce

Economic Development Administration

## PROJECT OVERVIEW

The Federated States of Micronesia (FSM) Department of Resources and Development (R&D) initiated the Food Systems Solutions (FSS) project, funded by the United States Economic Development Administration (EDA). This ambitious initiative aims to establish a sustainable national food system that strengthens supply chains and facilitates trade linkages both within and across the four states of the FSM. Through this project, FSM seeks to build a resilient and coordinated food system that enhances national food security by improving information systems, developing strategic plans for the creation of Food Innovation Centers in each state, building the capacity of local stakeholders, and empowering community-based management, and advocacy efforts.

Recognizing the complexity and interdependence inherent in food system development, the Food Systems Solutions project has been designed to promote inclusive engagement across all sectors of FSM society. It acknowledges that achieving sustainable food system growth requires collaboration among farmers, fishers, consumers, sellers, entrepreneurs, policymakers, educators, and civil society leaders. Through strengthening communication channels and encouraging cross-sectoral decision-making, the project aims to significantly enhance the efficiency, resilience, and effectiveness of FSM's local and national food systems.

This FSS project is intended to strengthen food security across the nation through an innovative approach focused on improving and coordinating food systems through enhancing information systems, developing plans for Food Innovation Centers in each state, increasing local capacity, and community management and advocacy. The Rutgers Food System Science team was contracted to supervise the Food Systems Solutions project in partnership with FSM state partners and local NGOs.

This Food Systems Solutions (FSS) project evolved from the 2021 United Nations Food System Summit and the corresponding Federated States of Micronesia Food System Summit Dialogue.



The objective of the FSS project is **Economic Growth through Local Food Production.**

## Economic Growth through Local Food Production

**71% of FSM Household Expenditure goes to food**, primarily imported food (GCFSAPO20 Baseline Assessment 2024). This means the majority of FSM families' income is supporting companies outside our country.



If we took just 20% of the money we spend on imported food and use it to buy locally produced food, cooking oil and drinks, we would have an additional **5 million dollars** circulating in our economy each year (2016 FSM Agriculture Policy).



Producing and buying locally-grown and processed food generates local jobs and keeps our money in our states and our nation, making us more independent, wealthier and healthier.

Local Food Processing **strengthens the economy by replacing imported foods** with locally processed foods to support local jobs and businesses to keep money within the states.

## ECONOMIC GROWTH FRAMEWORK

FSS project is designed to support community-led food system development through the building and sustaining of the local food market. The project does this by focusing on four identified mutually reinforcing enabling growth activities.



## FOUR ENABLING GROWTH ACTIVITIES SUPPORT LOCAL FOOD PRODUCTION:

First, the project seeks to expand food supply with a **tiered network of Food Innovation Centers**, supported by training for farmers and that boosts volumes and quality and provides central food hubs for processing and value-addition. Second, it enables matching between buyers and sellers and cuts search costs by way of a **user-friendly mobile communication platform** offering buyer–seller chat, live inventories of surplus produce, and a map of delivery points, linking farmers and buyers. Third, it seeks to develop education and technical training to support Food Innovation Centers and a local food system supply chain. Finally, it embeds robust **improved local governance** through democratically managed cooperatives and public-private partnerships that set quality standards **and policy advocacy** to implement transparent profit-sharing rules, ensuring trust, compliance, and long-term market resilience while also stimulating demand through targeted policy measures, such as state-led local food procurement mandates.

**Enabling Growth Activity 1: Development of Flexible Food Innovation Centers**

**1<sup>ST</sup> Enabling Growth Priority Area:**

**Development of Food Innovation Centers (FIC)  
Processing of Local Foods for Import Substitution**

Dried local papaya, mango & pineapple

Smoked fish

Local Baked Goods: Example, banana bread and coconut cookies

Local Coconut Milk & Coconut Water

Local Flour: Breadfruit, Coconut and Taro

Local Chips: Banana, Breadfruit, Taro, Yam

Local Juice Drinks: soursop juice

**Enabling Growth Activity 2: Improved Information Systems to support Decision-Making**

**2<sup>nd</sup> Enabling Growth Priority Area:**

**Develop FSM's Shared Information Systems  
Linking Food System Stakeholders  
Connecting Farmers and Markets**

**Pacific Pests, Pathogens & Weeds**

Identify Pests, Diseases & Weeds

Launch the interactive Key

Full Fact Sheets

Access the full detailed fact sheets

Mini Fact Sheets

ICT and Mobile Apps Drive Global Agriculture

Source: SourceTrace Systems, 2017. Pacific Pets Pathogens Weeds Phone App, 2023.

**Enabling Growth Activity 3: Improved Education, Training and Technical Support**

**3<sup>rd</sup> Enabling Growth Priority Area:**

**Develop Education, Training and Technical Support Plan for Food Innovation Center Jobs and Supply Chain**



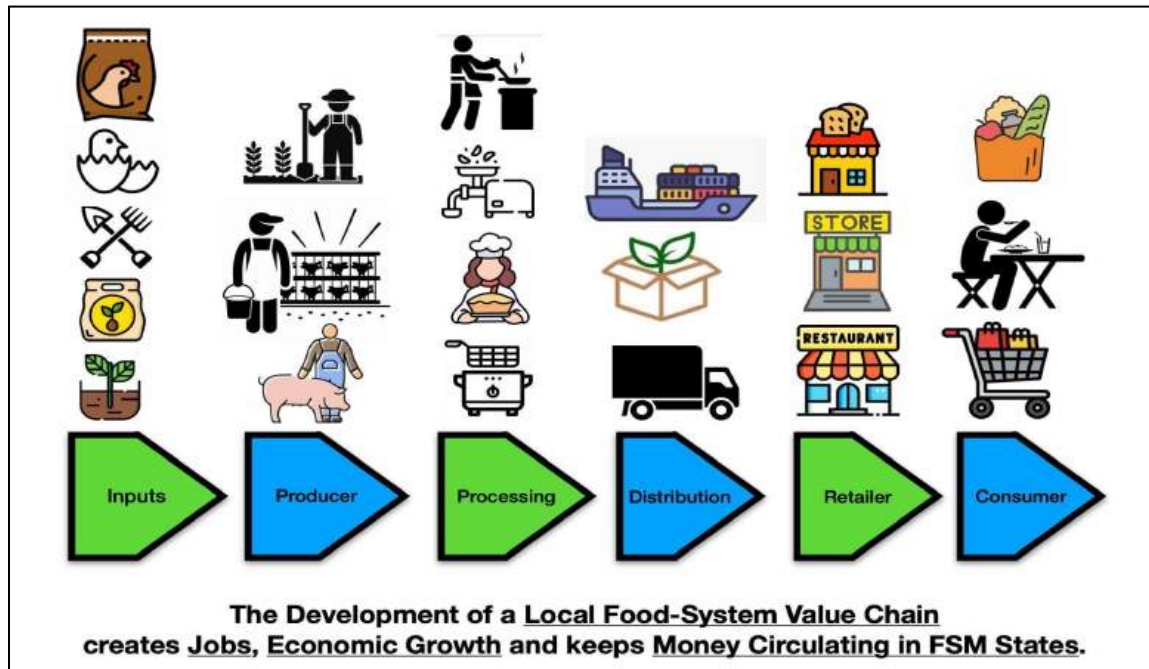
**Enabling Growth Activity 4: Enhanced Community Management and Policy Advocacy**

**4<sup>th</sup> Enabling Growth Priority Area:**

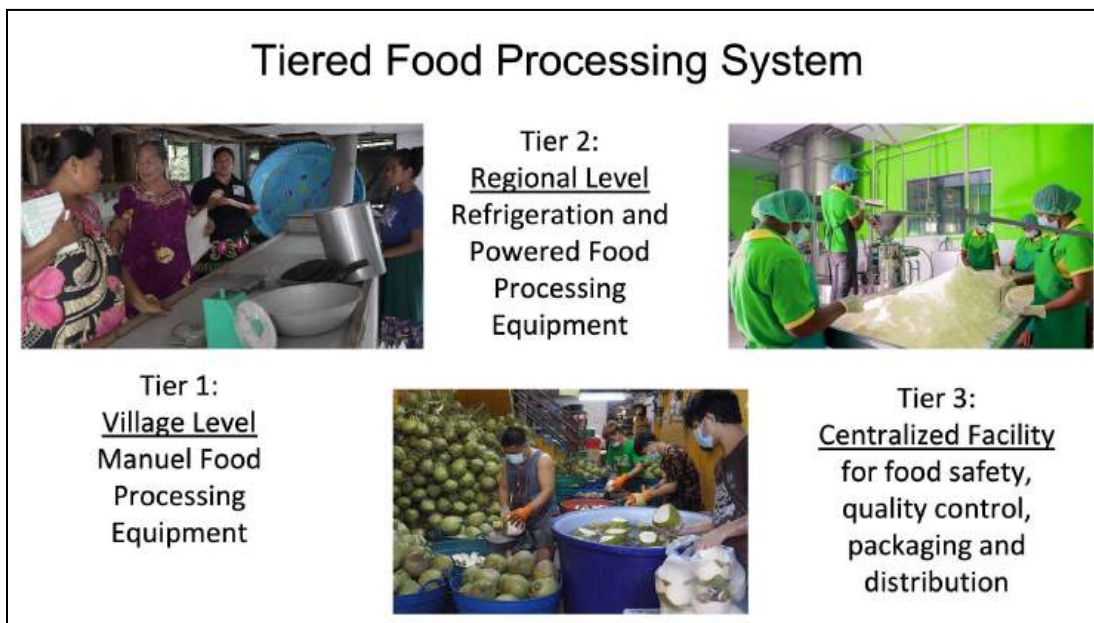
**Support Community Management and Policy Advocacy Capabilities for Effective Local Governance**



The Food Systems Solutions project seeks to support community-based food system development that builds each step of the **Local Food System Value Chain** by addressing four enabling growth pillar activities in a holistic interacting manner that when brought together facilitates short and longer-term sustainable growth. We consider sustainability to be grounded and guided by cultural, environmental and economic considerations.



A tiered food processing system offers **Value Addition Job Opportunities** throughout the community. This project stimulates the local economy through the use of a decentralized food system development approach to include as many people in the supply chain with a Food Innovation Center at the top tier for food safety, packaging, and distribution.



By strengthening and sustaining local food markets and raising farm productivity, this initiative lays the foundation for reliable access to affordable, nutritious food across all four states. The creation of value-adding processing hubs and support for smallholder agribusinesses generates new employment opportunities and broadens economic participation in rural communities. This integrated approach not only builds resilience against supply shocks and price volatility but also fosters sustainable growth, higher household incomes, and long-term food security for the Federated States of Micronesia.

**An example from Pohnpei State:** Imported foods that can be replaced with locally grown and locally processed foods. The amount of money spent on these food imports can be redirected to support local food producers and food processors. In 2021 alone, the people of Pohnpei spent more than 4.5 million US dollars on imported chicken meat and chicken/pig feed.

HS Codes-6 Digits	Import Items-Pohnpei(CIF\$)	2019	2020	2021
070490	Chinese Cabbage	\$44,384	\$30,436	\$40,710
070960	Bell Peppers	\$44,316	\$88,318	\$62,086
080450	Mango	\$14,235	\$5,542	\$24,848
080430	Pineapple	\$9,793	\$10,227	\$13,955
080711	Watermelon/Cantaloupe	\$42,299	\$42,348	\$30,102
070511	Lettuce	\$150,561	\$173,877	\$130,626
091011	Ginger	\$13,524	\$19,199	\$21,078
071420	Yam	\$25,805	\$31,283	\$52,673
080550	Lemons	\$4,443	\$3,839	\$6,731
151190	Vegetable Oils	\$3,116	\$33,558	\$50,328
040110	Milk (Fresh)	\$80,829	\$80,548	\$70,319
200410	Potato Chips	\$6,185	\$557	\$128,199
020714	Chicken (Frozen)	\$38,188	\$20,130	\$2,252,174
040721	Chicken Eggs (In Shell)	\$113,930	\$143,077	\$170,188
230990	Chicken and Pig Feeds	\$1,127,671	\$1,819,351	\$2,372,130
<b>Total</b>		<b>\$1,871,278</b>	<b>\$2,622,984</b>	<b>\$5,732,255</b>

As a nation, FSM imported \$5.64M in poultry meat in 2023 according to the Observatory of Economic Complexity (The Observatory of Economic Complexity, n.d.).

**A Community-Based, Participatory Approach to Food System Development:**

Community-engaged research is critical to addressing food insecurity, health disparities and empowering communities to meet their own needs. Community-engaged food systems research involves community members in the research process and helps ensure projects are relevant, practical, and widely accepted by the community. This approach also fosters trust and strengthens relationships between researchers and the community, ultimately enhancing the sustainability of projects.

A community-based participatory mixed methods approach was chosen to ensure inclusion of

the local food production aspirations of FSM's farmers and fishers and all other relevant stakeholders. Building upon the United Nations "Rethinking our Food Systems: Guide for Multi-Stakeholder Collaboration" and working in close collaboration with local NGOs and community groups in each FSM state, ten FSS survey tools were developed to collect data from food system stakeholders in each FSM state that included quantitative as well as open-ended questions. The below surveys were conducted in each FSM.

**Food System Stakeholder Groups Surveyed in each FSM State:**

**Producer Survey:** 65 per state minimum

**Consumer Survey:** 65 per state minimum

**Community Management Leader Survey:** 10-12 per state minimum

**Food Distributors and Retailers:** 24 per state minimum

- **Local markets** 11-12, minimum per state
- **Restaurants** 10-12, minimum per state, 4 for Kosrae

**Trainer Surveys:** 10-12 per state minimum

**Information Content Providers Survey:** 8 per state minimum

**Information Infrastructure Provider Survey:** 3 per state minimum

**Technical IT Survey:** 3 per state minimum

**Policymaker Survey:** 7-12 per state minimum



In addition to the surveys, qualitative data was also collected by way of focus groups, interviews and a two-day FSS stakeholder convening with workshops in each state.

In February 2025, a joint delegation composed of representatives from the FSM National Department of Resources and Development and the Rutgers University Food Systems Science team conducted field visits across all four states. Together with in-state NGOs, two-day stakeholder workshops/convenings were organized in each FSM state during which the FSS project's survey results and findings were shared. Each in-state convening/workshop served as an important platform to engage local stakeholders and gather critical insights as to how local food production and processing can be implemented. Convening/workshop participants included representatives from state governments, traditional leaders, and elected officials such as members of legislatures and mayors, farmer associations, members of crop and marine producer associations, and individuals from the private sector. These stakeholders had the opportunity to review FSS survey findings, participate in facilitated breakout sessions, and provide detailed feedback on the challenges and opportunities facing local food production and distribution systems. The stakeholders' contributions highlighted the pressing need to strengthen local agricultural production, enhance market access for producers, and build more robust trade networks within and between states.

The Food Systems Solutions (FSS) convenings emphasized the importance of developing locally driven food system strategies that **respect traditional knowledge**, and support community resilience, while advancing sustainable economic development objectives and adhering to practices and growth that strengthen and protect the environment. The FSS project, therefore, **prioritizes sustainable, economic growth and capacity building** in areas such as community led trade facilitation, agricultural economics, marketing strategies, and value chain development. By linking agricultural innovation with marketing and trade expertise, the project seeks to expand market opportunities for FSM's farmers and fishers, improve food availability, and generate new income streams that contribute to broader economic growth.

Working with the same NGO and community partners who collaborated on the Green Climate Fund SAP020 baseline assessment, the Food Systems Solution stakeholder survey tools were co-created to capture data relevant to local food system development from more than 600 farming families found here: <https://rd.gov.fm/food-security>

The results of the Green Climate Fund SAP020 baseline assessment informed the **Pohnpei Food Security Policy and Master Plan 2025** also prepared with support from the Rutgers Food System Science team:

<https://pohnpeistate.gov.fm/wp-content/uploads/2025/02/2025-Pohnpei-Food-Security-Policy-and-Food-Production-Master-Plan-submitted.pdf>

In 2024, 947 new mixed methods surveys of farmers/food producers were conducted by local enumerators conducted in local languages for this Food Systems Solutions project.

The 2-day workshops held in each of the FSM states in February 2025 included presentation of results from stakeholder surveys regarding challenges and goals for local food production with the following prompts for workshop breakout sessions:

**Prompt:** List the 3-4 most important local food raw materials that producers can supply to a FIC and what support do the producers need?

**Prompt:** Describe 3 ways community leaders can implement policy to support food production, food processing, increased nutrition and job growth.

**Prompt:** What features would be most useful in a food system app for your state?

**Prompt:** When developing a Food Processing System for your state, where and how should food be collected, stored, processed, and distributed per product?

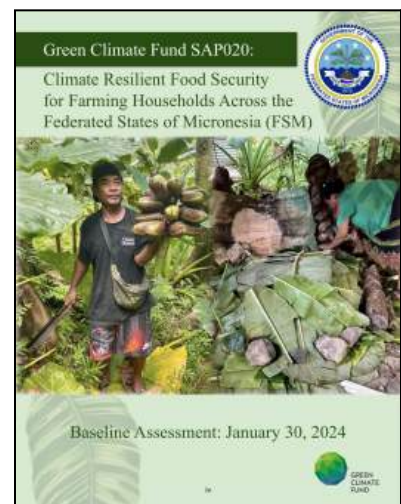
What type of facilities and equipment are needed and where should they be located?

**Prompt:** How and where should training take place in your state to support food production, business management, and food processing?

Convening workshop participants, including food producers, food sellers, community leaders, and policy makers, worked in groups to respond to the above prompts and then presented their answers at the convenings. All answers were recorded by video and have been transcribed to be included and summarized in the final Food Systems Solutions reports and proposed food production strategies that will be presented to each of the FSM states.

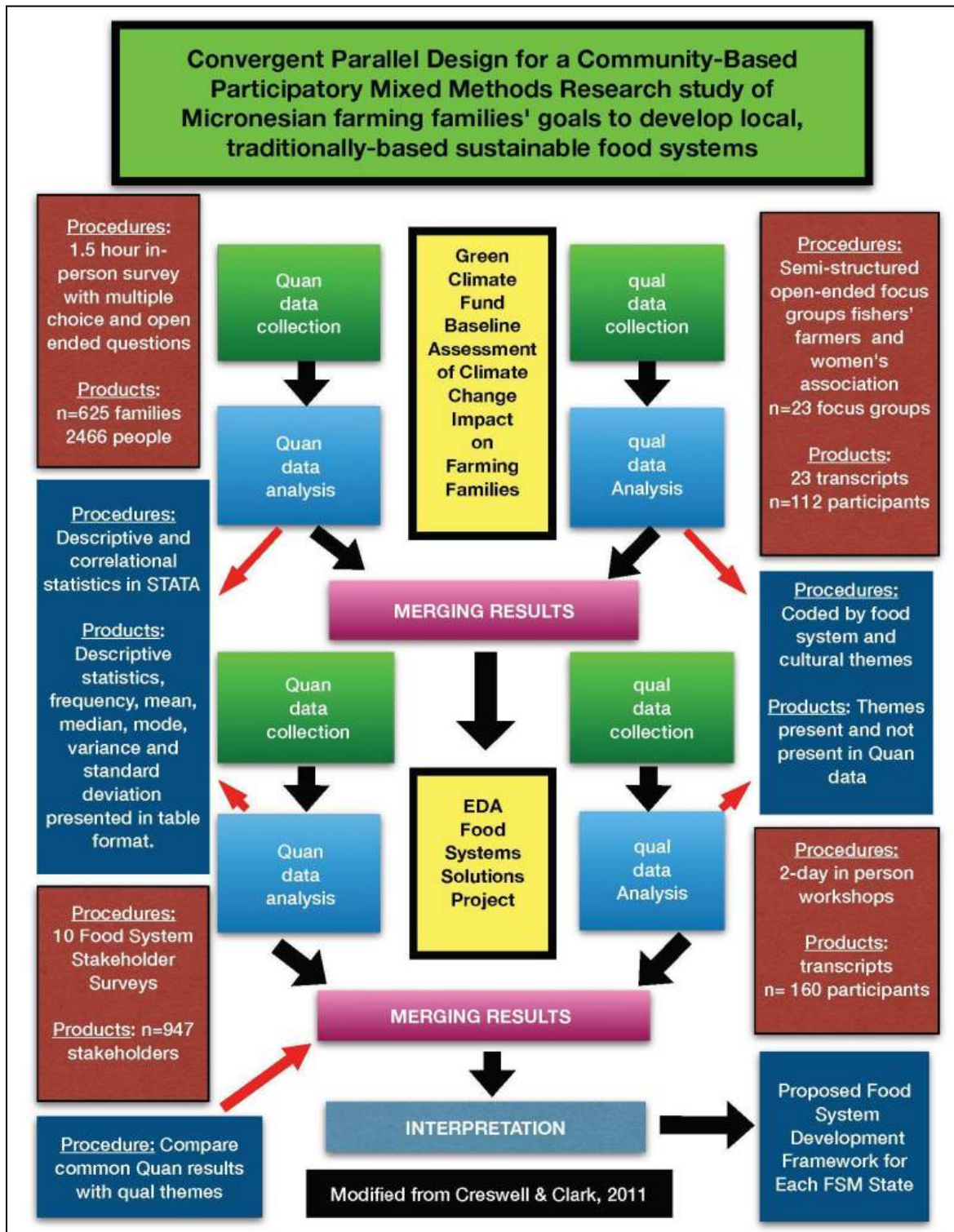
### **Comparing FSS data to GCF SAP020 data of climate change impact on more than 600 farming families**

In 2022, the Rutgers Food System Science team was awarded a contract to conduct the baseline assessment for the FSM Green Climate Fund food security project GCF SAP020 that includes studying the impact of climate change on more than 600 indigenous farming families across the nation. Using a community engaged, participatory approach in partnership with local NGOs and community groups, data was collected for the GCF baseline during 2022/2023. Working with the local partners, this data was shared with the community and final baseline reports were prepared with local Micronesian partners as co-authors. Using a convergent parallel design, the Rutgers Food System Science team now compares data from these two large FSM food system research projects that include more than 1000 surveys, focus groups, community convenings and interviews.



**Convergent Parallel Design Triangulation and Validation:** The convergent parallel design allows for the triangulation of data from two large FSM based projects (GCF Baseline and Food Systems Solutions), with results from the quantitative and qualitative analyses compared and

contrasted to validate findings and identify any inconsistencies or gaps in the research. The quantitative surveys provide patterns from large portions of the FSM populations, while qualitative interviews, focus groups and convenings, provided more nuanced cultural perspectives and were conducted within a more traditional Micronesian context of community knowledge sharing.



The Food Systems Solutions project has now prepared this research-driven, community-based food system development framework specifically designed for each FSM state and built from a wide variety of stakeholder and food producer input.

## **Food Systems Solutions Data Collection Methods and Results**

The research protocol titled “Strengthening Food Security in the Federated States of Micronesia: An Innovative Approach to Enhancing Information Systems, Establishing an FSM Food Innovation Center and Supporting Local Capacity Building” received Institutional Review Board (IRB) approval from both the College of Micronesia-FSM and Rutgers University. At Rutgers, the protocol (IRB Number Pro2024000757) was reviewed under minimal risk and granted exempt status (Exempt 2i) on April 30, 2024, with approval issued by the Rutgers Human Research Protection Program. At the College of Micronesia-FSM, the protocol (WIRB® Protocol #0020724072024) was reviewed on July 2, 2024, and formally approved as exempt on July 29, 2024, by the COM-FSM IRB. Both approvals affirmed that the study may proceed in accordance with the approved protocols and applicable human subjects protection regulations. For the surveys, partnering NGO facilitated trained local enumerators to conduct the food system stakeholder interviews in local languages. All enumerators were required to complete and were awarded CITI certification and received training from the Rutgers Food System Science Team prior to conducting the surveys.

In Yap State, the surveys were implemented through a partnership with the State of Yap and with the Yap Catholic High School (YCHS) with Michael Wiencek, Principal of the YCHS serving as the core contact and project implementer. A team of seven enumerators conducted a total of 216 surveys covering 10 survey tools designed for specific targeted participants/audiences across the 10 municipalities of Yap Proper, namely Dalipebinaw, Fanif, Gagil, Gilman, Kanifay, Maap, Rull, Rumung, Tamil, and Weloy. These surveys were conducted from August 1, 2024 to September 16, 2024. Residents from Yap’s inhabited neighboring islands, often referred to as the Outer Islands, and from the villages of Ruu, Makiy, Daboch, Gargey, Gitam, and Madrich were also surveyed. Many Outer Island residents of Yap State have chosen to live on main island Yap. We prepared a specific survey tool to capture the voices of the Satawal and Ablul communities on main island Yap.

Links to the complete Food Systems Solutions survey data methods and results can be found at <https://rd.gov.fm/fss> and by way of this QR code:



## **Part I: Yap State Evidence-Based Multi-Stakeholder Goals for Local Food Production and Processing**

### **A Participatory Approach to Ensure Place-Based, Culturally Appropriate Local Food System Development Input from Yap's Stakeholders:**

To gather critical state specific data to support local food processing, the Rutgers Food System Science team used a community based, participatory mixed methods approach to develop 10 stakeholder surveys that were conducted in each state by local enumerators in local languages as part of the project's participatory data collection methodology. The team worked closely with Yap Catholic High School's principal, Michael Wiencek, who oversaw the Food Systems Solutions (FSS) survey collection in Yap and ensured that all enumerators received CITI IRB certification through the Rutgers system.

#### **2024 Yap State Food Systems Solutions Survey Summary:**

**Producer Survey:** 70 surveys conducted

**Consumer Survey:** 67 surveys conducted

**Community Management Leader Survey:** 16 surveys conducted

**Food Distributors and Retailers Survey:** 25 surveys conducted

- **Local markets:** 15 surveys conducted
- **Restaurants:** 10 surveys conducted

**Trainer Surveys:** 10 surveys conducted

**Information Content Providers Survey:** 9 surveys conducted

**Information Infrastructure Provider Survey:** 3 surveys conducted

**Technical IT Survey:** 3 surveys conducted

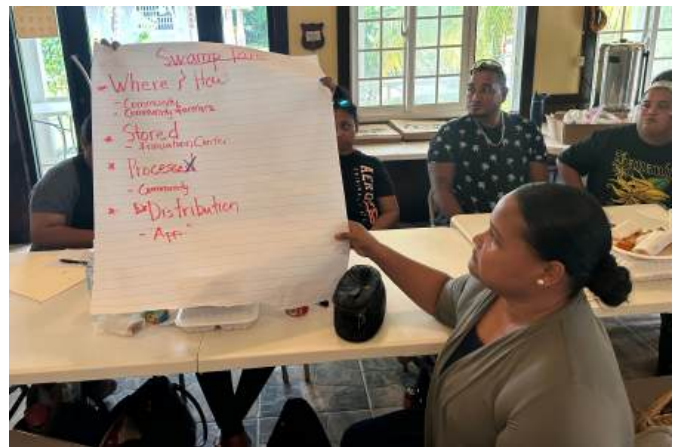
**Policymaker Survey:** 17 surveys conducted

**Ablul and Satawal Outer Island Communities on Main Island Yap:** 40 surveys conducted





**Expanding Qualitative Data: The Food Systems Solution (FSS) 2-day stakeholder workshop in Yap State, February 2025.**



In February 2025, a joint delegation composed of representatives from the FSM Department of Resources and Development and the Rutgers University Food Systems Science team conducted field visits across all four states. In Yap, the local partner was the Yap Catholic High School, where the two-day stakeholder workshop/convenings were held, during which the FSS project’s survey results and findings were shared. Each in-state convening/workshop served as an important platform to engage local stakeholders and gather critical insights as to how local food production and processing can be implemented. Convening/workshop participants included representatives from state governments, traditional



leaders and elected officials such as members of legislatures and mayors, farmer associations, members of crop and marine producer associations, and individuals from the private sector. These stakeholders had the opportunity to review FSS survey findings, participate in facilitated breakout sessions, and provide detailed feedback on the challenges and opportunities facing local food production and distribution systems. The stakeholders' contributions highlighted the pressing need to strengthen local agricultural production, enhance market access for producers, and build more robust trade networks within and between states.

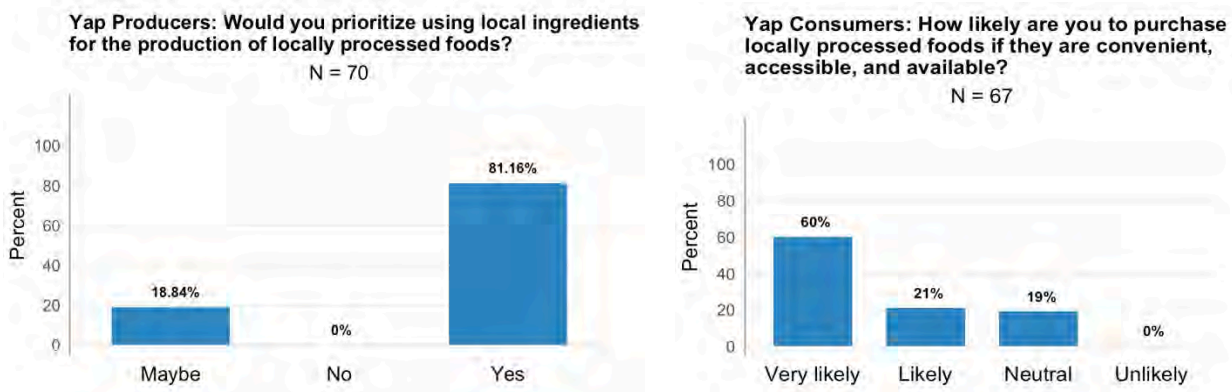
The February 2025 Food Systems Solutions (FSS) convenings emphasized the importance of developing locally driven food system strategies that **respect traditional knowledge**, support community resilience, and advance economic development objectives. The FSS project, therefore, **prioritizes economic growth** and capacity building in areas such as trade facilitation, agricultural economics, marketing strategies, and value chain development. By linking agricultural innovation with marketing and trade expertise, the project seeks to expand market opportunities for FSM's farmers and fishers, improve food availability, and generate new income streams that contribute to broader economic growth.

During the Yap FSS convenings, notable attendees include **Yap Senators Victor Barnog and John Mafel; Ted Rutun, Gabriel Ramoloilug, and Chief James Limar from the Council of Tamol; Chief of Agriculture Tamdad Sulog; Director of R&D Bernard Gorong; and Assistant Director Alex Yowblaw and Dr Murukesan Krishnapillai from College of Micronesia. Secretary Elina Akinaga and Assistant Secretary Menoleen Jacob** attended and participated for both days. In Yap, the FSS EDA team met regularly with Yap Catholic High School, our formal partner who serves as a lead coordinator on the ground for the implementation of our surveys and work in this project.



## Summary of Yap Stakeholder Survey/Convening Responses to Support Local Food Production and Food Processing:

During the convening/workshop held at Yap Catholic High School, Yap community members and stakeholders showed a strong interest in creating a circular economy through local food production. Members of Yap’s leadership, specifically state senators and chiefs, discussed the importance of recirculating wealth within their own communities to support food producers, create local jobs, and strengthen the local economy.

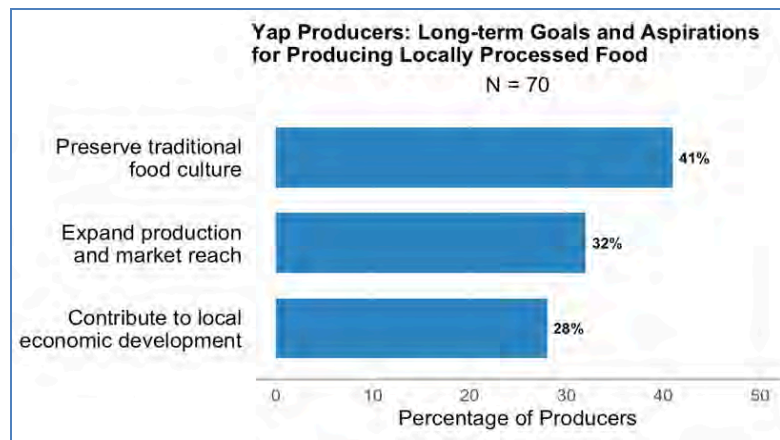


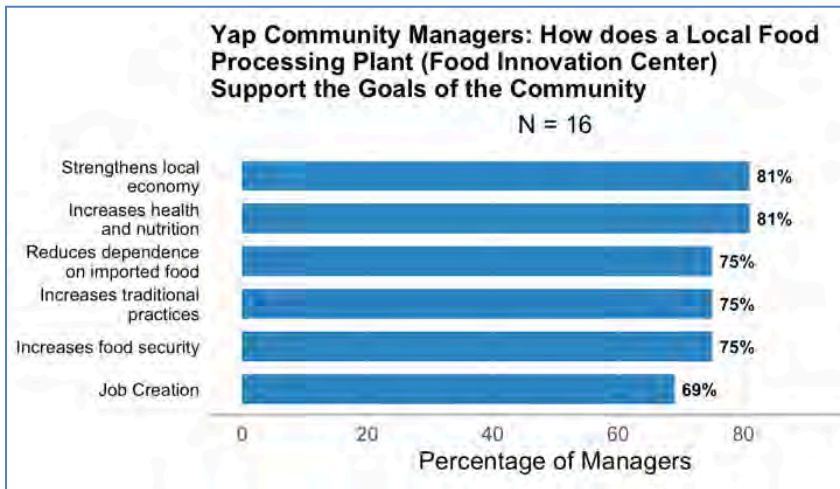
Yap State’s traditional food system revolves around locally grown and harvested foods, particularly taro, breadfruit, banana, and coconut, alongside fish and seafood. This system is deeply intertwined with traditional cultural practices, like shifting cultivation and agroforestry, and food is more often bartered than sold. While local food is consumed and sometimes sold in Yap, stakeholders shared that farming has not generally been recognized as a means to earning a cash income. The FSS Yap stakeholder results indicated a strong perception that local food processing of local staple crops would strengthen and support traditional Yapese culture.

### Yap’s food producers highlight the preservation of traditional culture as the main long-term goal of producing locally processed foods.

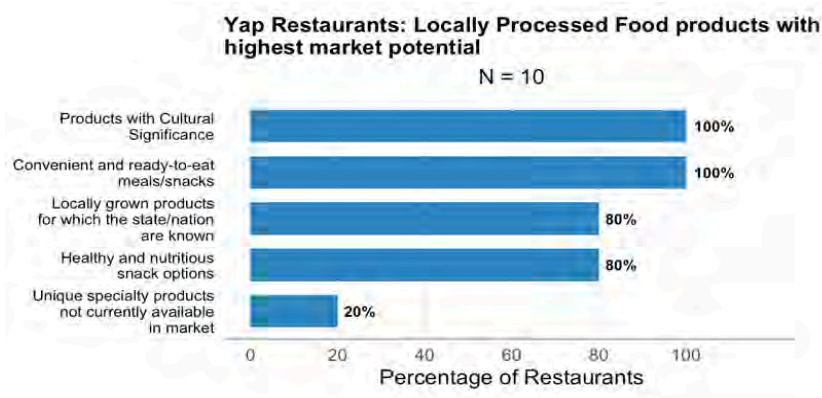
*The importance of cultural preservation supersedes both economic development and market expansion.*

Yap stakeholders surveyed showed overwhelming support for the development of food processing of local staple crops *within Yap’s cultural framework* to provide regular and nutritious import substitution.



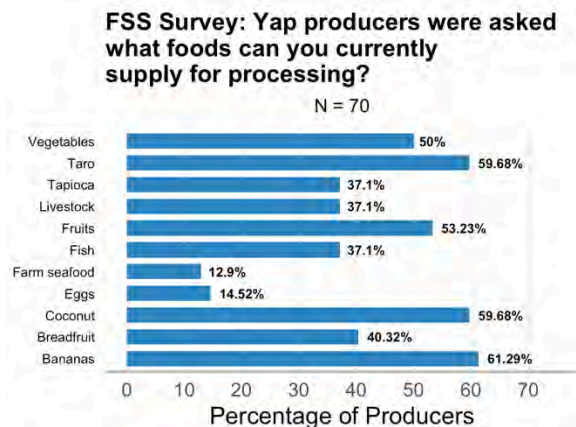
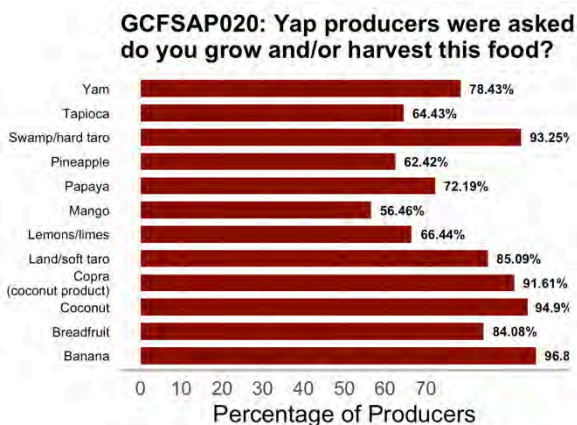


Yap's community managers are confident that a food innovation center where large-scale processing and storage will be located will actually increase traditional practices, again by prioritizing traditionally grown crops.



Yap's restaurants have identified traditional, culturally significant foods as the products with the highest market potential.

**Based on the GCFSAP020 and FSS survey data, Yap food producers share the local staple crops that they currently grow/harvest and can supply to local food processing facilities.**



Stakeholders also recognize that improved varieties of staple crops are necessary for more consistent, easier fruit production.



*“Breadfruit and mango are seasonal crops, so they are only available certain weeks or months for processing. This could lead to oversaturation of the market if all producers are providing these crops at the same time.”*

**– Senator Victor Bamog**



*“To me it’s the commitment, the time, and the passion from the farmers that is essential. Because if the farmers have those 3 things, then this will surely work as the market for locally processed food grows but we need to look closely at this sector.”* – **Chief James Limar**



*“We need to form these farmers associations for the farmers to come together and market their produce as a group. Policy can help. If policy agrees to limit the number of eggs imported, that would give the farmers the opportunity to sell their eggs to our local stores.”*

**– Chief of Agriculture, Tamdad Sulog**

**Local food products that Yap stakeholders most want from a local food processing system, according to producer and consumer surveys:**

Product	Yap Main Island (70 surveys)		Ablul/Satawal outer island communities on Yap main island (34 surveys)	
	Producers	Consumers	Producers	Consumers
Banana chips	64%	70%	65%	74%
Pickled vegetables	36%	67%	29%	21%
Hot sauce	36%	67%	24%	32%
Pork products	39%	67%	29%	44%
Rope/mats/fiber	19%	63%	38%	38%
Vinegar	34%	61%	35%	38%

<b>Coconut milk</b>	36%	61%	56%	53%
<b>Breads and baked goods</b>	23%	60%	38%	44%
<b>Chicken products</b>	37%	58%	29%	35%
<b>Dried spices</b>	30%	55%	32%	29%
<b>Breadfruit chips</b>	57%	55%	59%	56%
<b>Coconut cooking oil</b>	37%	48%	62%	62%
<b>Dried fruits</b>	26%	46%	26%	32%
<b>Smoked fish</b>	43%	45%	56%	53%
<b>Breadfruit flour</b>	43%	43%	41%	47%
<b>Animal feed</b>	39%	42%	29%	32%
<b>Coconut products (sugar)</b>	31%	42%	47%	32%
<b>Taro chips</b>	40%	40%	47%	56%
<b>Dried fish</b>	30%	38%	44%	50%
<b>Salted fish</b>	37%	31%	35%	47%
<b>Dried vegetables</b>	29%	30%	32%	26%
<b>Taro flour</b>	30%	27%	29%	53%
<b>Coconut flour</b>	26%	25%	47%	50%
<b>Tapioca</b>	37%*			

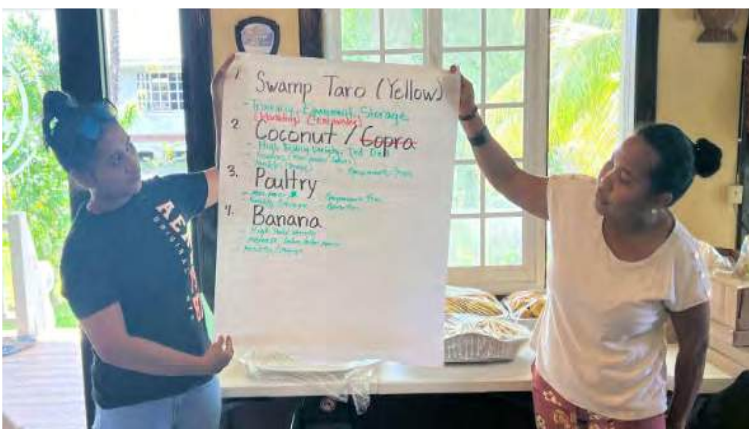
### **Transforming Staple Crops into Locally Processed Food Commodities:**

60% of surveyed main island and 44% of outer island consumers are requesting baked goods, but only 23% and 38% of producers are interested in processing these foods, respectively. The core ingredients – flour, oil, milk, sugar – of baked goods are understood to be imported products like wheat, butter, and cow’s milk. **Producers understand, however, that these raw ingredients can be made using staple crops like banana, breadfruit, and taro for flour, coconut sugar, oil, and milk.** In fact, 43% of main island producers are interested in producing breadfruit flour. The raw ingredients to create locally sourced baked goods are present and with enough training and creative recipes, these products can replace imported baked goods.

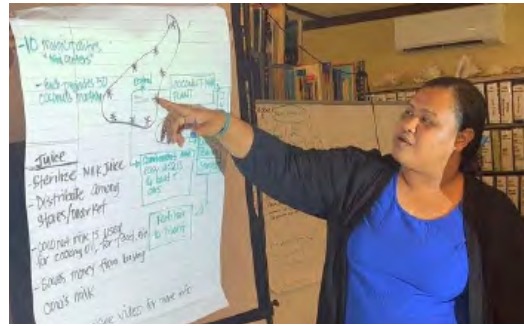
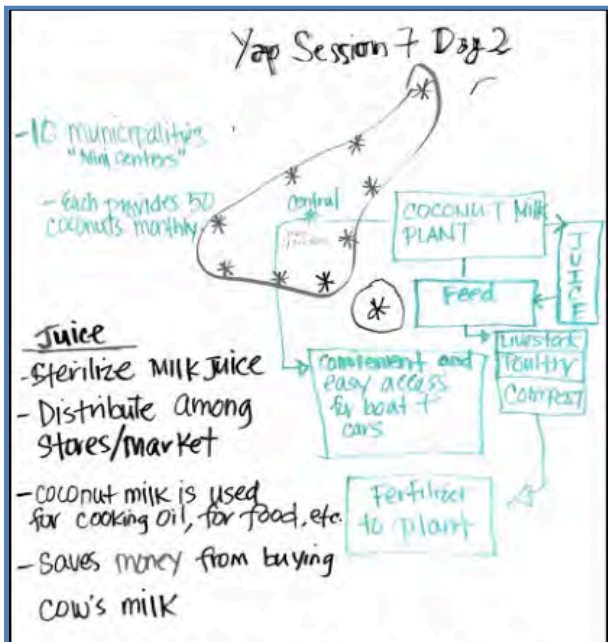
Product	Yap Main Island (70 surveys)		Ablul/Satawal outer island communities on Main Island (34 surveys)	
	Producers	Consumers	Producers	Consumers
<b>Breads and baked goods</b>	<b>23%</b>	<b>60%</b>	<b>38%</b>	<b>44%</b>
Taro flour	30%	27%	29%	53%
Breadfruit flour	43%	43%	41%	47%
Coconut flour	26%	25%	47%	50%
Coconut cooking oil	37%	48%	62%	62%
Coconut milk	36%	61%	56%	53%
Coconut products (sugar)	31%	42%	47%	32%

Yap State has already brought in a number of breadfruit varieties to help increase the consistency of fruiting.

*“In 2017, four varieties of breadfruit seedlings were brought to the atolls of Ulithi and Fais Island after the destruction from Typhoon Maysak. An additional 500 trees of the two most successful varieties came to the Yap Division of Agriculture in 2018 distribution on the main island. I think the food products we really need are from breadfruit as it is really wasted on Yap Proper but demand is in the outer islands, so we want to make it more attractive to the people to consume more breadfruit instead of going to waste.” – Chief Tamdad Sulog*

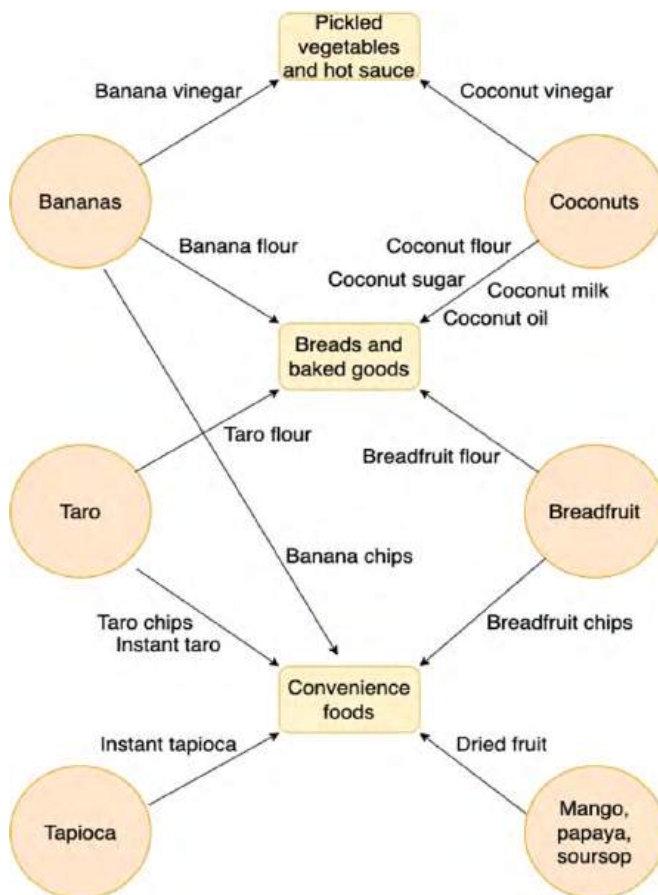


*“Since we have lots of coconuts on the island, for one coconut there are many things we can produce for the market. But we want to introduce high yield varieties like tall to the dwarf coconut and dwarf to dwarf.” – Mercedes Tiningmow, Farmers Association of Yap*

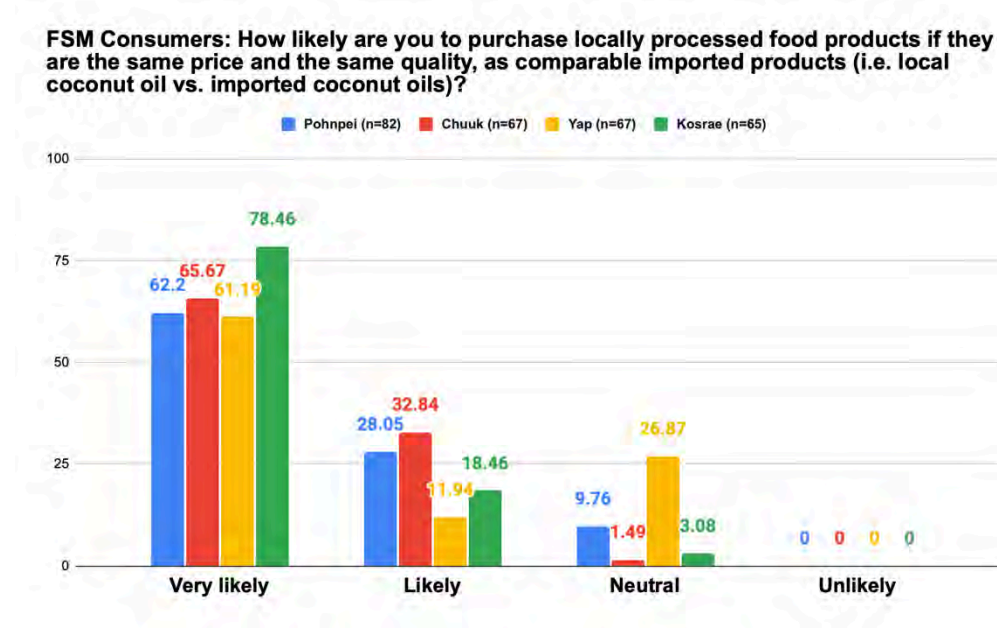


*"We propose making a local coconut milk factory and the waste can be used for chicken and livestock feed and compost for gardens. We would sterilize the milk and distribute among the stores to have local coconut milk to replace imported cows' milk."*  
 – **Marialyn Tiningmaw**, Tamil Youth Organization

**Local Staple Crops That Can Provide Raw Ingredients for Highly Desired Processed Foods as per FSS Survey/Convening Data:**



Import substitution with similar locally sourced products was highlighted throughout the GCFSAP020 surveys. Consumers recognize that many imported raw materials can be substituted from locally processed crops, and the majority are very likely to purchase local substitutions if they are comparable in price and quality.



**GCFSAP020: Survey respondents were asked if they are interested in replacing imported milk products with coconut milk.**

Questions	Resp.	YAP		Pohnpei		Kosrae		Chuuk		All	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Would you be interested in consuming <b>more locally produced coconut milk products</b> daily if they were more available and affordable?	No	13	8	26	17	5	3	7	5	51	8
	Yes	148	92	131	83	144	97	140	95	563	92
<b>...imported milk products</b> with coconut milk products for cooking?	No	54	33	40	25	9	6	11	8	114	19
	Yes	108	67	118	75	140	94	135	92	501	81

Coconuts offer a wide range of substitute products like oil and milk to replace imported goods. The vast majority of respondents from all four states in FSM are interested in consuming coconut milk instead of imported milk both for daily consumption and for use in cooking.

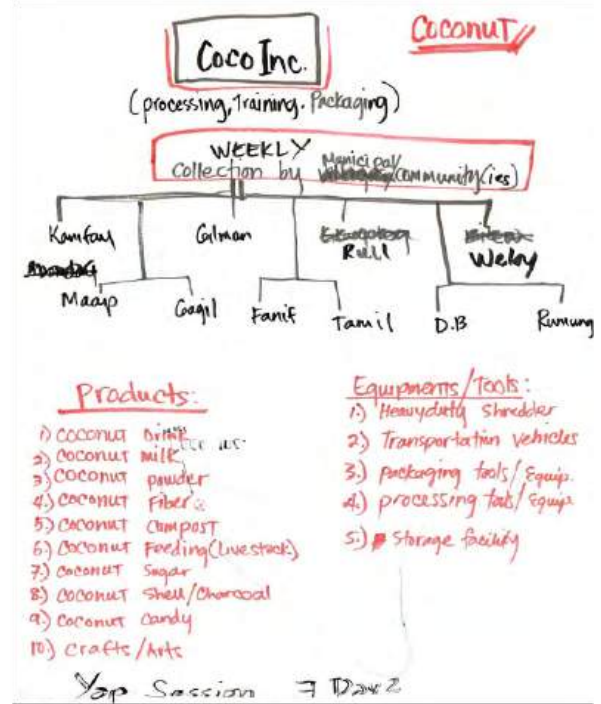
**In the FSS surveys and convenings, Yap stakeholders identified the potential of the state’s abundant coconuts to provide locally produced ingredients needed for baked goods.** During

the FSS convening in Yap, it was shared that Coco Inc. has the potential to produce coconut milk, coconut flour, coconut sugar, and coconut cooking oil.



“Since we have lots of coconuts on the island, for one coconut there are many things we can produce for the market. We can make vinegar, flour, sugar, milk, and oil. Waste from coconuts can be used for animal feed, compost, and firewood. Each of these coconut products can replace imported ingredients available at markets.”

-Mercedes Tiningmow



CoCo Inc. (INC 2020)			
Bi-products Rate Schedule			
PRODUCTS	Unit Rate	Batch	Batch
Coconut Milk - "CMT"	0.20 per cuppa	20 per gallon (cuppa) 20 cuppa	200 per 100 cuppa
Coconut Flour - "OWAN"	0.05 per cuppa	10 per 50 cuppa	50 per 100 cuppa
Coconut Shell - "LE"	0.02 per	20 per basket (20)	200 per load (200 per basket)
Coconut Husk - "QAPAT"	0.05 per	10 per	100 per load (100 per basket)
Coconut Shells - "QAPAT"	0.05 per load (10)	10 per basket (10)	100 per load (100 per basket)



### Interest in Livestock and Poultry Farming:



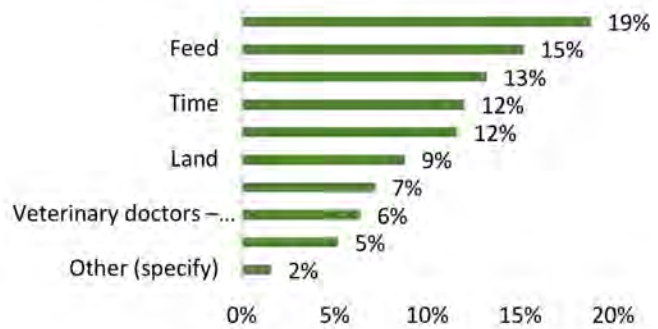
“We’re hoping that people can really benefit from raising more livestock and poultry. Every year we import \$2-3 million in pork and chicken. The cost of imported feed is a challenge we need to address.”

– Chief of Agriculture, Tamdad Sulog

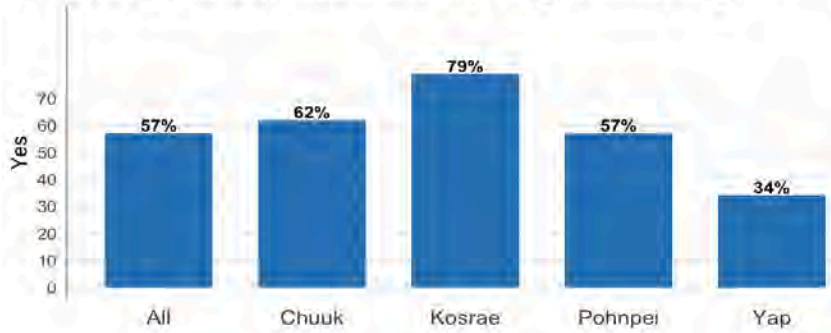
The GCFSAP020 Baseline Assessment (2024) identified feed as the largest obstacle to livestock and poultry farming. Feed production training would further reduce dependency on external inputs, enabling producers to create balanced, locally sourced diets for their livestock.

Other states in FSM are very interested in livestock production. This can encourage interstate trade within FSM.

Q6.10 What do you feel is the main obstacle to your raising livestock/poultry production?

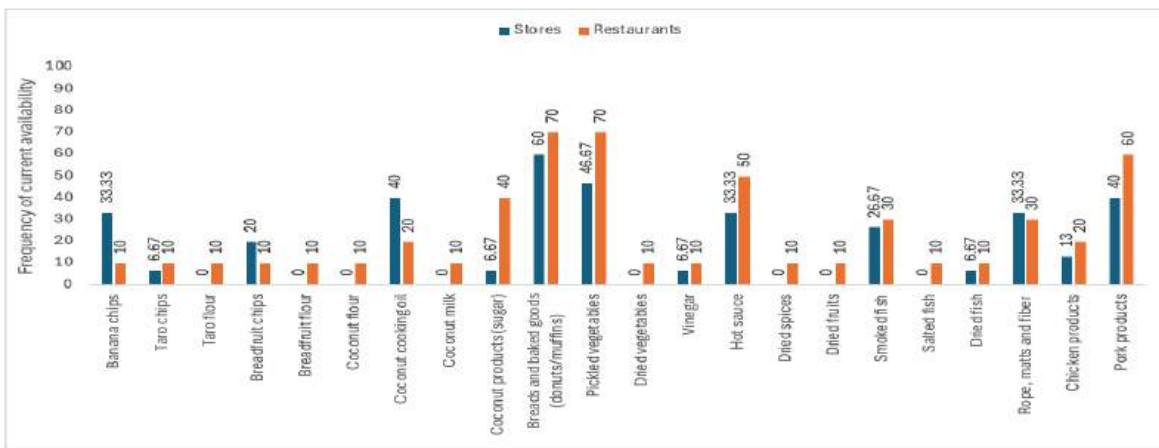


GCFSAP020 Survey: Each state's farming families were asked would you like to raise livestock/poultry commercially?



Although producer and consumer demand has been identified, these products are currently of limited availability in restaurants and stores.

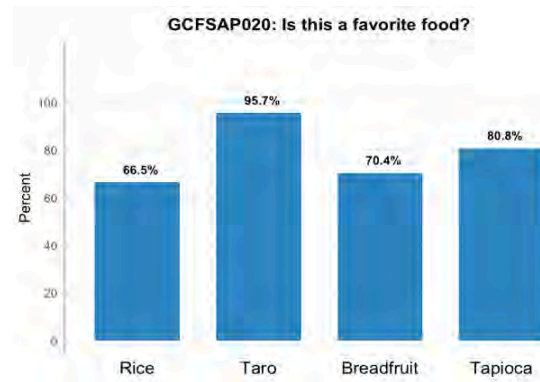
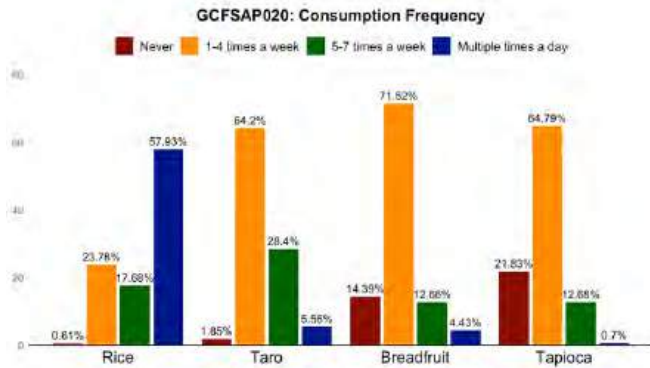
**Frequency of Local Processed Foods Currently Available in Yap's Restaurants and Stores:**



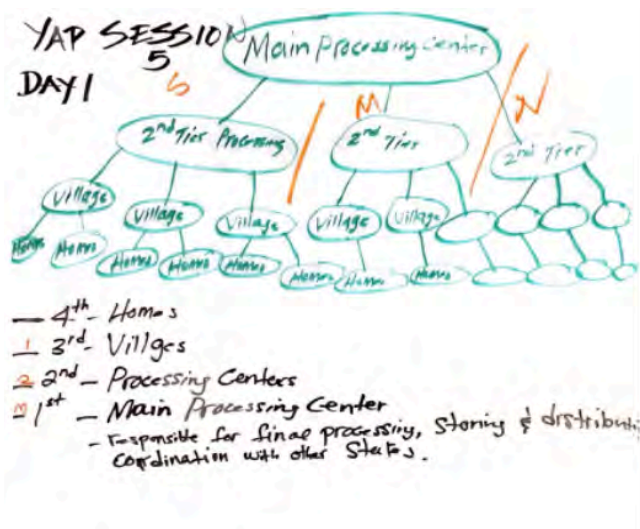
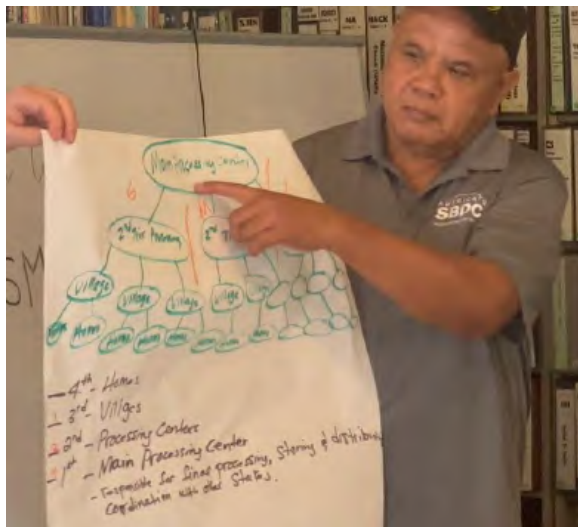
100% of restaurant and store respondents think that making locally processed food products in state is important.

**Rice is often consumed for convenience rather than preference.**

Based on extensive survey data (GCFSAP020 baseline) Yap stakeholders are communicating that they are consuming rice more frequently than staple crops, but it is not their preferred food.



**Yap State stakeholders expressed a need for a Tiered and Decentralized approach to local food production and processing to provide value added opportunities for as many Yapese residents as possible.**



*“We will start from individuals in the villages, their products will go to three collection and storage facilities, located in the north, middle, and south of the island. The top tier is the main*

*processing center. There will be manual powered food processing tools at homes and villages and more professional equipment at the top tier facility.” – Chief James Limar*

The success of Carmen and Augustine Muguy's family farm began the workshop by way of a short video featuring community demand for their home-grown vegetables.



*“I would like to consider how individual families can have opportunities to participate in the value-added process to earn some income. In Fiji, I saw families processing coconut oil manually at their homes. Is this something we could consider?” – Senator Gabriel Ramoloilug*



*“A decentralized system for local food processing is important for Yap to engage all members of our society and make sure everyone has an opportunity to benefit.” - Senator Ted Rutun*

Yap State senators suggested during the FSS convening that weekly collections of local food crop inputs and products would take place in each of the ten municipalities at First



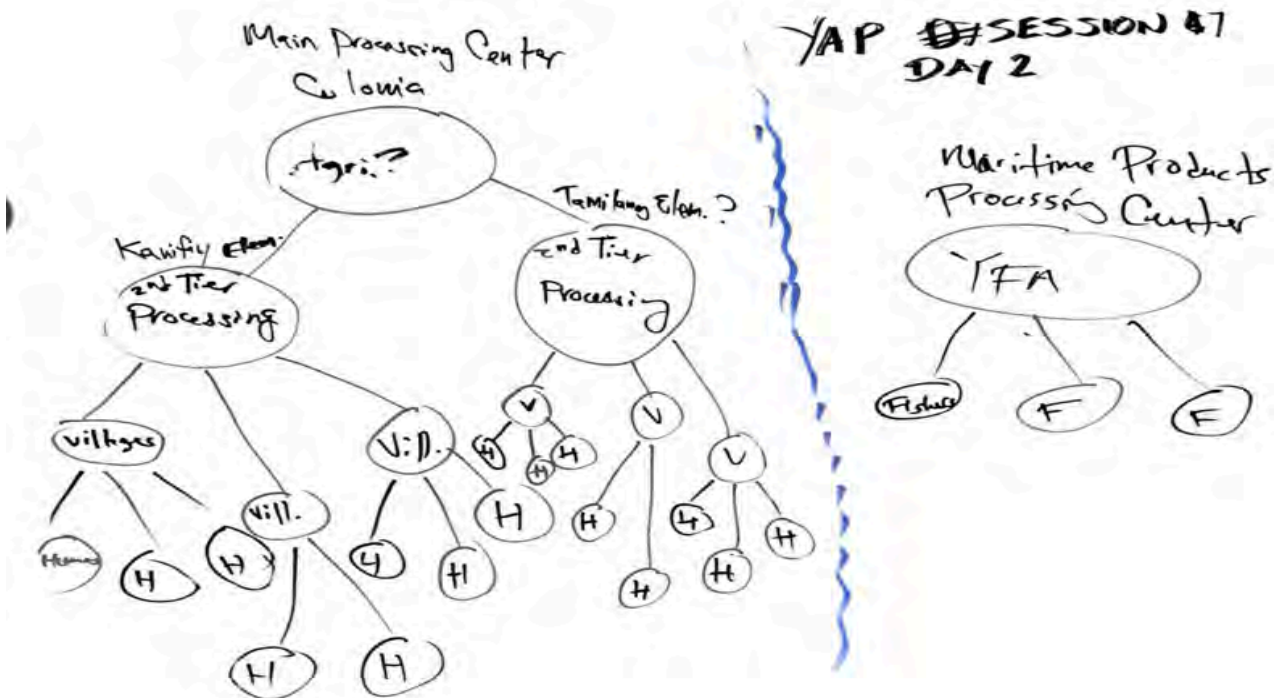
Tier facilities. Second tier processing and storage centers could be developed at Kanifay Elementary School and Tamilang Elementary School.

### Maritime processing and pickup:

*“For maritime products, like shellfish or reef fish, the processing center will be the Yap Fishing Authority. We can do processing there and the fishermen would stop by for ice and fuel.” – Senator John Mafel*



As proposed by the Yap State senators, fish and aquaculture products will be prepared as part of a two-tiered system. Fishermen will bring their fish to the Yap Fishing Authority processing center, where they can deliver fish to be sold fresh or rent out equipment to dry, salt, and further prepare fish. Yap Fishing Authority was created by the Government of Yap to promote, develop, and support sustainable commercial utilization of living marine resources.



*“This tiered concept will work in the neighboring islands where the main neighboring islands can serve as second tier collection and processing facilities that bring local food products to the main island.”*

– Senator Gabriel Ramoloilug



## Neighboring Island Production and Processing:

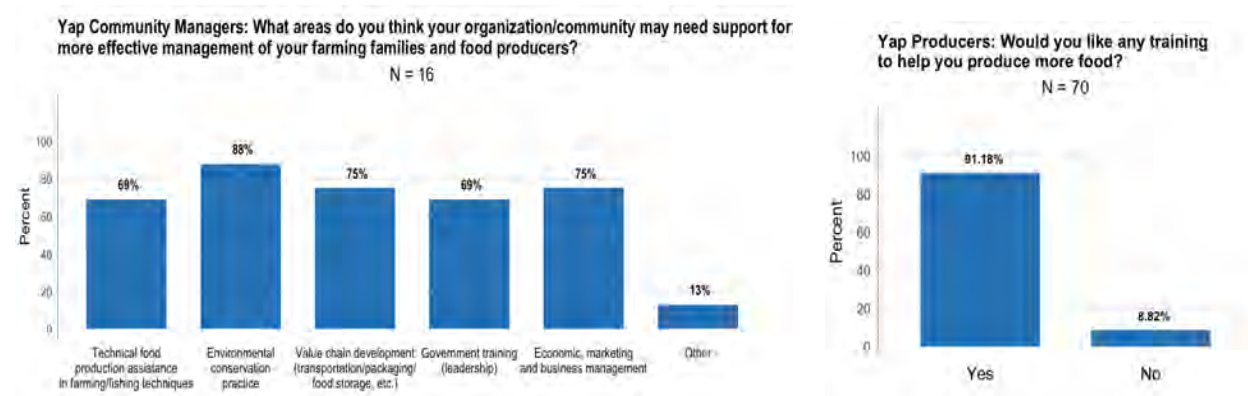
*“For the neighboring islands, they may not need the second tier. They would have a similar food processing model but a little simpler. Instead of homes to villages, it could be homes to a central outer island hub”*

– **Director Bernard Gorong.**



The neighboring islands do not have access to regular refrigeration for storage and have limited transportation to the main island. FSS convening stakeholders suggested that it will be important for neighboring islands to focus on foods that require less energy for processing and should focus on products for local consumption such as dried fruits and vegetables, salted fish, coconut sugar, and milk that can be consumed immediately. Stakeholders suggested that neighboring islands could sell non-perishable items to the main island like ropes, mats, and fibers made from banana and betelnut leaves.

**A significant challenge to local food production is the shortage of technical expertise in product development**, as reported by 80% of survey respondents. Without skilled personnel, it becomes difficult to create, refine, or expand product lines, which stifles growth and diversification within the local food industry. Additionally, 87% of respondents mentioned a shortage of trained workers, reflecting a workforce gap that may further hinder productivity and the consistent quality of local products (FSS, 2025).



Training programs are crucial to the success of food systems development. Past projects have only focused on new infrastructure, and as soon as the equipment broke down, there was nobody to fix it. **Providing producers with comprehensive training resources can empower them to navigate the complexities of food processing and marketing, fostering a more robust and**

**competitive local food industry.** It is necessary to ensure that trainers themselves have adequate training on topics of interest to producers.

### FSS Survey Results: Training Requested by Yap Food Producers

	<b>Training Requested (&gt;50% of surveyors requested) from Producer Survey</b> N = 70	<b>Trainers Needed (&lt;50% of trainers knowledgeable) from Trainer Survey</b> N = 10
Agricultural	General crop management Traditional agricultural practices Making fertilizer and compost Seed collection and saving Vegetative propagation Swamp taro, land taro, banana, breadfruit, tapioca, papaya, medicinal crops	Making fertilizer and compost  Swamp taro, land taro, banana, breadfruit, tapioca, papaya, medicinal crops
Livestock	Making feed General management Using woodchippers	Making feed Using woodchippers
Aquaculture	General fishing safety and search and rescue Traditional knowledge Sustainable fishing practices Invasive species Making fish aggregating devices (fads)	General fishing safety and search and rescue Sustainable fishing practices Invasive species Making fish aggregating devices (fads)
Food processing	Food safety Food preservation Cooking Food preparation and packaging	Food safety Food preservation and packaging
Agricultural technology	Greenhouse and nursery management Cold storage Solar power Sac and container gardening Irrigation Hatcheries Aquaculture Equipment repair/maintenance	Greenhouse management Cold storage Solar power Hatcheries Aquaculture Equipment repair/maintenance
Climate change	Adaptation strategies Sustainable farming and land management Water collection and storage Invasive species Soil erosion	Sustainable farming and land management Water collection and storage Invasive species Soil erosion
Business management	How to run a business How to apply for a loan Financial management How to generate business Laws and regulations	How to run a business How to apply for a loan Financial management Laws and regulations
Health and nutrition	General health and nutrition How to prepare easy local dishes	General health and nutrition How to prepare easy local dishes

## **The Importance of Developing a Yap State Food System Mobile App**

Yap State stakeholders identified the need for a food systems app to strengthen communication and information between producers, markets and consumers. The Food Systems Solution Convening included a workshop with Lubu Falanruw, President of Yap State's iBoom, a licensed telecommunications company that combines modern technology with local, cultural knowledge. iBoom has the capacity to develop a Yap State specific food system mobile app.

The FSS surveys identified current connectivity gaps specifically with Yap's outer islands, however, there are new solutions in Starlink, satellite links, and improving infrastructure to mitigate these issues. Facilitating an easier way for groups to connect is essential in keeping the food system organized and productive.

*"You take the things that traditional Yapese cultivators were doing intuitively, and you can use technology to monitor the conditions and share that information." – Lubuw Falanruw.*



**During the FSS convening, many stakeholders expressed that this new age technology is meant to build upon the foundation of traditional Yapese culture, not to replace it.**



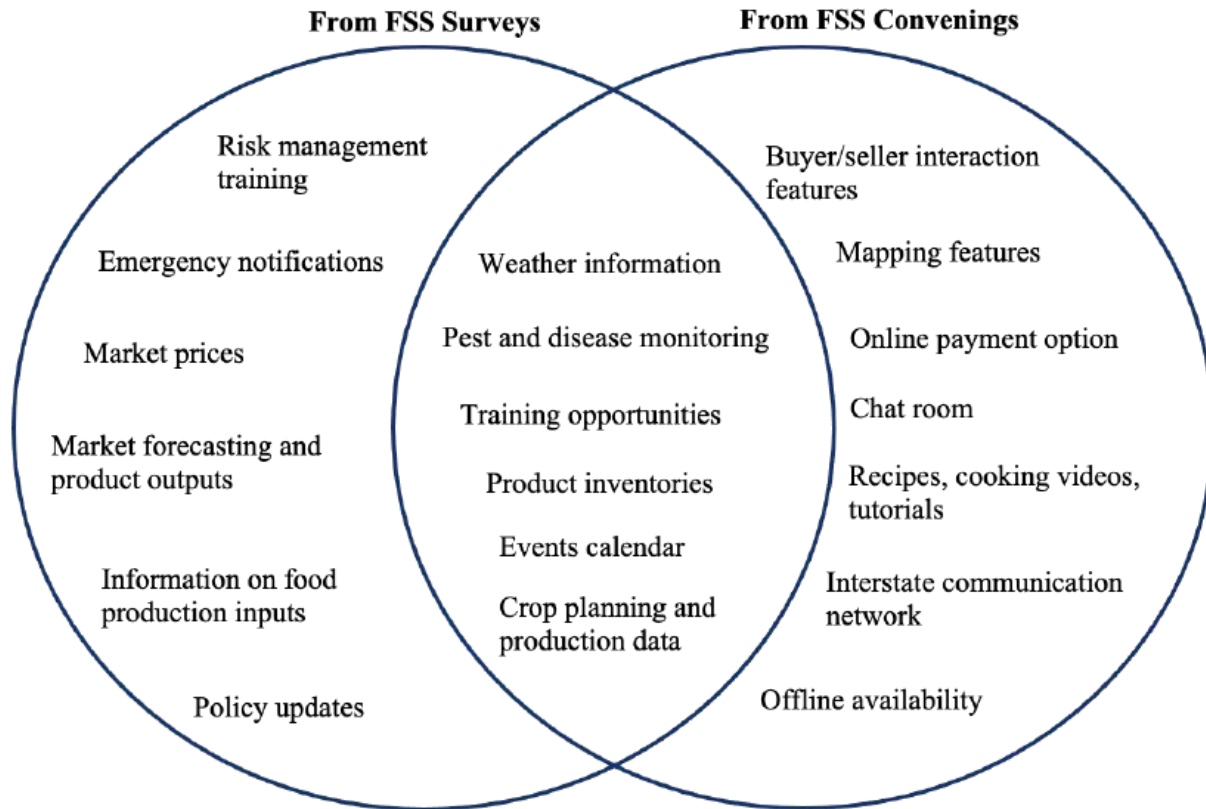
*"Technology is critical for us to keep our information and share our information across our islands connecting the farmers to the markets. Today, our people need this new technology. Sometimes we look outside of Yap for help, but we have the technology here now that can help us." Mercy Libian, iBoom.*



*"We are currently using a solar powered probe that we install in the taro patches that has a stand-alone mobile app to collect the soil data including salinity and moisture. This app can be connected to a new Yap food system app."*

*– Dr. Muru Krishnapillai, College of Micronesia*

## Stakeholder Preferences for a Yap Food System Mobile App:



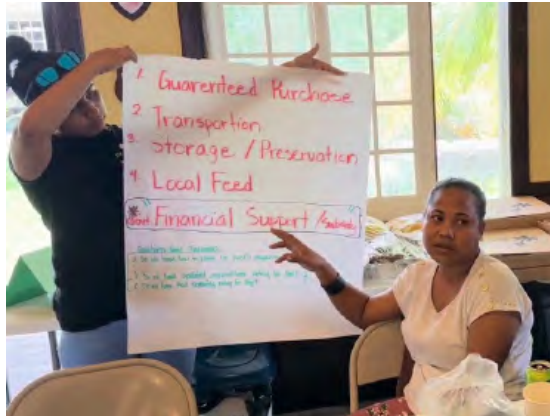
**Having features like offline availability also ensures that the outer islands can participate without infrastructural issues with connection.** Sustaining a centralized hub for information ensures effective communication and for stakeholder groups alike to work together.

### **Role of Policy Makers and Community Leaders**



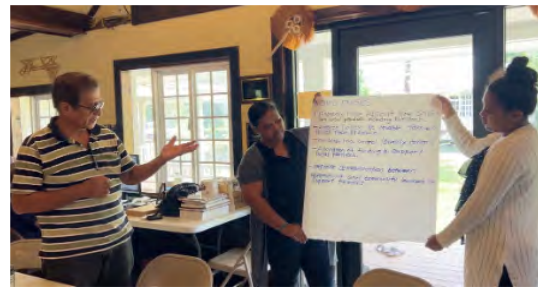
*“We should consider taxation for some imported products. We can also entertain the idea of creating a policy that can address subsidy incentives for the community.”*

**- Senator Victor Bamog**



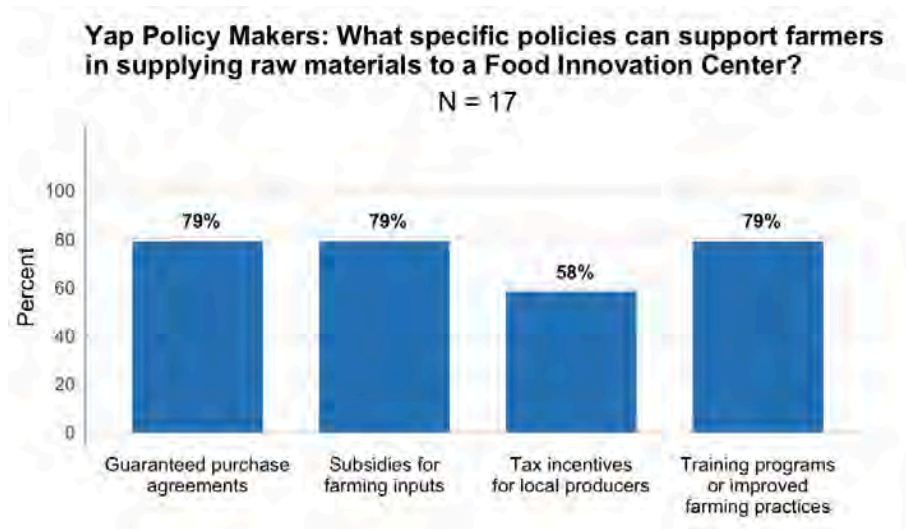
*"As farmers, our primary concerns are financial support and government subsidies. We need to know our food will be purchased and we have problems with transportation, storage, preservation, and the high cost of local feed. Additionally, we require clarification on existing laws for food production organizations, whether there's an updated food security policy, and what marketing structures farmers should have in place." – Mercedes Timingmow*

*"The key question is how leadership can support farmers through strategic import policies—not banning imports, but perhaps implementing tariffs or limitations to create market space for local produce. Price controls on local goods emerged as another potential solution to help farmers remain competitive. Additionally, improving communication between government officials and community leaders is essential, as these leaders serve as vital connections to farmer groups. Ultimately, the goal is securing meaningful government support for our agricultural community." - Chief Tamdad Sulog*



Policy makers report they can contribute to a stronger food system in multiple different ways. **There is a strong interest in increasing community involvement with local leaders and policy development.**

Focusing on what producers need by way of training, infrastructure, selling, and security is largely supported by policy makers as they strengthen ties to local involvement.



**Yap Policy Makers' Implementation Plan Over the First Two Years as  
Developed by Yap Stakeholders in the Food Systems Solutions Convenings on  
Feb 5, 2025.**

**Year 1:**

- \*Yap SBDC (Small Business and Development Center) to oversee for the first 2 years and to champion its growth
- \*Begin Local Food Production Education Awareness campaign for Economy Growth
  - \*Awareness campaign for Traditional Leaders and utilizing traditional networks
    - \*Assessment and Identification of locations for processing facilities:  
Tamil Elementary School, Colonia Small Business Facility, Kanifay Elementary  
Yap Fishing Authority
    - \*Designing the food innovation center and regional facilities
  - \*Begin construction/renovation and purchasing of equipment`
    - \*Ensure the inclusion of Food Safety Process(es)
    - \*Formation of Organization and Management Structure
      - \*Public/Private Partnership (NGOs)
      - \*Hiring management and staffing
      - \*Development of tools and IT Apps
  - \*Identification of at least 3 initial products and systems of production
    - \*Training for main and neighboring island
      - \*Engage and train our producers
      - \*Initiate small grants program
- \*Support import from neighboring islands (raw materials and value-added products)
  - \*Enabling legislation to facilitate growth

**Year 2:**

- \*Enhance training for food producers and food processors
  - \*Business plans for food producers
  - \*Monitoring and Evaluation (M&E)
    - \*Products in the Market/Reduction of imports
- \*Outreach and Education Awareness linked to social events
  - \*Food producer's certification program (COM)
- \*Food recipe competition – tied to Yap Day and other local events

**Conclusion:**

This Food Systems Solutions project provides evidence-based recommendations for the implementation of Yap state-specific food system development and food processing. These suggestions are based on stakeholder input and intended to support increased local food production, food processing and input substitution, improved market integration, enhanced community-led management, and stronger FSM inter-state coordination. Ultimately, the project aspires to help Yap State and FSM build a more resilient, self-reliant, and prosperous food system that meets the nutritional, economic, and cultural needs of its people. A detailed framework for a local food system processing implementation guide follows based on the Yap community stakeholder recommendations.

*Tamil Elementary School regularly serves traditional local food lunches.*



## Part II: Yap Food Systems App



Source: SourceTrace Systems, 2017. Pacific Pets Pathogens Weeds Phone App, 2023.

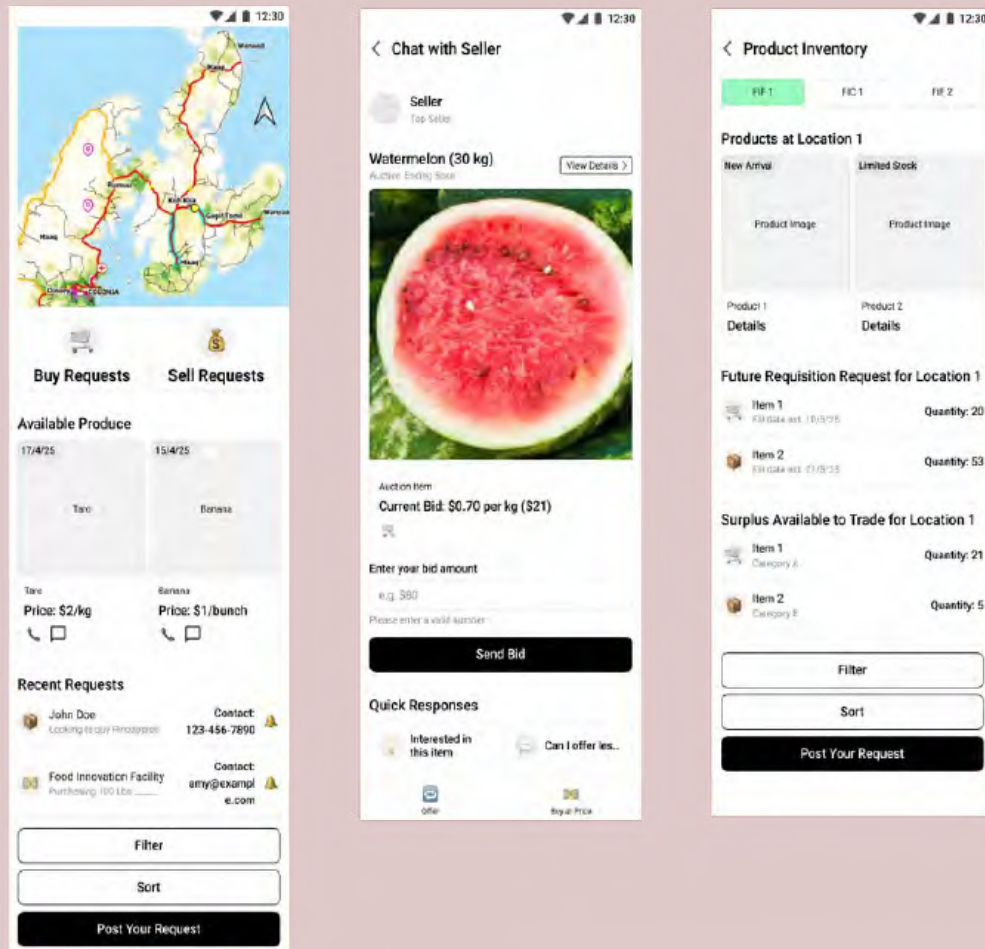
As identified by policymakers and stakeholders through FSS surveys and convenings, interconnectedness through technology is key to creating an integrated food system that connects all levels of the value chain to one-another. Sharing of information remains limited across FSM's islands, so using technologies such as websites and phone applications is essential to connecting producers, processors, sellers, and consumers. Such platforms offer repositories of information for people to share including agricultural practices (traditional and with new technologies), pest and disease management, market prices, harvest schedules, product availability, events calendar, real-time weather updates, special calls that require foods and other products, and a platform for communicating and linking producers with sellers. By enhancing interconnectivity across the entire food system, a web-based application will maximize efficiency and ensure all participants remain informed about developments in FSM's tiered agricultural ecosystem.

The centralized phone app is becoming popular within food processing hubs as a way to keep everyone connected. This proposed app is only one part of a larger information network, which includes websites that already exist.

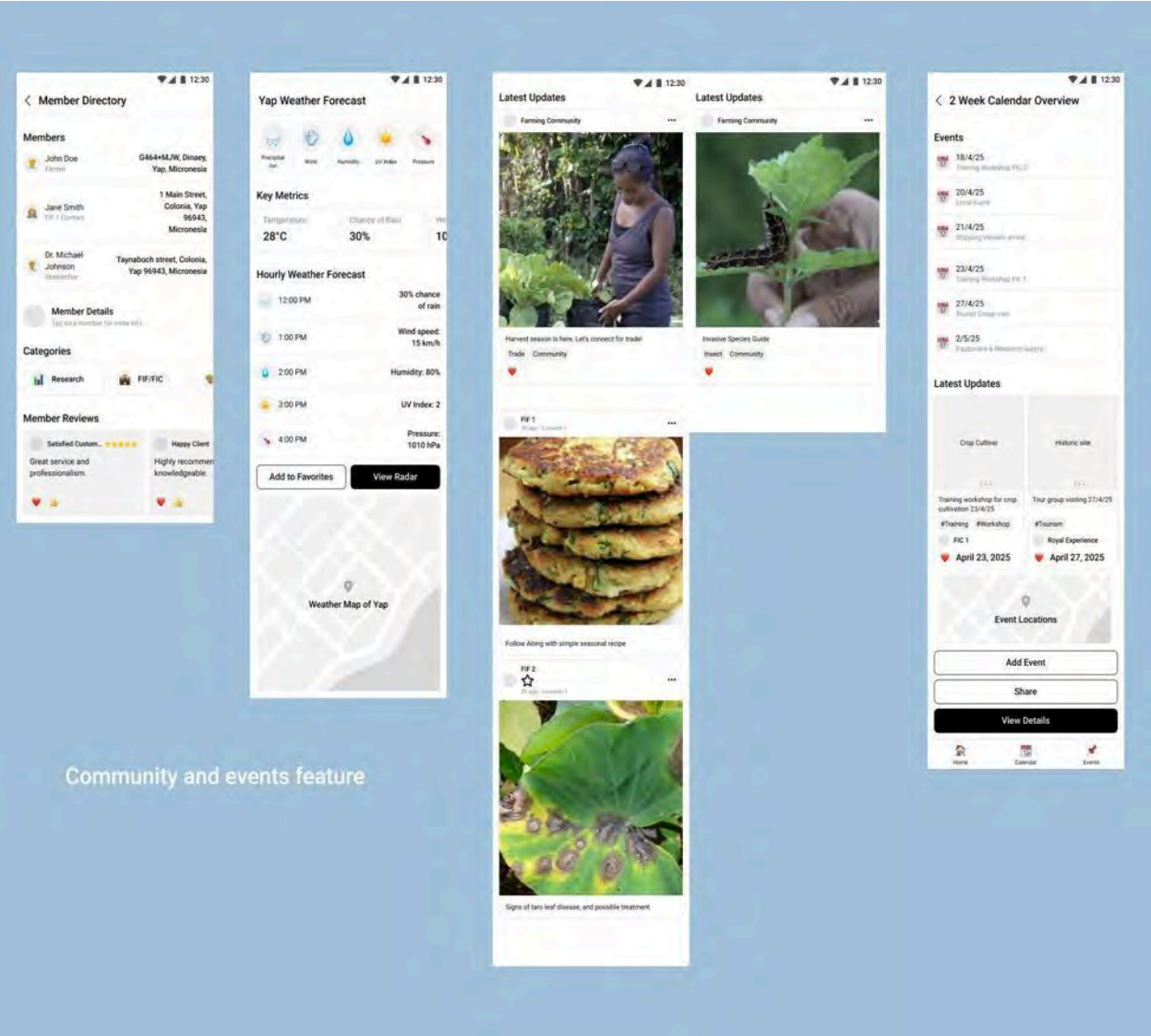
## Key features include:

1. A map of each island, identifying the locations of products or items available for purchase and if buyers want pins where they want food to be delivered.
2. Buyer-seller chat features to bid on wholesale produce as soon as it is harvested and to inform potential buyers of an upcoming collection or harvest. This chat feature is designed to be private between the two parties and enables the buyer to be in communication with the seller (collector/producer) to be kept aware of the product's availability, quantity, and processing status. This feature also is open to allow both parties to agree upon expectations as to state and quality of product from type of container to package and more. This site would be designed to accommodate and allow transfer of photos and agreements.

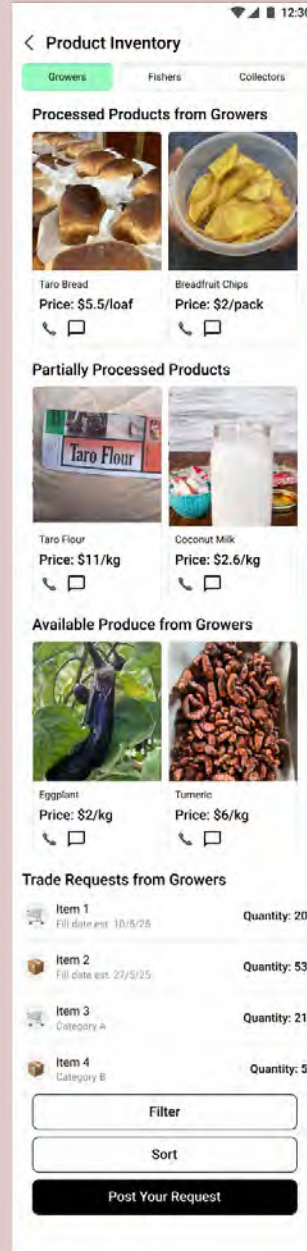
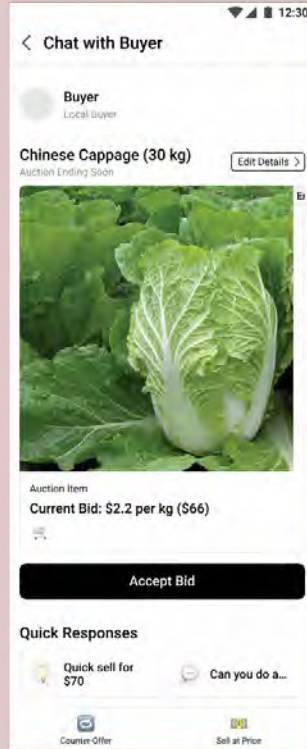
### Selling and map features



- 3. A comprehensive product inventory which highlights surplus produce available for trade and pre-order through future requisition requests.
- 4. A member directory of growers and processors, with business locations, contact information, and community member reviews.



- Real-time weather forecasts and emergency preparedness information. This could also be achieved by linking to existing platforms Yap State now uses with FSM Telecom and as practiced by DECEM. In this phone app, users would have the ability to report adverse weather and other emergencies in real time as they observe, thus serving as an early warning reporting that can complement the state and national services.



Selling and map features

6. A community social media feature to highlight local recipes, pests and diseases that emerge, success stories, and event outreach.
7. An overview of upcoming events happening in the state, including training workshops and farm/facility tours to help grow the capabilities in all levels of the tiered food processing system.

This phone app needs to be commercialized by a private vendor such as iBoom and made available to Yap State compatible with Android and Apple phones and in concert with FSM Telecom and the State. The phone app is to include the following features and functions:

(i) Offline functionality to access information without continuous connectivity to users.

That is, there needs to be sufficient memory for photos and data collection remotely when offline for later automatic downloading into the app's system when online.

(ii) Ensure sufficient storage capacity and backup solutions built-in to safeguard data and ensure uninterrupted access.

(iii) Easy to follow guides to enhance functionality for use.

(iv) Information dissemination policy and guidelines. FSM Telecom already has policy and guidelines in place to allow for the rapid or timely dissemination of information via SMS text to subscribers. This system is available but has not been used for food security, food production and agriculture/forestry/marine uses per se. Expanding the usage by Yap State as is now done by DECEMs current system to share vital emergency information for the public good through use of SMS texts would greatly strengthen Yap's Food System. Messages and notifications prepared by the State (in concert with other organizations such as COM and CRE and others) and submitted to FSM Telecom for review and distribution are recommended. FSM Telecom has a review system in place and is willing and able to expand its use to distribute such information public good (and not commercial) for free to all their subscribers. In short, SMS-based systems are recommended to deliver agricultural information, market updates, and weather forecasts to growers and residents.

(v) FSM Telecom also has policy and guidelines to allow for the rapid or timely dissemination of information via SMS text to subscribers for a fee when such messages are for commercial gain (buying and selling for example). This can be used by commercial growers/fishers and food collectors/distributors if/as needed.

(vi) Discussion with regional STARLINK distributors to determine if such similar arrangements could be agreed upon for their subscribers to get free access to content and SMS as part of their subscription agreement.

(vii) Building the requisite content for the information hub on the phone can be built on that which is developed and placed into an online website. We recommend that for Yap State, we make available space on the State's government website and that can be linked to that from National. Information relevant for the needs of Yap State would be coordinated by Yap State (e.g. Resources & Development) in concert with FSM National Resources & Development's Office of Agriculture and Office of Trade. Given the current role of COM, CRE, and state and national R&D as well as the limitations relative to staffing and expertise, we also propose to form a 'Food System Innovation Hub Committee' to include members from these sectors, as well as those who have been assisting us with our food system and environment, to join in order to have a state and national team that can assist us in building an information library hub for Yap and the FSM. As such, we recommend extending invitations to our current partners including the Food Security Research Team at Rutgers, the University of Guam, and the University of Hawaii. This Committee can then develop the background information and review the already online sources of information to recommend best practices and sound reliable information for our crops, their nutritional content, production and processing systems, technologies of interest, identification of pests and diseases, as well as control recommendations. These information sources are to include scientific reports, state and national reports, and studies which have been conducted but were not previously made accessible, extension materials, learning modules, and easy to follow practical guides and information to our farmers and communities.

### **Information Sharing Use Web-Based Platforms**

To be efficient, phone apps will need reliable scientific data and content to be prepared and made available. To strengthen our Yap State Food System foundation, we recommend that staff within the State R&D office be given the responsibility to coordinate with the state government and the COM and CRE to form a committee as detailed above in section (vii).

A Yap State website that allows all users free access to information on agriculture, including marine and fisheries, food production and processing, weather and environmental practices to mitigate against climate change and food security will be developed. Yap State is committed to including a coordinator to contribute toward building and ensuring access to such an information repository.

## Part III.

# Yap's Food Processing Implementation Framework

Here are the proposed steps to developing a tiered local food processing system for the State of Yap, based upon community input shared as part of the Food Systems Solutions project surveys, focus groups, and convenings.

These sustainability strategies will inform both the economic opportunities available to local communities, and the broader village and national approaches to improving food security and sustainable development systems. These adaptations to food prioritization and valuation systems are flexible and responsive to real-time events, ensuring feedback from state government and community members to inform the development of a sustainable and culturally relevant local food processing system.

### The Value of a Food Innovation Center (FIC) in Food Processing System:

A Food Innovation Center (FIC) within a local food processing system offers **versatile equipment** for food safety, commercial grade processing and professional packaging that can be used for a variety of staple crop preparation. Food Innovation Centers are intended to increase affordability and availability of local, healthy, and convenient food products while providing jobs, strengthening the economy, and reducing dependence on imported processed foods.



## Centralizing Processing of Local Crops for Convenient Processed Foods

**Taro** - high levels of vitamin C, vitamin B6, and vitamin E



Locally-made,  
convenient and  
nutritious food



Made with Local Coconut Oil



## Capacity Building and Job Creation examples



Commercial Smoking



Commercial Baking



Food Preparation



Food Safety Awareness Training



Packaging and Labeling



Commercial Food Drying



Food Grading



Commercial Bottling

## Decentralized, Tiered Food Processing System for Yap State:

In Yap State, stakeholder feedback indicates that an FIC would be part of a decentralized, tiered food processing system with linkages from households and villages to communities, and ultimately to the larger-scale shared FIC processing facility.

### Illustrated Example of the Connections between the Food Processing Facilities at Tier I, Tier II and Tier III (Food Innovation Center)



The proposed Yap State decentralized food processing system begins at the household and village level, referred to as **Tier-I**. This tier provides basic, cost-effective, and context-appropriate processing equipment, much of which can be operated without electrical power. Tier-II consists of community-level Food Innovation Facilities (FIFs), with approximately two such facilities in Yap State. These facilities include teaching and training kitchens for commercial food preparation, mid-scale processing equipment for priority products identified by Yap State, and storage infrastructure. Tier-III represents a more advanced, state-level FIF, with one centralized facility per state, equipped with modern, large-scale processing technologies. These three tiers are designed to function both independently and in coordination with one another. This modular structure reduces operational risk, promotes rapid adoption, and creates opportunities for income generation and employment. Each FIF and the broader FIC system are intended to stimulate local food production and processing while enhancing food security. Key stakeholder surveys and multi-day convenings with grower, seller, consumer, and community leader representation were employed to identify the locations of these facilities and priority food products to be processed. An in-depth analysis of survey and convening responses can be found in the evidence-based stakeholder goals document. These decisions were informed by tradition, culture, familiarity of traditional food systems, and market demand, and are aligned with existing agricultural and foraging/collection practices. This design is rooted in a decentralized approach that emphasizes food safety, accessibility, and broad-based participation while mitigating risk. The establishment and utilization of FIF and FIC as economic drivers of change will promote and increase local food production, processing, and consumption while reducing imports and creating a more circular economy that keeps more money in the state for families and communities.

### **Tier I Food Innovation Facility (FIF)** **– Located in Individual Homes:**

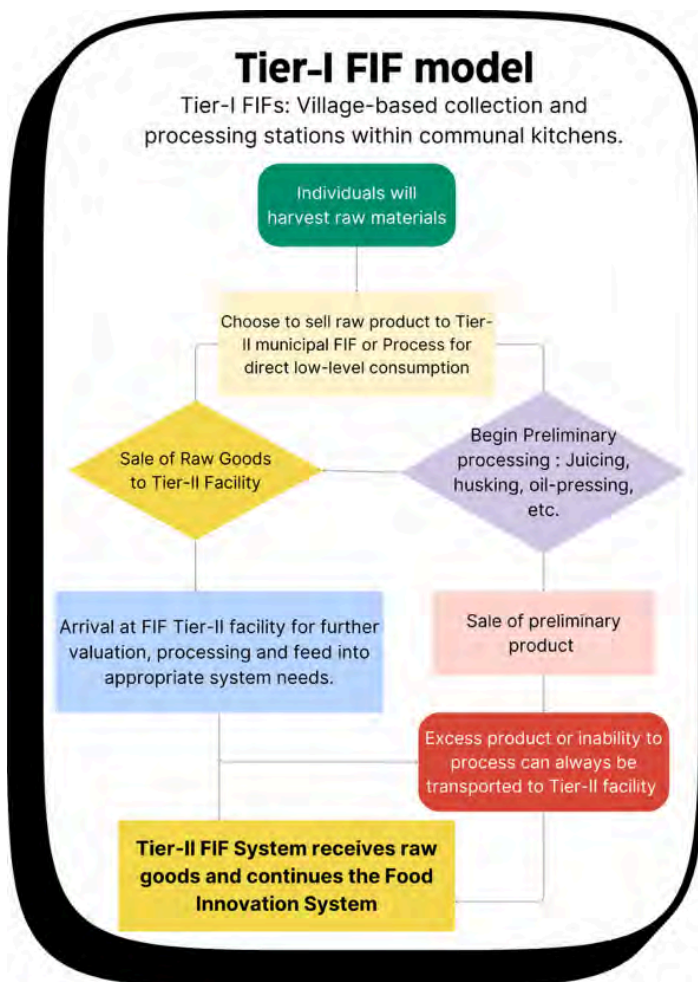
Tier-I facilities represent the foundational level of the food innovation processing system, consisting of 100-200 square foot spaces that can include communal kitchens. Yap stakeholders have suggested ten Tier-I facilities, one for each municipality on Yap main island. These spaces will be equipped with fully functioning workbenches and essential materials necessary for preliminary food staging and processing activities.

The operational workflow begins when individual community members harvest raw materials from their local sources and deliver them to the village-level communal kitchen facility. They can choose to prepare raw materials for direct sale as inputs, making them available for weekly pickup by Tier-II facilities, or they can opt for low



level processing that involves preliminary, low-energy equipment to create value-added products either for direct consumption or to be brought to Tier-II .

The processing activities at Tier-I facilities encompass a diverse range of products and techniques. For immediate sale items, the facilities focus on products like coconut water or fruit juice, which will perish quickly and therefore only be accessible for same-day consumption. This also includes coconuts that have been husked and pressed for oil extraction. Simultaneously, staple crops such as taro, bananas, and breadfruit will be collected and stored in designated areas, awaiting transport to higher-tier facilities where they will undergo more sophisticated processing. An important aspect of the Tier-I operation involves the strategic utilization of byproducts, where food processing waste is converted into valuable components for poultry and animal feed, ensuring minimal waste throughout the system. Each Tier-I facility will use food waste to prepare compost piles, which will then be used to tend to soil in the surrounding area. Food waste, green kitchen waste, and locally available materials will be collected and placed on top of the ground in 1m x 2m x 1m piles or into specially constructed open boxes made of local materials. If space is available, the compost pile can be placed within a wooden frame. Composts will be placed away from toilets and streams, and will be watered during dry periods, but otherwise simply turned with a shovel or hoe every few weeks. The more poultry or animal manure that is added, the better the quality of the compost will be, because it will accelerate the decomposition process and make the compost more uniform.



Documentation and coordination represent critical components of the Tier-I operation, with community partners maintaining comprehensive records through both physical and digital logging systems. These logs will capture detailed information about food harvesting activities, preparation and processing procedures, and all exchange transactions that occur within the facility. This meticulous documentation serves a dual purpose, providing immediate operational insights while feeding into the broader national food sustainability and security planning system through a dedicated food systems mobile application.

The market coordination and communication functions of Tier-I facilities will rely heavily on the digital app system to maintain efficiency and prevent market oversaturation. Through this platform, facilities will log processed items and raw material inventory, coordinate with community leaders to organize local sales events, and communicate product availability directly to local consumers. The system also enables sharing of information with other Tier-I processing centers, creating a network that helps prevent oversaturation of single products at higher-tier facilities and ensures balanced market distribution across the region.

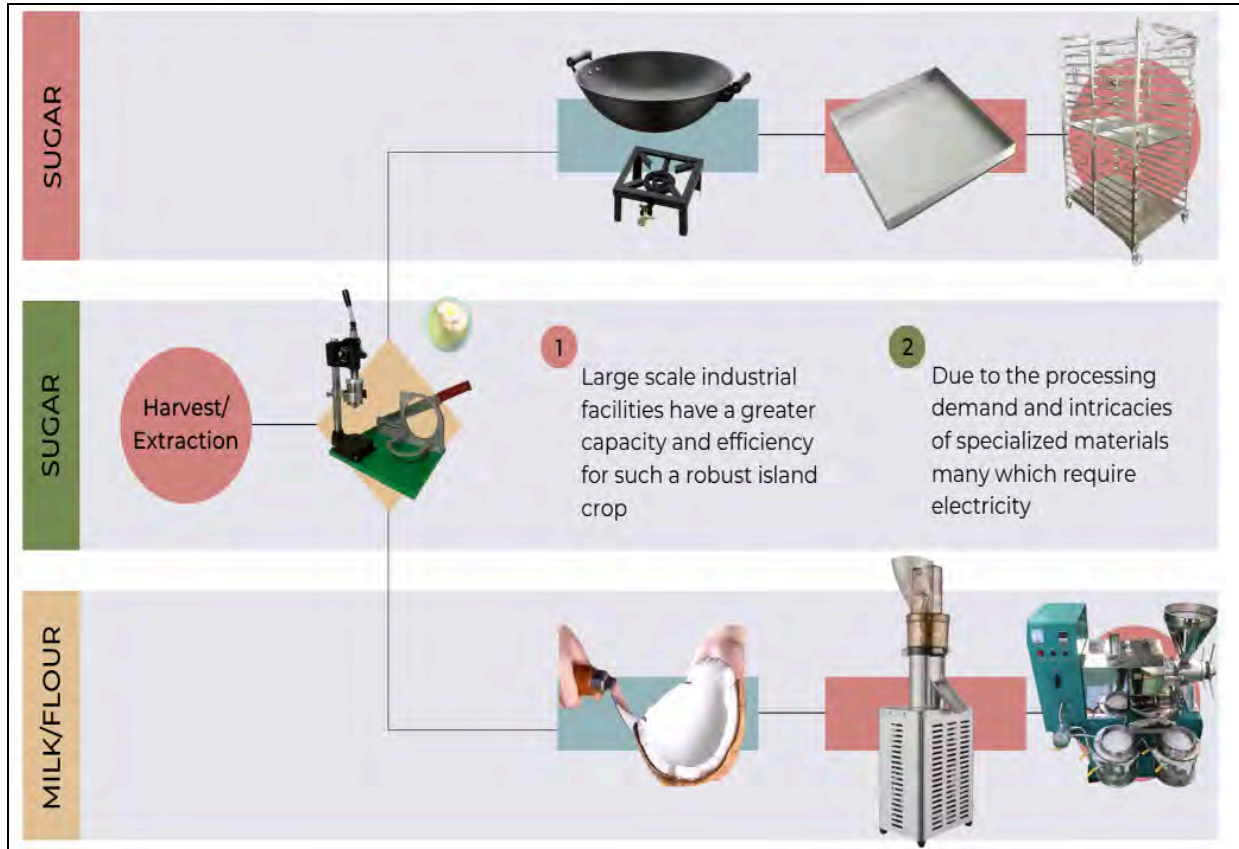
Each Tier-I facility will operate within a comprehensive output notification system that digitally reports critical operational metrics. These reports include the quantity of raw materials received during each operational period, the amount of processed goods available for local market sales, the volume of materials designated as inputs for Tier-II value-added processing systems, and the quantity of food scraps that will be delivered to the local Poultry Feed Processing System (P.F.P.S.). This systematic reporting ensures transparency and enables effective coordination across all levels of the food innovation network.

### **Tier-II Food Innovation Facility Layout (5,000–6,000 sq ft) – Located at Kanifay Elementary and Tamilang Elementary.**

Tier-II Facilities will receive raw and low-level processed materials from each of the ten Tier-I facilities. During the FSS convening, Yap policy makers identified **Kanifay Elementary and Tamilang Elementary** as the two Tier-II processing locations, each equipped with manual and powered equipment, storage spaces for fruits/vegetables and staple crops, and outdoor community kitchens for workshops and training.

If the Tier-II system has additional faculties in their ability to process staple crops, including bananas, coconuts, taro, and breadfruit coconuts, it is important to note that these types of materials take added precautionary measures to ensure that they are all uniform, clear of contamination, and maintain the most sanitary practices throughout the system workflow. Our core layout proposal includes designated square footage and functionality for each critical process area:

- Receiving/Loading Dock – 1,000 sq ft
- Staple Crop Processing - 600 sq ft
- Community Kitchen/Workshop Training – 500 sq ft [Outdoor]
- External Storage Container
- Factory Room (Gymnasium) 1,000 sq ft



**Example Coconut processing for Milk/Flour/Sugar at Tier-II:**

Coconut processing is more integrated than most other fruits and vegetables and requires the use of more sophisticated technologies to ensure that all parts are used with the most efficiency. Certain aspects of the coconut processing system can be done at the Tier-I FIF level, but the waste generated or an inability to retrieve all the flesh or water will render it less efficient.



Taro flour processing on Pingalap atoll, Pohnpei State.

## Tier III Food Innovation Center Layout (5,000–6,000 sq ft) - Located in Colonia

The proposed Tier-III layout includes designated square footage and functionality for each critical process area:

- Staple Crop & Vegetable/Fruit Processing – 1,000 sq ft
- Community Kitchen – 1,000 sq ft
- Storage Areas – 800 sq ft
- Administrative Office – 300 sq ft
- Food Testing Lab – 300 sq ft



Food quality check, packaging and distribution at Tier III facility.



### Tier-III Food Innovation Center

#### Technical Scope of Each Room

#### Designation Area

Room Designation	Function, types of crops and types of technology
<b>Room 1</b> Staple Crop Processing	<p>Functions: Washing, chopping, drying (solar-assisted), grinding, and packaging.</p> <p>Crops: Breadfruit, taro, cassava, coconut.</p> <p>Technologies: Solar dryers, low-energy grinders, local packaging systems</p>
<b>Room 2</b> Vegetable & Fruit Processing	<p>Functions: Cleaning, peeling, slicing, dehydration, vacuum sealing.</p> <p>Produce: Banana, papaya, mango, greens.</p> <p>Technologies: Blade processors, solar drying systems, hand wash stations.</p>

<b>Room 3</b> Community Kitchen	Functions: Cooking demos, nutrition education, recipe development.  Tools: Solar-powered stoves, fermentation crocks, culturally rooted recipe books.
<b>Room 4</b> Storage Areas	Features: Dry and cold storage, inventory tracking, adaptive cooling systems including eggs
<b>Room 5</b> Administrative Office	Functions: Recordkeeping, training coordination, business management.
<b>Room 6</b> Food Testing Lab	Functions: Nutritional testing, product development, food safety monitoring.
<b>Room 7</b> Workforce Training Room	Functions: Video display, hands-on workshops, youth and women engagement.

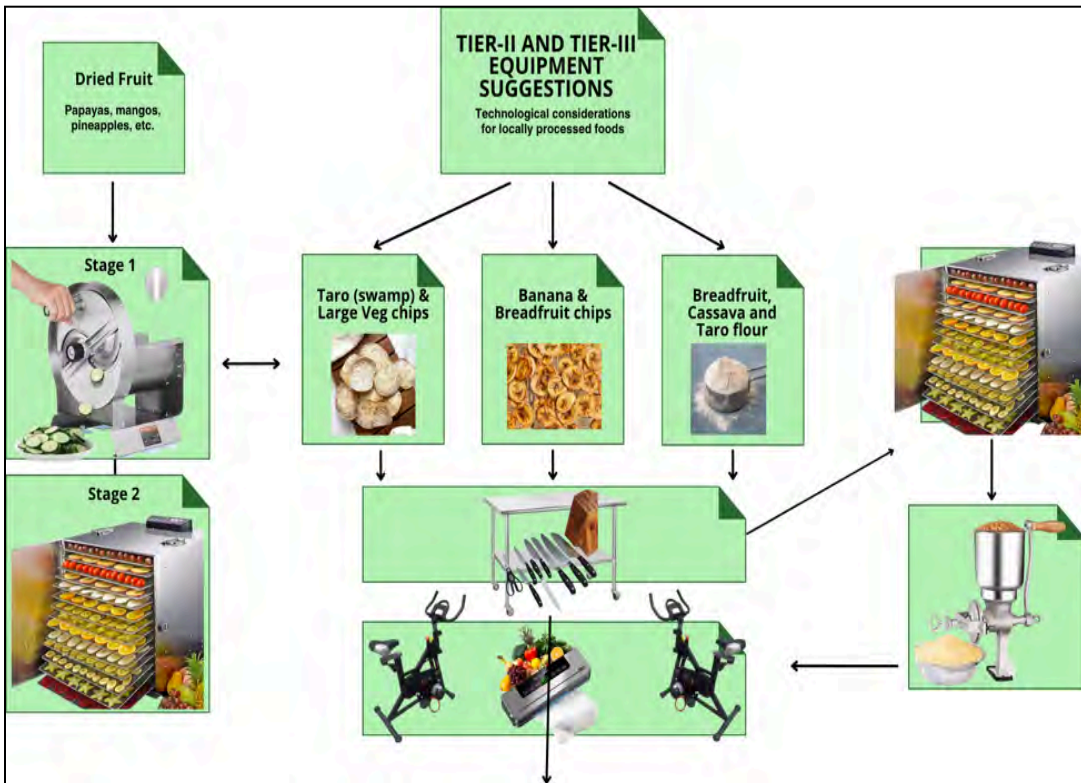
These full-scale regional Food Innovation Centers will be supporting research, policy integration, high-volume processing, storage, logistics, and training. The Yap State facility will be located in Colonia. Each of these facilities will be in an agreed-upon location on each of the four main islands and will be fully supported by electricity and back up generator power, which are crucial for the high-powered equipment used for processing, testing, and long-term storage. The FIC will produce the highest quality of value-added products with the longest shelf life and highest safety standards in order to meet the levels of sophistication, long-term storage, and industry standards which were requested during the convening meetings, and which are necessary to meet the lionshare of the requests. These facilities will be made to achieve the highest levels of preservation, processing, and innovation.

Food processing will be completed at this level and a long term storage unit will be



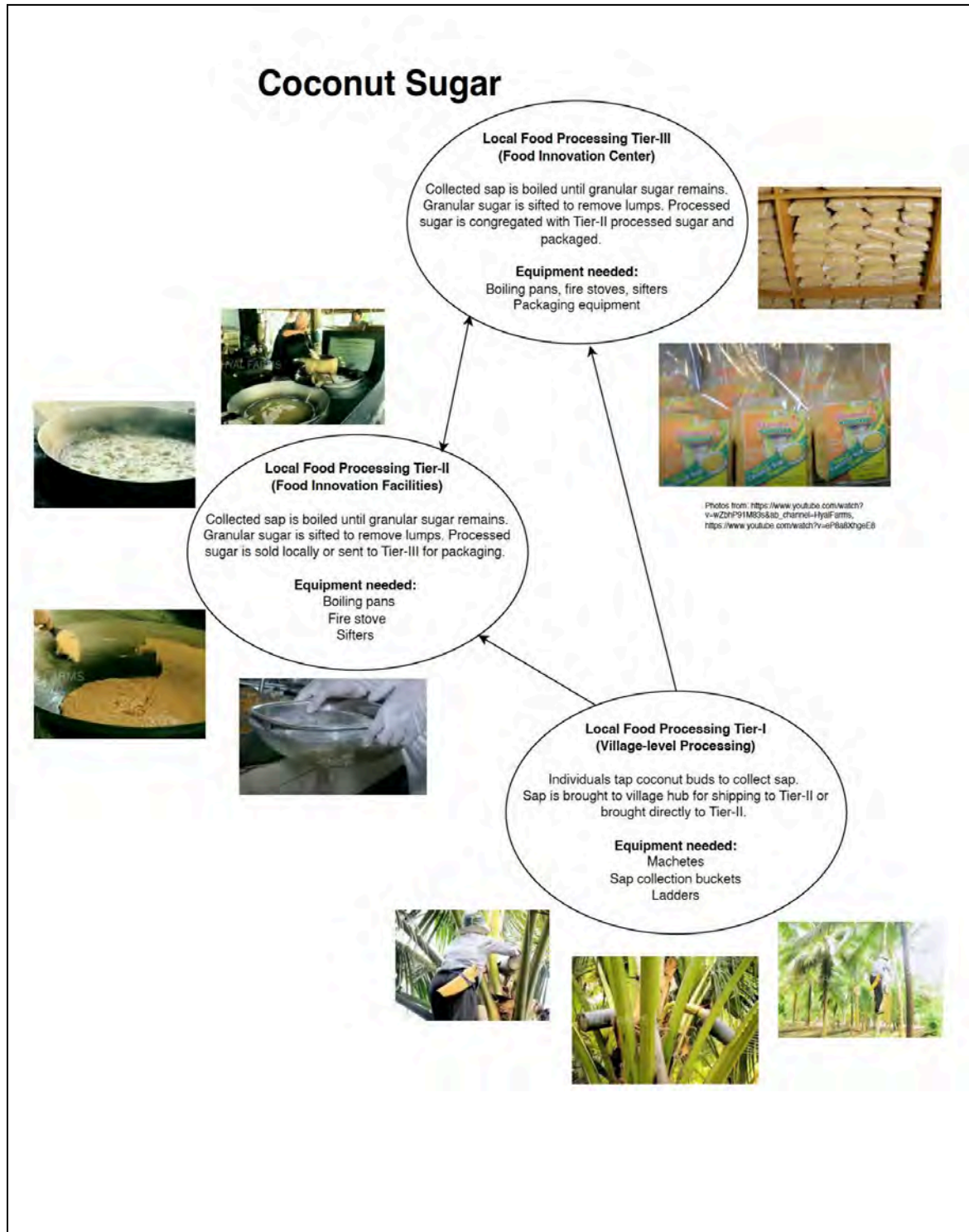
attached for inter island support (when needed). This will also be the site of the larger research articulations, providing data analysis, tracking seasonal trends and purchase/sale schematics, and informing representative food system input collaborators with up to date, live-time updates. This facility will host large conferences, collaborative challenges, and will facilitate large scale convenings, meetings and training.

**Example of Tier-II and Tier-III Processing System:**





# Example of Tiered System for Processing of Coconut Sugar



# Example of Tiered System for Processing of Banana, Breadfruit and Taro Chips

## Banana, Breadfruit, and Taro Chips



Photo from: <https://www.com/mvshop/kran's-breadfruit-chips-50g-9999katt/>



Photo from: [https://www.youtube.com/watch?v=gk3UF6s\\_uYQ&ab\\_channel=Lina200](https://www.youtube.com/watch?v=gk3UF6s_uYQ&ab_channel=Lina200)



Photo from: <https://www.youtube.com/watch?v=foUUnPy9n0k&channel=FinEstalGo>



**Local Food Processing Tier-II  
(Food Innovation Facilities)**  
Banana, breadfruit, and taro will be cleaned, peeled, sliced, and fried for local consumption or to be brought to Tier-III for packaging.

**Equipment Needed:**  
Sink, Frying pan,  
Vegetable cutter, frying oil



Photo from: [https://www.youtube.com/watch?v=K0E7U73zpg&ab\\_channel=CaroleTerwilligerMeyers](https://www.youtube.com/watch?v=K0E7U73zpg&ab_channel=CaroleTerwilligerMeyers)

**Local Food Processing Tier-I  
(Village-level Processing)**  
Bananas, taro, and breadfruit are harvested and brought to a village collection site to be sent to Tier-II and Tier-III.

**Equipment needed:**  
Machetes



Photo from: <https://www.acsr.gov.au/media-search/blogs/fresh-hope-samoan-taro-exports-australia>



Photo from: <https://www.wired.com/story/breadfruit-caribbean-pacific-climate-change-super-food/>

**Local Food Processing Tier-III  
(Food Innovation Center)**

Banana, breadfruit, and taro will be cleaned, peeled, sliced, and fried, then combined with chips from Tier-II. Chips will be packaged and labeled as products of Yap.

**Equipment Needed:**  
Sink, Frying pan,  
Vegetable cutter, frying oil  
Labeling machine, sealable bags

# Example of Tiered System for Processing of Coconut Milk and Coconut Cooking Oil

## Coconut Milk and Oil Tiered Processing



**Local Food Processing Tier-III  
(Food Innovation Center)**

Husked coconuts are cut, ground, and squeezed to extract milk. That milk is combined with milk from Tier-II. The combined coconut milk is sterilized and packaged for long-term storage, or boiled to separate the coconut oil.

**Equipment Needed:**  
Collection bins for water byproduct, Knives, shredders, Milk extractors, Cheese cloths, Storage tanks, Scales, Pots and boilers for sterilization and oil extraction



**Local Food Processing Tier-II  
(Food Innovation Facilities)**

Husked coconuts are cut to extract coconut water and the meat is ground. Ground meat is squeezed to extract coconut milk. Coconut milk is sold directly to consumers to be used that day or brought to Tier-III for sterilization and packaging.

**Equipment Needed:**  
Collection bins for water byproduct, Knives, shredders, Milk extractors, Cheese cloths, Storage tanks, Scales



**Local Food Processing Tier-I  
(Village-level Processing)**

Individuals harvest coconuts and husk them. They are brought to a village collection site to be collected for Tier-II and Tier-III processing.

**Equipment needed:**  
Dehusking knives and blade  
husk waste collection for chicken feed and kindling



Photos from: [https://www.youtube.com/watch?v=WseuOYaAZhY&ab\\_channel=FoodieFoodguy](https://www.youtube.com/watch?v=WseuOYaAZhY&ab_channel=FoodieFoodguy),  
[https://www.youtube.com/watch?v=QZJUDqQPtKI&ab\\_channel=Livingflavourswithsunitha](https://www.youtube.com/watch?v=QZJUDqQPtKI&ab_channel=Livingflavourswithsunitha)

## Maritime Food Processing Tiered System

Rather than a three-tiered system for fish, policy makers have identified the Yap Fishing Authority (YFA) to serve as the sole fish processing center. The YFA is already equipped with ice for storage and basic machinery for processing, so it will be easiest to build upon that pre-existing infrastructure.

Individual boats will serve as a Tier-I operation, collecting fish and bringing them to the YFA.



The YFA's capabilities will be expanded to include equipment and space for drying, salting, and smoking fish as value-added products with a longer shelf life.



Fish waste will be utilized for chicken feed, which will be processed in a Tier-II microenterprise facility.

# Local Fish and Marine Food Processing at Yap Fishing Authority

## Maritime Processing Tiered System



Photo from: Yap Fishing Authority

### Local Food Processing Tier-III (Yap Fishing Authority)

Caught fish will be brought to the YFA for cutting, cleaning, cold storage, smoking, drying, and packaging

#### Equipment needed:

- Filet cutter
- Cleaner/gutter/descaler
- Fryer
- Ice maker
- Smoking oven



Photo from: <https://food-drying-machine.com/food-drying-solution/fish-drying-in-bangladesh.html>



Photo from: <https://thefishsite.com/articles/oven-ready-aquaculture>



Photo from: <https://www.honupointvacationrental.com/where-to-buy-fresh-fish-north-shore-kaunoi-hawaii>

### Local Food Processing Tier-I (Individual Fishermen)

Fishermen bring their fresh-caught seafood to the Yap Fishing Authority for direct sale, storage, or processing.

#### Equipment needed:

- Fishing lines
- Nets
- Spears



Photos from: Yap Fishing Authority



## Tropical Food Preservation through Canning and Pickling

Stakeholder surveys indicated the desire for longer term storage through shelf-stable, ready-made products. Consumer survey respondents ranked pickled vegetables as a top requested food item, and the seasonal availability of preferred fruits documented in the GCFSAP020 Baseline Surveys demonstrates a clear need for canning as an off-season preservation method. This overview brings together best practices in food storage through canning and pickling, adapted for environments of high heat and humidity, which accelerate food spoilage. Below is a review of canning and pickling practices that highlight food safety and longevity of shelf life.

### Fundamental Principles of Canning and Pickling

Canning works by heating food to very high temperatures (116-121°C) under pressure and sealing it in airtight containers. This heat kills harmful bacteria, enzymes, and other microorganisms that cause food to spoil. The airtight seal prevents new bacteria from getting in and keeps gases or liquids from escaping. This process makes food safe to store at room temperature without refrigeration.

Pickling preserves food by making it acidic. When food becomes acidic enough (with a pH below 4.6), harmful bacteria such as *Clostridium botulinum* cannot grow. There are two ways to make food acidic for pickling: adding vinegar directly, or using natural fermentation where beneficial bacteria produce acid that lowers the pH naturally.

Both methods allow food to be stored safely for long periods without spoiling.

### Summary table of canning and pickling processes, from Peter & Lief (2003):

Category	Canning	Pickling
Microbial Stability	Very High (Sterile)	High (if pH maintained < 4.6)
Shelf Life (in controlled environment)	1-5 years	6-24 months
Energy Input	High (Thermal technology, 1-2kWh/batch)	Low (Minimal heating)
Nutrient Retention	Moderate - Low (Thermal loss of Vit C & B-Complex)	Moderate to High (Some vitamin loss in brining)
Sensory Qualities	Texture/structure changes (Softening)	If Brine controlled can maintain crispness
Failure Points	If seal is compromised	pH drift, unstable fermentation, yeast/mold growth

## Workflow steps for Canning (Pressure Canning Emphasis)

Steps	Consideration
Step 1 (Selection)	Harvest selection of produce should occur at peak ripeness. <i>Bruised, moldy or overripe food items should be rejected</i>
Step 2 (Cleaning and Prep)	Food stuffs should be washed in potable water with 50ppm chlorine solution <i>Provisions for food items should be discerned whether to peel, core, slice as needed based on food item</i>
Step 3 (Pre-treatment)	Blanch (high-acid foods) like tomatoes and fruits Boiling (low-acid foods) like green beans, poultry
Step 4 (Packing Jars)	Hot pack methods are often preferred in humid regions to reduce internal jar airspace Maintain headspace of about .5-1 inch
Step 5 (Sterilization/Pressure Canning)	Use Pressure Canner at 10-15 psi <i>(dependent on current altitude at time of processing)</i> Process 20-100 minutes <i>(depends on food density)</i>
Step 6 (Cooling and Sealing)	Allow jars to cool undisturbed for 12-24 hours <i>(Test seals, Label food item with date and other pertinent information)</i>
Step 7 (Storage)	Store in temperature controlled environment or low-humidity room <i>(Additionally can cover jars with cloth to reduce condensation-induced rusting due to environment)</i>

## Workflow steps for Natural Fermentation and Vinegar Pickling

Steps	Consideration
Step 1 (Selection)	Harvest selection of produce should occur prior to peak ripeness. <i>Selecting for young vegetables without the presence of bruising. Moldy or overripe food items should be rejected.</i>
Step 2 (Cleaning and Prep)	Looking for signs of pathogen presence on food stuffs and removal of those indicating (Salmonella, listeria and other risks in hot climates). Food stuffs should be washed in potable water with 50ppm chlorine solution <i>Provisions for food items should be discerned whether to peel, core, slice as needed based on food item</i>

Step 3 (Pre-treatment) Brine Preparation	Fermentation brine 2.5-5% salt by weight Or Vinegar Pickling via 5% acetic acid vinegar (Commercial Standard)
Step 4 (Submergence)	Submerge food stuff under brine and ferment at 22-26 degrees Celsius for 5-14 days in a controlled environment Pickling causes immediate acidification (via use of vinegar) and therefore no fermentation processing is required
Step 5 (Monitoring)	Being mindful at this step for signs of yeast film, molds and other tropical susceptibilities. Skim off films if needed
Step 6 (Finishing Step)	Transfer fermented food stuffs into clean jars and top with fresh brine
Step 7 (Storage)	Store in/under refrigeration or vacuum seal in the case of ambient storage

### Summarizing Technical Strategies/Considerations

Therefore to summarize Technical Strategies and evaluate which technique is not only preferential (according to current seasonal needs) but also which is best fit for the type of food you are processing, please see below:

Canning	Can you meet this parameter (Y/N)	Pickling	Can you meet this parameter (Y/N)
Strict adherence to pressure/time parameters  <i>(Please see USDA Canning Guidelines)</i>		Salinity adjustment <i>Aiming for 3.5-5% salt brine in hot/humid climates</i>	
Use of pressure rated glass jars and lids		pH testing <i>Using simple pH meters or test strips with a final pH target of &lt;4.0</i>	

<p>Monthly inspection</p> <p><i>Stored goods for rust, leaks, or bulging lids</i></p>		<p>Shortened fermentation times</p> <p><i>Completing fermentation between 5-7 days in controlled environments/climates to avoid microbial ingress</i></p>	
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## Circular Village Egg Production:

Key stakeholder surveys and convenings have highlighted the increasing demand for locally sourced eggs. Yap state has many wild chickens, but they do not consistently lay eggs due to an improper diet. The proposed egg farming model exists within the tiered Food Innovation System, with Tier-I being home-coops, Tier-II being microenterprises around chicken feed and hatcheries, and Tier-III being an egg congregating and processing center to be sold directly to restaurants/stores or to be used for baked goods and sold. The tiered structure enables a circular, zero-waste method that uses waste from the processing of staple crops for chicken feed and waste from poultry as manure for the crops.

The initiative prioritizes community engagement and value-added production through **Step 1: Community Organization & Training**, establishing training modules for community leaders and individuals that are interested in poultry farming for eggs. **Step 2: Coop Infrastructure & Design** utilizes local materials such as bamboo and coconut wood to construct elevated, climate-resilient structures with integrated rainwater collection and composting systems.

**Step 3: Chicken Acquisition & Care** identifies hardy, heat-tolerant egg-laying breeds and introduces best practices for maintaining a flock. **Step 4: Local Feed Production** meets the dietary needs of egg-laying chickens and transforms food scraps from other Food Innovation Facility operations into nutrient-rich fermented feed. **Step 5: Daily Maintenance & Biosecurity** establishes protocols that support bird health, prevent disease and predation, and ensure long-term productivity.

The system addresses waste management through **Step 6: Waste Transformation**, converting manure, bedding, and spoiled feed into compost. **Step 7: Egg Collection, Grading & Storage** implements gentle handling procedures, clay pot cooling methods, and community recordkeeping systems. **Step 8: Sales, Barter & Community Distribution** creates micro-economic opportunities that reinvest local labor into community prosperity.

**Step 9: Feedback & System Monitoring** establishes monthly review processes, performance scorecards, and responsive improvement mechanisms to maintain system transparency and effectiveness. Finally, **Step 10: Circular Economy Integration & Innovation** ensures complete

resource utilization by transforming every byproduct into a valuable input while building knowledge transfer systems that enhance regional resilience.

This framework extends beyond infrastructure development to embody the Food Innovation Center's commitment to collective restoration, where sustainable production methods, systematic feedback, and community-driven innovation create lasting food system transformation.

## **Community Organization & Training**

The goal and focus of this critical step should be creating a shared vision, a sense of cooperative trust and rotational sustainable responsibilities through strategic activities. Sufficient training was highlighted as one of the largest deficiencies in poultry farming. Yap State currently has wild chickens foraging in the woods and irregularly laying eggs, leaving community members to forage for a couple of eggs at a time. In creating an egg farming training program, community members will learn best practices for creating a coop, feeding chickens an appropriate diet, tracking trends in egg laying to understand seasonality or environmental barriers, and waste management for full utilization of the community's resources. Individuals will use the knowledge gained from these workshops to build their own backyard coops, purchase chicks from a hatchery, and begin their own Tier-I chicken production facility.

Recent research models complement some of the questions and ideas brought forth from community members and key stakeholder groups in the GCFSAP020 Baseline Assessment (2024) and the FSS Yap stakeholder surveys and convening sessions (2025). This data was utilized to tailor the focus of this step to consider the following, from Besbes et al. (2012):

1. What are small-scale and village poultry production systems?
2. What practices will increase the supply of eggs throughout the year?
3. How will individual egg production lead to income generation?
4. What to do during extreme weather events?
5. How to monitor trends in individual and community egg production through the Yap Food Systems app.

These investigation tools will help create a community feedback mechanism for a living coop model and therefore ensure the long-term success of this aspect of the FIC system, establish a shared governance/training and clarify roles for village residents.

In developing community organizational structures and public participation we have initiated contact through collective invitations to workshops, to be recorded and available on Yap State's food system app and radio notices to community leaders previously identified in our FSS 2025 surveys and convenings (farmers, youth leaders, women's groups, school staff and traditional leaders). Outer island representatives will be encouraged to attend workshops to bring the knowledge back to their communities, so coops and hatcheries can be set up on outer islands as

well. Infographics will be used to succinctly show best practices for coop design, chicken feed, and waste management.

Discussed below, the project vision and invitation to the construction of orientation gatherings.

Gathering via village assembly: with the use of visual aids, (maps, mockups, storyboards) and intergroup dialogue, we created a safe space for ideas, stories, wisdom exchange and resource identification.

We have formed working groups: which have identified prospective facilitators, leadership rotations and begins the establishment of teams to advance in the following areas:

1. Egg team
2. Feed team
3. Coop team
4. Compost team
5. Recordkeeping team

We will continue to build on these previous steps of Community Organizational development around the Chicken & Poultry model in the FIC system in the following steps:

Foundational Trainings: Covering chicken care, sanitation, egg handling, cooperative models and systems of transport/articulation with other FIC Tiered Structures. Additionally, community leaders have highlighted the importance of incorporating traditional cultivation techniques and successes and failures of past projects to ensure community members avoid the mistakes that were made in the past.

Communication mechanisms through the Yap food systems app, bulletin boards near coops, color-coded flag systems (Green = help needed, yellow = supply request and red = critical alert) will enable need-based monitoring system designs that improve our poultry system (Sari, Aritonang, & Sumarlin, 2021).

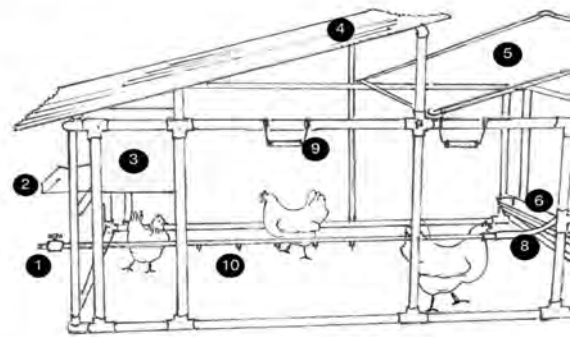
## **Coop Infrastructure & Design**

Ecological considerations and local resource availability are necessary in developing a protocol for coop design. Simple cages can be constructed from bamboo stems, wire mesh, and a tarp roof to house at most ten chickens. This has been successfully done in Yap through a USDA-SARE project by the College of Micronesia (Young-Uhk, 2011), shown in the image below.

Environmental considerations for coop design and maintenance include heat, high wind, heavy rain, saltwater inundation, and disease and pest pressure.



*Young-Uhk (2011)*



- |  |                      |
|--|----------------------|
| (1) Valve (to flush out water reservoir) | (6) Feed trough      |
| (2) Egg tray                             | (7) Covered water r  |
| (3) Nesting box                          | (8) Flexible hose co |
| (4) Partial roof cover                   | (9) Full handles     |
| (5) Top cover (shown in open position)   | (10) Nipple waterer  |

*Fukumoto (2009)*

Village-level design workshops will be administered by community leaders, who themselves have already completed this training. The workshop will engage villagers in a basic participatory sketch session, utilizing ropes to map out the coop's geographic footprint on the land and especially considering the logistics associated with Food Innovation Facilities (FIF's). Participants will actively survey materials for harvest (including bamboo and coconut wood), collection of palm leaf, recycled tin sheets and old barrels.

Construction of the foundation and coop floor will be scheduled immediately following the design workshop to begin the implementation of skill development procedures, like that of digging post holes and installation of elevated supports utilizing coconut trunks and bamboo flooring slats for nutrient cycling (Brass et al., 2015).

Walls and roofing material can either be layered palm leaf (thatch) or tin roofing based on available viable materials. The structure of the pitch design for the roofing will be location-specific as well as the availability of bamboo panels or slats as building material. Nesting box installation and perches go hand in hand with the structural considerations of a locally sourced sustainable chicken coop enclosure and are essential compliments to elevated structures that undoubtedly serve the positive health supports for the chicken populations (Malchow et al., 2019). Other available building resources include coconut husks, old crates and salvaged wood to begin the design for access hatches for egg collection.

The incorporation of rain catchment systems is especially important in anticipation of water scarcity (due to limited availability of liquid tanker trucks and heat conditions) and the high amount of agricultural and egg production needs in the future. Rainwater harvesting systems must incorporate precipitation measurements/trends (specific for each island community), roofing designs, demand-specific considerations (in reflection to the number of chickens to feed ratio) and production cycles (based on health, behavior and demand) (Arenas-Navarro et al.,

2020). The rain catchment system will consist of bamboo or recycled PVC pipes. Additionally, incorporating recycled barrels or food-grade containers as forms of water storage.

## **Chickens: Acquisition & Care**

Adaptation to Yap's climate is a crucial consideration in poultry selection. Yap currently has feral chickens across all of its populated islands, which offer an irregular supply of eggs. These chickens are likely a hybrid of domesticated chickens brought over by early settlers and redfowl, which is a wild chicken breed (Martin Cerezo et al., 2023). They are extremely resilient to the heat and rainfall experienced throughout FSM and it is crucial to find similar chicken breeds that can withstand extreme climate conditions.

### **Chicken breeds suitable for Yap's climate include:**



Leghorns – Tolerant to high heat, good foragers, produce many crisp white eggs, the most common commercially available eggs. Enjoy a free range environment. Can be flighty, difficult for beginners. Start laying eggs between four-six months. Finish between 6-7 years.

Manorcas – Tolerant to high heat, tolerate foraging and free-range environment, also tolerate confinement. Good layers, large white eggs. Flighty but can be socialized. Start laying eggs around 4 months. Finish between 5-7 years.



Rhode Island Reds – Can be raised for eggs and meat. Excellent layers, producing up to 300 eggs a year. Extra-large, brown eggs, two to three years of peak laying, can lay eggs all year. Relatively friendly, but can become territorial in confined spaces. Start laying eggs around 4-5 months. Finish around 5-7 years.

Australorps – Can be raised for eggs and meat. Excellent layers, producing up to 300 eggs a year. Active and enjoy foraging. Can adapt to warm climates with sufficient shade and water. Sit on their eggs, light brown eggs. Start laying eggs around 5-6 months. Finish around 4-5 years.



Raising egg-laying chickens in Yap's tropical climate requires careful attention to heat management and humidity control. Adequate shade and ventilation in coops should be provided, as temperatures can remain consistently high year-round, and proper drainage ensured to prevent moisture buildup during the frequent rain showers. Hens should be fed a balanced layer feed supplemented with calcium sources like crushed oyster shells, and provided with constant access to fresh, clean water, as chickens consume significantly more water in hot climates. Flocks should be protected from tropical storms with sturdy, well-anchored coops, and a regular health monitoring routine should be maintained as the warm, moist environment can promote parasites and bacterial infections. The timing of egg collection should be considered, as eggs can spoil quickly in high temperatures, and adequate predator protection should be planned and organized since island ecosystems may have unique threats like crabs or introduced mammals.

## Local Feed Production

The GCFSAP020 Baseline Assessment and follow-up surveys and convenings identified sufficient access to feed as the number one barrier in egg production across FSM. This presents a unique opportunity for chicken feed production to serve as a microenterprise (Tier-II facility) on Yap's main island, to supply feed to individuals on the main island and across outer islands.

Egg-laying chickens require a specific diet, which includes around 15-20% protein, 3-4% calcium, and 0.4-0.5% phosphorus. The rest of the diet should be carbohydrates/starches, traditionally grains but with available substitutions of FSM's staple crops (Pacheco, Gulizia, & Downs, 2022). Some raw materials incorporated in feed productions include fish meal, copra meal, palm kernel meal, coconut oil, and added supplements (Glatz et al., 2013).

### Proposed diet from available staple crops:

40-45% taro, tapioca for starch

30-35% fish byproducts, for protein

10-15% coconut meat for healthy fats

10% mangoes, papayas, seaweed, leafy vegetables for added vitamins and nutrients

Supplement with giant clam shells for calcium

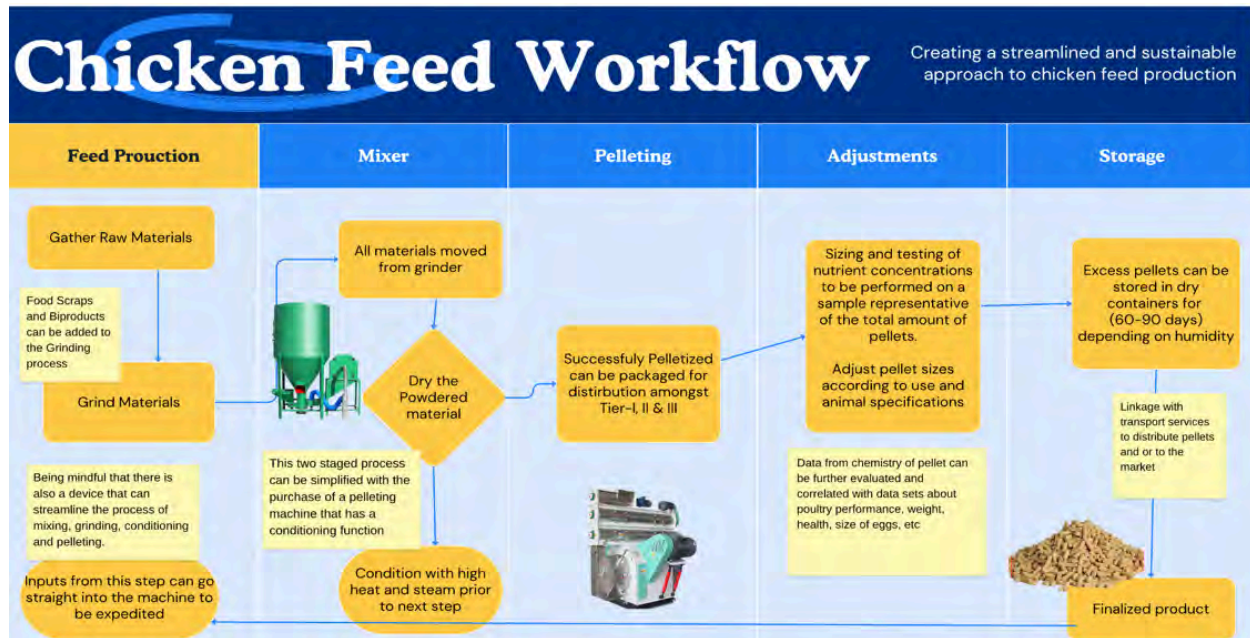
Fermented ingredients will help with nutrient uptake and digestion

Imported or farmed soybean or corn will also be beneficial to include in chicken feed for a complete diet.

This Tier-II microenterprise will be a place for Tier-I facilities to bring less-than-desirable or excess harvested staple produce.



The Poultry Feed Processing/Pellet System (P.F.P.S.) is aimed to retrieve all the waste products (peels, skins, byproducts and excess raw materials) as inputs towards the production of village pellets for animal feed.



## Chicken Hatchery Microenterprise

In order to maintain chicken egg production and processing, Yap State will require a chicken hatchery microenterprise, which will provide day-old chicks to individuals to expand their flocks. Facilities will include:

- Climate-controlled incubation room
- Brooding area to 2-week old chicks
- Parent stock will need to be vaccinated for Marek's disease, Fowl Pox, and Infectious Laryngotracheitis (ILT) (Poland, 2019).



## Chicken Hatchery Microenterprise Plan Executive Summary

This plan outlines the establishment of a small-scale chicken hatchery in Yap State to supply day-old chicks to local families and small-scale farmers for egg production. The microenterprise

will focus on hardy, heat-tolerant breeds suitable for tropical conditions while providing education and ongoing support to customers.

#### Target Market

- Local families interested in backyard egg production
- Small-scale farmers looking to diversify income
- Schools and community groups for educational programs
- Tourist facilities seeking fresh, local eggs



#### Market Demand Factors

- High cost of imported eggs and poultry products
- Growing interest in food security and self-sufficiency
- Limited local poultry breeding operations
- Stable year-round demand for protein sources

## **Chicken Hatchery Business Model**

### **Products and Services:**

#### **Primary Products:**

- Day-old chicks (laying breeds)
- Started pullets (6-8 weeks old)
- Fertile hatching eggs for local breeders

#### **Secondary Services:**

- Poultry care workshops and training
- Basic veterinary supplies and feed
- Technical support and consultation
- Custom hatching services for local farmers

### **Revenue Streams**

- Chick sales: \$3-5 per day-old chick
- Started pullets: \$12-18 per bird
- Hatching eggs: \$1-2 per egg

- Training workshops: \$25-50 per participant
- Consultation services: \$50-75 per visit

## **Operations Plan**

### **Location Requirements**

- 1/4 to 1/2 acre of land with reliable electricity
- Proximity to main population centers for easy customer access
- Good drainage and protection from strong winds
- Access to clean water source

### **Infrastructure Needs**

#### **Essential Facilities:**

- Incubation room (climate-controlled, 200-500 egg capacity)
- Brooding area for day-old to 2-week chicks
- Growing pens for started pullets
- Breeding pen for parent stock (25-30 hens, 3-4 roosters)
- Feed storage area (rodent-proof)
- Small office/customer service area

#### **Equipment Requirements:**

- 2-3 small cabinet incubators (200-300 egg capacity each)
- Brooder heat lamps and temperature controllers
- Feeders and waterers (various sizes)
- Backup power source (generator or solar system)
- Basic veterinary supplies and medications
- Scales and record-keeping materials

#### **Recommended Breeds for Yap Climate:**

- Rhode Island Red (heat tolerant, good layers)
- New Hampshire Red (dual-purpose, hardy)
- Black Australorp (excellent layers, calm temperament)
- Local crossbreeds adapted to island conditions

## **Start-up Requirements**

### **Initial Investment (Estimated)**

- Land preparation and basic construction: \$8,000-12,000
- Incubation and brooding equipment: \$3,000-5,000
- Initial breeding stock: \$1,000-1,500
- Feed and supplies (first 6 months): \$2,000-3,000
- Permits and legal requirements: \$500-1,000
- Working capital: \$2,000-3,000

**Total Initial Investment: \$16,500-25,500**

### **Ongoing Monthly Expenses**

- Feed costs: \$300-500
- Utilities: \$150-250
- Veterinary supplies: \$100-200
- Marketing and transportation: \$100-150
- Equipment maintenance: \$50-100

## **Marketing Strategy**

### **Customer Acquisition**

- Partner with local agricultural extension services
- Demonstrations at farmers' markets and community events
- Social media presence showcasing successful customers
- Word-of-mouth referrals through satisfaction guarantee
- Collaboration with schools for educational programs

### **Pricing Strategy**

- Competitive pricing slightly below imported alternatives
- Volume discounts for orders of 10+ chicks
- Package deals including starter feed and basic supplies
- Seasonal promotions during peak demand periods

### **Customer Support**

- Comprehensive care guides for new poultry owners
- 24-hour hotline for emergency questions

- Monthly follow-up with new customers
- Replacement guarantee for chicks that don't survive first week

## **Financial Projections**

### **Year 1 Targets**

- 2,000-3,000 chicks sold
- 200-400 started pullets sold
- 20-30 workshop participants
- Gross revenue: \$15,000-25,000
- Net profit margin: 15-25%

### **Growth Projections**

- Year 2: 50% increase in production capacity
- Year 3: Add specialty breeds and expand to outer islands
- Year 5: Potential franchise opportunities on other islands

## **Risk Management**

### **Key Risks and Mitigation Strategies**

#### **Disease Outbreaks:**

- Strict biosecurity protocols
- Regular health monitoring and veterinary partnerships
- Isolation facilities for sick birds
- Insurance coverage for livestock loss

#### **Power Outages:**

- Backup generator with automatic transfer switch
- Solar power system for critical equipment
- Battery backup for temperature monitoring

#### **Supply Chain Disruptions:**

- Local feed production partnerships
- 3-month feed inventory minimum
- Multiple supplier relationships

## **Natural Disasters:**

- Storm-resistant construction
- Emergency evacuation plans for breeding stock
- Business interruption insurance

## **Regulatory Requirements**

### **Permits and Licenses**

- Business license from Yap State
- Agricultural operation permit
- Import permits for breeding stock
- Veterinary inspection clearances
- Environmental compliance certificates

### **Health and Safety Standards**

- USDA or equivalent poultry health protocols
- Biosecurity plan approval
- Regular health testing of breeding stock
- Medication record keeping requirements

## **Sustainability and Community Impact**

### **Environmental Considerations**

- Composting program for poultry waste
- Organic feed sourcing when possible
- Rainwater collection systems
- Solar power integration

### **Community Benefits**

- Reduced dependence on imported protein
- Job creation (2-4 part-time positions)
- Educational opportunities for youth
- Enhanced food security for families
- Potential export opportunities to neighboring islands

## **Implementation Timeline**

### **Phase 1 (Months 1-3): Planning and Setup**

- Secure land and permits
- Construct basic facilities
- Order and install equipment
- Acquire initial breeding stock

### **Phase 2 (Months 4-6): Initial Operations**

- Begin incubation cycles
- First chick sales to pilot customers
- Develop customer support systems
- Refine operational procedures

### **Phase 3 (Months 7-12): Full Operations**

- Scale up to target production levels
- Launch marketing and education programs
- Establish regular customer base
- Plan for expansion

## **Success Metrics**

### **Key Performance Indicators**

- Hatch rate percentage (target: 85%+)
- Chick survival rate at customer locations (target: 90%+)
- Customer retention rate (target: 80%+)
- Monthly revenue growth
- Customer satisfaction scores

### **Monitoring and Evaluation**

- Monthly financial reviews
- Quarterly customer surveys
- Annual business plan updates
- Regular veterinary health assessments

### **Summary of Chicken Hatchery Potential:**

A chicken hatchery microenterprise in Yap State has strong potential for success given the local demand for fresh eggs and the limited competition. Success will depend on maintaining high-quality breeding stock, providing excellent customer service, and building strong relationships within the community. With proper planning and execution, this venture can contribute significantly to local food security while generating sustainable income.

### **Daily Maintenance & Biosecurity for Poultry Farming**

On average, poultry farming usually only requires 15 minutes a day (Diambra-Odi & Hollyer, 2017). Daily hygiene management includes disinfection, feeding, supplying fresh drinking water, replenishing bedding, checking ventilation and temperature, and manure cleaning.

**Feed and water:** Key considerations for water systems include quality, height, pressure, mineral content, and accessibility. A rainwater collection and storage system will be the simplest way to ensure that there is a water reserve during extreme heat or times with little to no rain. On average, a mature hen should consume around 100-150 grams of feed (¼ pound) daily. It is important that this feed has the appropriate ratio of carbohydrates, protein, phosphorus, and calcium to ensure efficient and quality egg-laying. Fresh feed should be provided daily, as old or spoiled feed can lead to illness (APA Admin, 2022).

**Environmental Monitoring:** Temperature, humidity, and air quality should be monitored to ensure the chickens are comfortable. Chicken breeds that are resilient to FSM's climate should be prioritized, as they will require the least amount of attention during extreme weather events. Appropriately selected chicken breeds should be able to withstand temperatures up to 40° C (105° F) and 75% humidity (Wilson et al., 1975).

**Biosecurity Considerations:** It is important for chickens to have a secured coop for protection from predators. Common predators of eggs and chicks include cats, dogs, birds of prey, monitor lizards, and large crabs (Yap, FM, 2018). The primary diseases that can affect chickens are Avian Encephalomyelitis, Avian Influenza, Avian Tuberculosis, and Newcastle Disease to name a few (Disease - Poultry Hub Australia, 2020). These diseases can be spread from wild migratory birds so it is important to catch them early and separate birds that may have been exposed/infected. New birds should be quarantined before they are introduced to the flock to ensure that they are not carrying any diseases.

### **Waste Transformation**

When fed an appropriate diet, chicken manure is extremely nutrient-dense and can be used as a natural fertilizer for vegetable farming. Chicken manure contains significantly more nitrogen and phosphorus and about the same amount of potassium as other farm manures. It is also an excellent soil amendment, as it can increase the soil's moisture-holding and nutrient-holding

properties (McCall, 1980). Chicken manure can either be applied directly to the soil or it can be dried, pulverised, and packed to be sold as fertilizer. The dried manure can then be added to an irrigation supply or simply sprinkled on the soil and tilled in before rainfall. Tilling the manure into the soil is not necessary, but will remove the odor. Only about 15-40 pounds of dried manure should be applied to 100 square feet of farmland (1 heaping shovel per large plant) to prevent nutrient burning of the plants. Manure should not directly touch the plants.

### **Egg Collection, Grading, and Storage**

Egg production typically varies throughout the year, depending on day length and temperature. In general, chickens need 14-16 hours of light to maximize egg production, and warmer temperatures typically lead to higher production (Diambra-Odi & Hollyer, 2017). In general, the summer months see the most eggs produced. During peak season, eggs should be collected twice a day. As long as the eggs are not rinsed with water, they do not have to be refrigerated. Once eggs are washed, however, they lose a protective membrane and require refrigeration. Egg color depends on the species of chicken. For example, Rhode Island Reds and Australorps produce brown eggs, while Leghorns produce white eggs. Shell color does not have any effect on the quality of the egg. Unfertilized eggs are for consumption, while fertilized eggs are for chicken production, so it is important to keep roosters separate from egg-laying hens unless you want to increase your breeding stock.

### **Sales, Barter, and Community Distribution**

Chicken eggs will be sold to the Food Innovation Center (Tier-III) in Colonia to be used for baked goods processing. Eggs will also be sold to restaurants and stores to be sold to consumers. As individuals will all have the opportunity to produce eggs on their land, we expect that some eggs will be used for home consumption.

Stakeholders noted, however, that the largest barrier in poultry production is availability of feed. This creates an opportunity for a microenterprise separate from the FIC that makes chicken feed mixes to sell to farmers.

### **Feedback & System Monitoring**

All sales to the Food Innovation Center should be logged on Yap's food systems app. Individuals should also log any disease pressure that they experience within their coop to prevent an epidemic on an island.

### **The development of Appendices & Technical Tools**

Each facility includes testing kits and safety systems to ensure compliance with national and international food safety guidelines. These include:

- **Food Quality Testing Tools:**

- pH meter (with calibration kit)
- Thermometers (digital + infrared)
- Water Activity Meter
- Moisture Meter
- Colorimeter
- Brix Meter
- Allergen Test Kits
- **Microbial Testing:**
  - Salmonella
  - E. coli
  - Staphylococcus aureus
  - Yeast & Mold
  - Listeria monocytogenes
- **Food Safety Systems:**
  - Consumer Complaint Program
  - Crisis Response Templates
  - Pest Control SOP
  - Internal Audit Program
  - Hold & Release Procedures

Based on community needs and collective FSM organizational conversations, we are also developing new Communications Innovations: A FSMTC-Integrated Mobile App.

In partnership with FSM Telecommunications Corporation (FSMTC), we are developing a digital mobile app designed to streamline communication, logistics, and food system coordination. Features include:

- Cloud-based document & photo repository
- Transportation date sharing for tech, goods, and equipment
- Real-time map of:
  - Nearby FIFs, FICs, surplus storage, schools, clinics, and shops
  - Goods flow and transport status
- Inventory tracking and needs forecasting
- Encrypted messaging between staff, communities, and institutions
- Educational suite: Videos, manuals, food safety guidance
- Emergency alert and weather forecasting integration
- Marketplace features for local sales and payment facilitation
- Recipe and nutrition library with local inputs
- Open forum for questions, innovations, and feedback

All digital strategies are low-bandwidth optimized and offline-adaptable for remote environments.

## **Part IV: Management and Organization Structure for the Food Innovation Facilities and Food Innovation Center in Yap State**

There are several key factors critical to the success of a business enterprise in Yap. These include a clear vision and mission grounded in traditional values and community cohesion, supported by strong management and organizational structure with clearly defined roles that are consistent with Yapese customary leadership, village governance, state regulations, and applicable national policies.

To strengthen food security and economic resilience, Yap State aims to develop a decentralized food innovation system rooted in local realities such as low population density, outer island connectivity challenges, reliance on imported foods, and smallholder-based production systems. The strategy focuses on the processing and value addition of locally sourced foods such as taro, breadfruit, banana, poultry, fish, and marine products through a tiered system consisting of village-based Tier I facilities, regional Tier II Food Innovation Facilities (FIF), and a central Tier III Food Innovation Center (FIC). Each facility will serve as a node for local food aggregation, small-batch processing, packaging, storage, and where feasible, more advanced value-added operations.

Given Yap's tight knit communities and communal labor systems, this model will thrive when built around cooperative and inclusive ownership structures. It is proposed that each facility be established through a public-private partnership in which Yap State and municipal governments contribute public infrastructure, regulatory support, and seed funding, while the facilities are operated by independent cooperatives or community enterprises that emphasize local ownership, training, and employment. This model encourages entrepreneurial development without compromising environmental integrity or traditional knowledge systems.

The proposed organizational structure recognizes Yap's geographic spread and diverse community settings from Colonia to remote outer islands. Therefore, while the three tiered system is designed for coordination and vertical integration, each facility must also be capable of functioning autonomously. This enhances resilience to transportation disruptions, ensures local control over production and revenue generation, and supports niche product development suited to the cultural and ecological assets of each region.

Operational success depends on recruiting and mentoring local talent, especially youth and women, integrating environmental safeguards to protect Yap's fragile ecosystems, such as low input processing and renewable energy integration, and ensuring transparency in cooperative governance. Community engagement must occur at every stage, from site selection and design to

management, so that the initiative reflects the values, food traditions, and development priorities of Yapese people.

Accordingly, Yap State endorses the formation of public-private partnerships based on cooperative frameworks that allow communities to participate meaningfully in both governance and benefit sharing. This approach is vital to ensuring the economic, cultural, and environmental sustainability of the Food Innovation Center and associated facilities throughout Yap State.

## **The Partnership Framework can be built using a partnership model.**

The partnership framework in Yap can be structured using a culturally responsive and locally anchored partnership model. This model reflects the essential collaboration between the Yap State government, municipal councils, traditional leadership, and an independently operated cooperative that is deeply embedded in the community. It aligns public development priorities with the practical efficiencies and entrepreneurial energy of the private sector, while fully honoring Yapese traditions, environmental stewardship, and village-level engagement.

**Partnership Model:** A collaborative arrangement among state and local government authorities, councils of traditional chiefs, and a community-based cooperative that is independently managed. This model is designed to support Yap’s goal of building food security and local economic resilience through food processing, value addition, and the revitalization of local agriculture, fisheries, and livestock sectors. It is built on respect for customary decision-making, recognition of land tenure systems, and equitable inclusion of outer islands and remote communities.

**Core Principle:** The cooperative maintains full operational independence, both economically and technically, while working in partnership with public sector institutions to advance shared goals. These goals include creating decentralized facilities that can store, repack, distribute, and process fresh and locally harvested crops, livestock, poultry, and marine resources. The model is also committed to training and employing local community members, including youth and women, to build skills and provide livelihoods. Wherever feasible, facilities will be made available through rental or shared-use agreements to individuals, families, and community groups who wish to develop and market their own food products.

All activities must be carried out in ways that reflect Yap’s commitment to environmental protection, respect for traditional land and resource management systems, and the promotion of local self-reliance. This includes prioritizing low waste systems, the use of renewable energy, and aligning food production with climate resilience. The partnership model must also promote inclusive governance, fair benefit sharing, and decision making that reflects both modern and customary authorities.

This Yap-specific partnership model ensures that innovation and enterprise development proceed in ways that reinforce cultural values, sustain natural ecosystems, and maximize community ownership and participation across all islands and municipalities.

## Formation Structure

### Public Sector Partners

- **Yap State Government and Local Municipalities**

Key agencies such as the **Department of Resources and Development**, **Yap State Department of Agriculture and Forestry**, and **Yap State Environmental Protection Agency** will provide regulatory oversight, policy support, and public infrastructure investment. Municipal governments will play a critical role in site identification, community mobilization, and integration with local planning priorities.

- **Traditional Leaders**

Councils of traditional chiefs (e.g., Pilung and Tamol Councils) must be formally engaged at every stage to ensure cultural alignment, land use approval, and the incorporation of customary governance systems. Their involvement will help strengthen legitimacy and community ownership.

- **Community-Based Organizations and Producer Groups**

Established associations such as the **Yap Farmers' Organization**, **Yap Women's Association**, and **Outer Islands Community Groups** will be essential partners for organizing producer networks, coordinating training, and promoting equitable access to processing and marketing facilities. These groups represent key agricultural, fishing, and value-adding constituencies in both main island and outer island communities.

- **Public Financing and Development Institutions**

Institutions such as the **FSM Development Bank** and the **Yap State Credit Union** may offer financial support through concessional loans, microcredit schemes, or matching grants to support enterprise development and equipment procurement for cooperatives and facility users.

- **Research and Training Institutions**

Local branches and programs under the **College of Micronesia-FSM (COM-FSM)** including the **Yap Campus** and the **Cooperative Research and Extension (CRE) Program** will provide technical expertise, training modules, and participatory research to enhance the capacity of cooperatives and local entrepreneurs. Regional partners such as the **Pacific Community (SPC)** and the **University of Guam** may support research and value chain development efforts.

### Private Sector Cooperative

- **Independently Incorporated Cooperative Owned by Private Members**

The cooperative will be legally established as a Yap-based food processing and marketing enterprise, owned by individual member-producers, small businesses, and community groups who contribute equity and use the facilities.

- **Autonomous Governance Structure with Elected Board**

The cooperative will be governed by a locally elected board, ensuring representation from both

main and outer islands, different producer sectors (e.g., poultry, marine, root crops), and key demographic groups including women and youth.

- **Self-Directed Management and Operations**

Day-to-day operations will be led by a professional management team drawn from local talent wherever possible, and supported through capacity building partnerships with COM-FSM and regional organizations.

- **Private Capital Investment from Member-Owners**

Initial capital will be mobilized through share purchases and in-kind contributions from member-owners, supplemented by reinvested profits and potential grants from development programs such as the **FSM Climate Change and Food Security Fund**.

This Yap-specific formation structure ensures that both traditional and modern systems are integrated to foster a cooperative model that reflects local realities, protects cultural values, and creates inclusive economic opportunities throughout the state.

## **Partnership Formation Process**

### **Phase 1: Partnership Development**

This phase focuses on building a shared vision and identifying aligned objectives among Yap's key stakeholders, integrating customary authority, public institutions, and community-based organizations.

- Identification of mutual objectives and complementary capabilities among **Yap State Government**, municipal councils, the **Pilung and Tamol Councils**, and organizations such as the **Yap Farmers' Organization**, **Yap Women's Association**, and the **COM-FSM Cooperative Research and Extension Program**
- Feasibility studies and market analysis tailored to Yap's food production systems, local consumer preferences, environmental constraints, and inter-island transportation realities
- Stakeholder consultation and community engagement through participatory village meetings, traditional leadership consultations, and workshops held with producer groups from both the main island and outer islands
- Risk assessment and mitigation planning focused on Yap's geographic isolation, climate vulnerabilities (typhoons, sea level rise), energy and water reliability, and inter-island logistical challenges
- Initial establishment of the cooperative model for food processing, drawing on lessons learned from the **Food Systems Solutions Project** and small-scale value-added activities piloted with groups like **Gargey Women's Group** and **Weloy Cooperative Farmers**

Phase I has been largely completed through the groundwork laid by the Yap Food Systems Solutions Project, which involved extensive fieldwork, community input, and technical assessments.

## **Phase 2: Legal Framework**

This stage formalizes the institutional and legal basis for operation while ensuring both cooperative autonomy and alignment with state and customary systems.

- Development of a formal partnership agreement outlining the roles and responsibilities of Yap State Government, local municipalities, traditional councils, and cooperative members
- Governance protocols that respect cooperative independence while incorporating traditional oversight where appropriate
- Agreements on intellectual property, data sharing, and the use of indigenous knowledge in product development and marketing
- Establishment of performance metrics related to food production increases, job creation, environmental sustainability, and cooperative profitability

Yap State recommends moving forward based on existing public-private arrangements that have proven effective in areas such as microenterprise development and fisheries management, and to build upon institutional structures already supported by the **FSM National Government** and international partners, such as **SPC** and the **FAO**.

## **Phase 3: Implementation**

This phase initiates operations across tiers, guided by clear structure, community representation, and infrastructure readiness.

- Formal incorporation of the cooperative and recruitment of active member-owners from each municipality and outer island region
- Institutionalization of cross-tier representation, ensuring that members involved at the Tier I village level also have seats or advisory roles in Tier II regional FIFs and the Tier III FIC, to build vertical integration and maintain feedback loops
- Allocation of public resources for equipment, site preparation, water and sanitation infrastructure, and cold storage systems by agencies such as **Yap State Department of Public Works** and the **FSM Division of Agriculture**
- Joint development or upgrading of facilities with local contractors, use of government buildings when feasible, and integration of climate resilient design principles
- Launch of operations with defined service levels including training, facility use access, processing schedules, and packaging support
- Involvement of the **Yap State Public Service Corporation (YSPSC)** to plan for reliable electricity access, renewable energy integration, and long-term utility expansion aligned with facility growth

This phased formation process ensures that the Food Innovation Center and related facilities are rooted in Yap's social structure, supported by technical expertise, and responsive to the realities of a remote island economy. It also helps cultivate ownership and accountability across all levels of the system.

## Operational Structure

### Cooperative Independence

In Yap, the cooperative model is rooted in community trust, shared responsibilities, and cultural governance traditions. The cooperative will function as a self-sustaining, member-driven enterprise that reflects Yapese values of mutual support and transparency.

- Ownership is held by private members including farmers, fishers, women’s groups, youth entrepreneurs, and small agribusinesses organized through entities such as the **Yap Farmers’ Organization, Outer Islands Agricultural Cooperatives, and Yap Women’s Association**. Each member has equal voting rights regardless of financial contribution, aligning with Yapese values of communal equity.
- An independent board of directors will be elected by cooperative members, with initial nominations guided by Yap State in consultation with the **Pilung and Tamol Councils**, municipal governments, and key producer organizations to ensure geographic and demographic representation.
- Management and staff hiring will be autonomous, with preference for local candidates trained through institutions such as the **College of Micronesia–FSM Yap Campus**, and with support from regional partners like the **Pacific Community (SPC)** and the **USDA Natural Resources Conservation Service (NRCS)** technical assistance programs.
- Business strategy and daily operations will be designed and implemented by the cooperative, with flexibility to respond to market trends, seasonal production changes, and community needs, while maintaining full compliance with state regulations and traditional protocols.
- Financial operations including budgeting, reinvestment, and profit distribution will be conducted transparently, with dividends distributed based on usage volume, and a portion retained for reinvestment into equipment, training, and infrastructure maintenance.

### Public Sector Role

The public sector will play a vital enabling and regulatory role without interfering in the daily management of the cooperative, supporting the broader goals of sustainable development, economic resilience, and food security in Yap.

- The **Yap State Government** will establish and maintain the enabling policy and regulatory framework in consultation with traditional leaders and national stakeholders to ensure environmental protection, land use respect, and food safety compliance.
- Financial assistance will be provided through grants or guarantees from sources such as the **FSM Development Bank, Yap State Capital Improvement Program**, and climate adaptation funds, with support from partners like the **Food and Agriculture Organization (FAO)** or **German Society for International Cooperation (GIZ)**.
- Technical support and capacity building will be offered through the **COM-FSM Cooperative Research and Extension Program, NRCS**, and regional programs focusing on value chain development, business literacy, and climate-smart agriculture.
- The government will assist in facilitating market access by promoting Yap-branded products in regional tourism markets, government food procurement programs (e.g., schools, hospitals), and through connections to regional trade fairs and niche markets for traditional foods.
- Infrastructure investments will focus on improving access to transportation for inter-island

shipment, expanding cold chain and storage capacity, enhancing telecommunications for business operations, and securing reliable utilities in partnership with **Yap State Public Service Corporation (YSPSC)**.

## **Governance and Accountability**

### **Dual Accountability System**

The governance structure in Yap reflects the importance of traditional leadership, community consensus, and modern cooperative principles. It is designed to promote transparency, equity, and responsiveness while aligning with Yapese cultural values and public policy goals.

- The cooperative is accountable to its member owners including farmers, fishers, women's groups, and local producers through democratic processes. One member, one vote elections will ensure equal participation and accountability. Organizations such as the **Yap Farmers' Organization**, **Yap Women's Association**, and **Outer Islands Community Councils** will support broad member engagement across Yap's diverse communities.
- The public-private partnership is accountable to traditional authorities, municipal leaders, and Yap State agencies through performance indicators that reflect Yap's unique priorities. These include increased use of local raw materials, job creation for youth and women, affordability and access for remote communities, and adherence to cultural and environmental values.
- Regular reporting on cooperative and partnership outcomes will be conducted through quarterly community meetings, municipal consultations, and an annual public review. These reports will be accessible through the **Yap State Economic Planning Office** and will be shared at community outreach sessions supported by the **COM FSM Cooperative Research and Extension Program**.
- Independent monitoring and evaluation mechanisms will be developed in collaboration with external partners such as **SPC** and **FAO**, and coordinated locally by institutions like **COM FSM Yap Campus** and the **Yap State Department of Agriculture and Forestry** to ensure transparency and local relevance.

### **Decision Making Authority**

The decision making process will balance cooperative independence with meaningful collaboration and oversight.

- The cooperative retains full authority over internal operations including hiring, pricing, sourcing, product development, and business planning. Decisions will be guided by the elected board and local management, grounded in the needs and realities of Yap's producers and communities.
- Joint decisions between the cooperative and public sector partners will be required only in areas where state investment or shared oversight is involved, such as public land use, facility development, and alignment with state food security policies.
- Public sector involvement will remain advisory. Agencies such as the **Yap State Department of Resources and Development**, **Environmental Protection Agency**, and **Department of Health Services** will provide technical guidance, regulatory clarity, and program coordination without direct control of operations.
- Dispute resolution will use both formal legal pathways and culturally grounded mediation

methods involving respected elders and traditional leaders. This ensures both procedural fairness and harmony within Yap's close knit communities.

## **Financial Arrangements**

### **Public Sector Contributions**

The Yap State Government and its development partners will play a foundational role in supporting the financial sustainability of the Food Innovation Center and its associated facilities. Contributions will reflect Yap's need for small scale infrastructure, climate resilient design, and capacity building for dispersed island communities.

- Infrastructure support may include grants for construction, renovation, and equipment installation through the **Yap State Capital Improvement Project (CIP)** and targeted allocations from the **FSM National Government's Compact** funding and **Climate Change and Food Security** programs.
- Technical assistance and training will be delivered through local institutions such as the **COM FSM Yap Campus** and its **Cooperative Research and Extension Program**, supported by external partners like the **Pacific Community (SPC)** and the **USDA Natural Resources Conservation Service**.
- Risk mitigation will be facilitated through tools such as loan guarantees or micro-insurance programs offered by the **FSM Development Bank** and **Yap State Credit Union** to encourage smallholder and cooperative investments in processing and value addition.
- Market development support will include product branding initiatives by the **Yap Department of Resources and Development**, and promotional opportunities through the **Micronesian Trade Fair**, tourism platforms, and potential exports to regional niche markets.

### **Private Sector Investment**

To ensure ownership and long term viability, private capital will be mobilized from individuals, families, and community enterprises actively engaged in Yap's agriculture, fisheries, and food service sectors.

- Member equity contributions and share purchases will come from farmers, fishers, women entrepreneurs, and small businesses organized through groups like the **Yap Farmers' Organization**, **Yap Women's Association**, and municipal producer cooperatives.
- Retained earnings from facility operations will be reinvested into maintenance, equipment upgrades, and training programs to strengthen long term sustainability.
- Private debt financing, where feasible, will be supported by the **Yap State Credit Union** or revolving loan funds linked to enterprise development programs led by NGOs and church based economic initiatives.
- Performance-based returns will be distributed to member owners based on their level of usage and contribution to the cooperative's services, promoting equitable growth and reinvestment.

### **Shared Benefits**

The financial structure is designed to generate broad based benefits across Yap's diverse communities, particularly those in rural and outer island settings.

- Job creation will be localized and tied to food production, processing, logistics, and cooperative management, providing income opportunities for youth, women, and returning migrants.
- Agricultural and marine value chains will be strengthened by providing stable markets, reducing post harvest losses, and supporting the development of locally branded products such as smoked fish, dried banana, or coconut oil.
- Food security will be improved by reducing reliance on imported products, increasing the availability of processed local foods, and reinforcing self reliance at household and community levels.
- Knowledge transfer will be promoted through applied training in processing techniques, food safety, small business operations, and environmentally sound practices, delivered by **COM FSM** and partner organizations.

## **Risk Management**

Risk management in Yap must address the unique challenges of a remote island environment, including the small and dispersed population, limited infrastructure, and strong reliance on traditional leadership and community cohesion. The following framework aligns with Yapese governance norms, environmental constraints, and cooperative principles.

### **Public Sector Risks**

- Ensuring consistent performance monitoring by Yap State Government agencies without interfering in the internal operations of the cooperative. Oversight responsibilities will be coordinated through agencies such as the **Yap State Department of Resources and Development** and the **Yap State Economic Planning Office**.
- Maintaining political continuity and long term support for cooperative initiatives across different administrations. Engagement with traditional leadership bodies such as the **Pilung and Tamol Councils** will provide cultural stability and reinforce nonpartisan alignment.
- Promoting transparent and appropriate use of public resources including Compact funds, climate adaptation grants, and development bank financing. Accountability will be ensured through publicly accessible reports and regular reviews involving municipal governments and community based organizations.

### **Private Sector Risks**

- Exposure to market volatility due to Yap’s small market size, seasonal fluctuations in agricultural output, and vulnerability to shipping delays. This risk is especially significant for outer islands with limited access to inter-island transport.
- Ensuring cooperative autonomy from political influence, especially during public investment phases or when engaging in government procurement. Operational independence will be safeguarded through strong bylaws and member-led governance.
- Sustaining active participation and long term commitment from cooperative members, including smallholder farmers, women entrepreneurs, and youth. Fluctuations in income, migration, and competing livelihood priorities may affect continuity.

## Mitigation Strategies

- Developing clear contractual agreements between Yap State, municipalities, and the cooperative that define responsibilities, resource use, and exit procedures. These agreements will be supported by local legal advisers and aligned with Yapese norms.
- Implementing regular performance reviews and learning-based evaluations that involve cooperative members, public sector stakeholders, and external technical partners such as the **COM FSM Cooperative Research and Extension Program** and the **Pacific Community**
- Diversifying funding sources through a blend of member contributions, earned income from processing and packaging services, technical assistance grants from donors, and financing from local institutions like the **FSM Development Bank** and **Yap State Credit Union**
- Reinforcing strong governance structures through training and support for cooperative boards, ensuring representation from each municipality and sector. Guidance from institutions such as the **COM FSM Yap Campus** and partner NGOs will help build transparency and resilience.

## Success Factors

### Critical Elements

- Respect for cooperative autonomy is essential to build trust and accountability among Yap's producers, fishers, and community members. The cooperative must operate independently while remaining aligned with public development goals and cultural values. Groups such as the **Yap Farmers' Organization**, **Yap Women's Association**, and Outer Islands agricultural groups exemplify grassroots ownership and governance models that can inform cooperative design.
- Clearly defined roles, responsibilities, and boundaries between the cooperative, **Yap State Government**, municipal authorities, and traditional leadership councils such as **Pilung and Tamol** are necessary to avoid overlap, confusion, or undue influence.
- Alignment of objectives between public sector agencies and private cooperative members must be based on shared goals such as food security, local employment, import substitution, and environmental protection while preserving day to day operational independence for the cooperative.
- Strong leadership is required in both public and private components. This includes committed officials from agencies such as the **Department of Resources and Development**, and experienced community leaders from producer groups and local cooperatives who understand Yap's market and logistical challenges.
- Adequate financing and timely resource allocation must come from a mix of public investment, member equity, donor support, and small scale financing tools through institutions such as the **FSM Development Bank and Yap State Credit Union**.
- Community support and active stakeholder engagement are central to long term success. The project must regularly engage communities through participatory planning, feedback sessions, and traditional consultative forums led by village chiefs and local associations.

### Performance Indicators

- Financial sustainability of the cooperative, including consistent revenue from processing services, product sales, and member use. Member satisfaction will be measured through annual

surveys and participation rates in governance activities.

- Achievement of public policy objectives such as reduced food imports, improved nutrition, support for youth entrepreneurship, and economic diversification across Yap's municipalities and outer islands.
- Community economic impact demonstrated through increased household income from agriculture and fisheries, local job creation especially for women and youth, and new business formation linked to value added products.
- Innovation and technology adoption including the use of solar powered cold storage, low input processing methods, CoolBot refrigeration systems, and appropriate packaging technologies developed through partnerships with **COM FSM** and the **Pacific Community**.
- Environmental and social responsibility measured through waste reduction, sustainable sourcing, protection of marine and land resources, gender equity, and inclusive participation from remote communities.

## Long-term Sustainability

### Partnership Evolution

- An annual review process will be institutionalized to assess cooperative performance, community outcomes, and alignment with state and municipal development priorities. These reviews will be facilitated by the **Yap State Economic Planning Office** in collaboration with the **Department of Resources and Development**, the cooperative board, and traditional leaders from the **Pilung and Tamol Councils**.
- Over time, the cooperative will move toward full operational and financial independence, reducing reliance on state or donor subsidies. This transition will be supported by leadership training through **COM FSM Cooperative Research and Extension Program** and by developing internal systems for budgeting, marketing, and procurement.
- Successful models and practices from the central Food Innovation Center and regional Food Innovation Facilities will be documented and adapted for other islands or sectors, such as root crop drying in Maap or marine product packaging in Ulithi. Replication will be guided by lessons from community based organizations like the **Yap Farmers' Organization** and **Weloy Cooperative**.
- A culture of continuous learning and innovation will be cultivated. The cooperative will regularly test technologies including solar powered equipment, low waste packaging, and indigenous preservation methods. Support from regional partners such as the **Pacific Community** and **University of Guam** will be essential for applied research and training.

### Exit Strategy

- A clear set of performance benchmarks and governance milestones will define when the public sector can transition from a direct partner to an oversight and support role. These criteria will be set during the initial agreement and reviewed annually.
- If public infrastructure or funding is used, there will be transparent arrangements for asset ownership transfer to the cooperative or to local governments, depending on the nature of the investment and agreements in place. Legal guidance from the **Yap State Office of the Attorney General** will ensure clarity and fairness.

- The cooperative is expected to continue operations beyond the end of formal partnership agreements. This will be supported by a strong member base, diversified revenue, and connections to local institutions like the **Yap State Credit Union** and **FSM Development Bank** for future financial needs.
- The legacy of the partnership will be sustained through ongoing community relationships, regional knowledge sharing, and the visibility of Yapese products in local and regional markets. Schools, health programs, and tourism operators may continue sourcing products from the cooperative, reinforcing its role in the broader economy.

## **II. Food Innovation Facilities and Food Innovation Center will operate as a Food Processing Cooperative**

### **Cooperative Principles**

The Yap-based cooperative will follow internationally recognized cooperative values while fully integrating local customs, traditional decision-making practices, and community-based economic models. It will operate under the principles of democratic member control, shared ownership, and active economic participation, adapted to Yap’s village-based production systems and communal norms. Equal voting rights will be extended to all members regardless of the size of their financial investment or land holdings, consistent with Yapese traditions of consensus and equity.

### **Membership Structure**

#### **Member Owners**

The cooperative will be owned and governed by active producers and small enterprises engaged in agriculture, fisheries, marine harvesting, and food processing. Members may include individuals, families, village groups, and producer cooperatives from both the main island and outer islands. Priority groups include:

- Members of the Yap Farmers’ Organization
- Women entrepreneurs affiliated with the Yap Women’s Association
- Fisher cooperatives from outer islands such as Ulithi, Woleai, and Fais
- Youth-led enterprises and church-based community farming initiatives

#### **Membership Requirements**

- Active engagement in agricultural, fishing, or related value-added production
- Purchase of a minimum number of shares, with options for in-kind contributions such as raw materials or labor in the startup phase
- Commitment to using the cooperative’s facilities or services such as drying, packaging, storage, or labeling
- Agreement to uphold the cooperative’s bylaws, which will be reviewed and endorsed by traditional leaders, municipal councils, and the membership

## Governance Structure

### Board of Directors

- The board will consist of 7 to 9 members elected through a democratic process involving all active member owners, with at least one seat reserved for representation from outer islands and one for a women's group.
- Board terms will be staggered to ensure continuity, with initial appointments possibly guided by Yap State and traditional councils to build balance and trust.
- The board will provide strategic oversight, set policy direction, and appoint and evaluate management. It will also ensure alignment with local development plans and uphold community values.
- Meetings will be held quarterly and rotated between locations when possible to facilitate inclusion from remote areas.

### Executive Leadership

- **General Manager:** Responsible for day-to-day operations, community relations, and ensuring services meet member needs. Preferably a Yapese professional with experience in cooperative management or agribusiness.
- **Operations Manager:** Oversees all processing activities, including food safety, quality control, scheduling, and equipment maintenance. Will coordinate closely with village-level collection points and seasonal production cycles.
- **Financial Manager:** Manages bookkeeping, budgeting, and transparent reporting, with support from the **Yap State Credit Union** or outside auditing firms for accountability.
- **Marketing Manager:** Develops local and regional sales strategies, supports branding of Yap-made products, and maintains relationships with buyers such as schools, tourism outlets, and shipping distributors.

## Operational Management

### Processing Operations

The day-to-day operations of the Food Innovation Center and regional Food Innovation Facilities in Yap will reflect local production rhythms, community labor structures, and environmental constraints such as water availability and energy reliability.

- Production supervisors from within Yap will oversee daily processing of local crops such as taro, breadfruit, banana, coconut, and marine products like tuna and rabbitfish. These supervisors will be trained through the **COM FSM Cooperative Research and Extension Program** and mentored by external experts in food safety and small-scale processing.
- A dedicated quality assurance team will ensure that food products meet safety and hygiene standards. They will be guided by protocols developed with the **Yap State Environmental Protection Agency** and the **Department of Health Services**.
- Maintenance staff will be responsible for regular cleaning, equipment repair, and facility upkeep. Whenever possible, youth from vocational training programs at **Yap High School** and

COM FSM Yap Campus will be recruited and trained to handle these roles, fostering local employment.

### **Member Services**

Member services will be community-centered and reflect Yap's strong tradition of cooperation, respect for elders, and inter-village coordination.

- A member liaison will act as the primary contact for cooperative members, including farmers, fishers, and women-led microenterprises. This individual will speak local languages, regularly visit remote sites, and report feedback to the cooperative board.
- The liaison and their team will coordinate raw material receiving, grading, weighing, and payment. Payment systems will be designed to accommodate cash-based and barter-based interactions where appropriate, especially for producers in outer islands.
- Technical assistance and market information will be provided through partnerships with **Yap Farmers' Organization**, the **Yap Women's Association**, and support from regional programs led by the **Pacific Community** and the **University of Guam**. Services will include training on product grading, packaging, business skills, and value chain linkages.

### **Decision Making Process**

Cooperative decision making will blend formal governance procedures with traditional consultative methods to ensure transparency and cultural legitimacy.

- Major decisions such as bylaw revisions, large capital investments, or membership rule changes will require a vote at annual or special member meetings. These meetings will be rotated across municipalities and scheduled in consultation with traditional councils to ensure inclusive participation.
- The elected board of directors will be responsible for developing strategic plans, approving budgets, and monitoring cooperative performance in line with community values and economic sustainability.
- Management will handle operational decisions such as staff schedules, pricing strategies, and procurement within board-approved guidelines. This structure supports efficient responses to market needs while preserving member oversight.
- Financial transparency will be ensured through quarterly reports presented at member meetings and public forums. Visual tools and local language summaries will be used to promote accessibility and understanding.

### **Profit Distribution**

The cooperative will reinvest in its future while sharing financial benefits fairly among members.

- Net margins will be distributed to members based on their patronage, meaning the volume of raw materials supplied or services used. This ensures that rewards are tied to active participation.
- A portion of annual profits will be retained for capital improvements, maintenance, training, and emergency reserves to ensure the long-term stability of the facility.
- Patronage dividends will be distributed once financial and operational benchmarks are met, in line with cooperative bylaws approved by the membership.

## Accountability Measures

- Annual member meetings will present audited financial statements, cooperative achievements, and development plans. These meetings will also provide a platform for feedback from village representatives and traditional leaders.
- Board meetings will be held at least once per quarter and documented with written minutes in both English and local language where feasible.
- Independent financial audits will be conducted annually by a third-party accounting firm or in collaboration with the **Yap State Auditor's Office**.
- A clear grievance and conflict resolution process will be established, combining formal procedures and community-based mediation. This will include anonymous feedback options, member dispute panels, and where needed, involvement of respected elders for culturally appropriate resolution.

*This structure ensures democratic control while maintaining efficient operations, balancing member interests with business sustainability and growth.*

# Part V: Food Innovation Centers and Facilities

## Proposed Budget

**Total estimated cost for building and equipping a US FDA Compliant Tier III Food Innovation Center (FIC) plus two regional Food Innovation Facilities (FIF) and 10 village level Tier I FIFs is: \$8.8 million US**

**Total Budget: \$8.8 million USD**

Below is a **comprehensive budget narrative** that aligns with the facilities layout and equipment zones described in the design document. We present these plans recognizing each need to be flexible and adaptable while allowing for the core products to be processed safely, packaged and commercially sold. The following description separates the most advanced FDA compliant Tier III Food Innovation Center (FIC) with its own breakdown and costs; then the less sophisticated regional Tier II Food Innovation Facilities (FIF) are presented with their breakdown and costs; and finally the village level Tier I FIFs with the smallest investment of equipment and processing is then presented. This decentralized approach allows for each Tier to operate, manufacture and sell locally and operate independently as well as in coordination and connection with the larger FIFs and FIC to procure adequate product supply and with increasing sophistication and quality from Tier I, Tier II and Tier III.

**A. FIC- Tier III. Total cost = \$5,755,541.95**

The Tier III FIC is envisioned as a two-part facility, which may be developed either at a single site or across two locations. One component is planned for Colonia, with the specific site to be determined by Yap State, and the other is proposed within the existing facilities of the Yap Fishing Authority in Colonia. At this stage, we present the FIC as a unified entity with the objective of establishing FDA compliant food safe infrastructure, one part dedicated to seafood (fresh, frozen, processed, and packaged) and the other to all remaining food products.

**B. FIF- Tier II (2 total). Total cost= \$2,724,070**

- Two regional Tier II Food Innovation Facilities are proposed to be located on main island Yap, designed for coconut products (sugar, oil, milk) and local crop flour/chips/vinegar. Each of these FIFs are designed at 2,500 square feet each, with construction costs estimated at \$450 per square foot, totaling \$1,125,000 per Tier II facility. With two such FIF's total is \$2,250,000. When equipment, administrative setup, training infrastructure, and contingency allowances are included, the full cost for both facilities amount to \$2,724,070. These centers will support value-added processing of coconut-based and plant/crop-based products, advancing enterprise development and market integration across the state.

C. Village Level Tier I (10 total, as one per village)= **\$61,728.78**  
The total estimated investment for 10 Tier I Food Innovation Facilities (FIFs) in Yap is \$61,728.78. These micro-scale FIF centers will be distributed across all ten municipalities of main island Yap. Designed to support pre-processing, aggregation (the receiving, holding and distribution of food products to Tier II or III facilities, and training, these community-level facilities are key to promoting inclusive participation, localized trade and sales and localized value addition within Yap’s food system.

A. Contingency Funds= **\$300,000**.

**Grand Total= \$8.8 million**

## A. The Yap Tier III Food Innovation Center (FIC)

A. FIC- Tier III. Total cost = \$5,755,541.95 (4,500,000 + 905,541.95 + 90,000 + 185,000 + 75,000)

### **Budget Narrative:**

#### 1. Construction and Infrastructure: \$4,500,000 (1 or 2 facilities)

This estimate reflects the cost of constructing a single 6,000 square foot Tier III FIC in Yap State, based on a benchmark rate of \$750 (\$US) per square foot and aligned with FDA compliant food grade facility standards.

Alternatively, this design allows for **two FDA-compliant food processing facilities**. One facility focused on seafood and located within the existing **Yap Fishing Authority (YFA)** premises, covering 2,500 square feet. The second facility, at 3,500 square feet, would be located at a **designated site in Colonia** and dedicated to the processing, manufacturing, and packaging of other food products such as breadfruit, coconut, taro, bananas, oils, seeds, and poultry.

The estimate accounts for imported materials, skilled labor as needed, refrigeration, sanitary systems, climate-resilient construction, and project management. We present the design this way to offer flexibility for Yap State and the YFA to select whether to renovate parts of their existing cold storage and processing infrastructure as part of the implementation.

#### A. Foundation and Structural Works – \$1,845,000

This component covers all civil works and vertical construction activities required to develop a fully enclosed, climate-resilient, food-safe structure. It reflects the reality of building in a remote Pacific Island context, where nearly all inputs—gravel, sand, cement, steel, and if/when needed skilled labor—must be imported and staged via complex logistics.

##### 1. Site Preparation and Slab Work – \$575,000

- **Land clearing, grading, and compacting:** Using imported equipment or locally leased machinery.

- **Sub-base and reinforcement:** Placement of imported gravel, sand, and geotextiles to stabilize the ground and prevent moisture seepage.
- **Reinforced concrete slab:** 6-inch industrial-grade poured slab with rebar mesh, designed to withstand heavy food processing equipment and resist erosion in high-humidity conditions.
- **Drainage design:** Sub-slab slope for floor drains and integration with underground graywater or septic systems.
- **Shipping surcharges:** Includes shipping fees for over 600 tons of construction-grade aggregate and cement, plus demurrage and stevedoring costs at FSM ports.

#### 2. Structural Framing and Envelope – \$750,000

- **Main steel frame and columns:** Galvanized steel I-beams and tubular trusses prefabricated offshore and shipped for on-site assembly.
- **Roof framing and support:** Trussed rafters designed to withstand cyclonic wind loads and intense rainfall.
- **Exterior and internal framing:** Combination of steel studs and treated timber (coconut or imported hardwood) for interior non-load-bearing partitions.
- **Anchoring and wind resistance:** Bolted foundations and hurricane ties installed to meet regional engineering codes.

#### 3. Roofing System – \$250,000

- **Galvanized corrugated steel panels:** Durable and rust-resistant, with Class A fire rating.
- **Radiant insulation barrier and vapor shield:** Reduces heat transmission and protects indoor equipment from condensation.
- **Rainwater management:** Full guttering, downspouts, and cistern integration for rainwater harvesting.
- **Roof overhangs and soffits:** Provide passive shading and minimize wall exposure to driving rain.

#### 4. Loading Bay and Exterior Finishes – \$170,000

- **Receiving and dispatch area:** Concrete apron with covered roof, sufficient for pallet delivery and product transfer.
- **Driveway grading and compaction:** Access for delivery trucks and service vehicles, including slope stabilization.
- **Exterior wall finishes:** Cement-rendered block or insulated sandwich panel siding, painted with mold-resistant, food-safe coatings.
- **Security features:** Exterior lighting, metal mesh window screens, and heavy-duty steel doors at delivery and emergency exits.

#### 5. Construction Logistics and Material Handling – \$100,000

- **Crane rental and offloading services:** For handling prefabricated steel frames, HVAC units, and refrigeration modules.
- **Storage containers and on-site warehousing:** For securing equipment and materials over the multi-month build timeline.
- **Inter-island transport and labor mobilization:** Includes barge charters or airlift of specialized tools, generators, and technical staff.
- **Customs brokerage and insurance:** Required for high-value material imports and in-transit construction components.

This section ensures the physical backbone of the FIC is built to international food facility standards while addressing the climate, labor, and infrastructure challenges of the FSM context.

## B. Plumbing and Electrical Systems – \$715,000

This component ensures that the facility is hygienically operable, energy-resilient, and food-safety compliant. In a tropical, infrastructure-limited environment like FSM, plumbing and electrical systems must be both robust and adaptable to accommodate supply interruptions, high humidity, and heavy sanitation needs. The budget reflects full importation of components, installation labor, and contingency allowances.

### 1. Potable Water and Sanitation Systems – \$310,000

- **Facility-wide potable water lines:** Food-grade PEX or CPVC piping installed across all processing, storage, restroom, and office areas.
- **Dedicated hand-wash stations:** Minimum of two per processing room, equipped with foot- or elbow-operated faucets and paper towel dispensers.
- **Triple-compartment sinks:** Installed in the community kitchen, R&D lab, and sanitation zones for proper utensil and container cleaning.
- **Grease traps and floor drainage:** Stainless steel grease interceptors and epoxy-lined floor drains with proper slope, fully integrated into a graywater system.
- **Rainwater catchment and storage system:** Gutter-fed cisterns with basic filtration and UV or chlorination options for non-potable uses.
- **Septic system:** Onsite waste treatment facility designed to manage high volumes of wastewater from food processing and cleaning.

### 2. Electrical Distribution and Food-Safety Power Design – \$260,000

- **Dedicated circuits for critical equipment:** Cold storage rooms, vacuum sealers, and dryers receive prioritized, isolated feeds with voltage stabilizers.
- **Processing zone separation:** Each room has its own electrical sub-panel to prevent overloads and simplify maintenance.
- **Food-safe electrical finishes:** All conduits, outlets, and panels sealed and moisture-protected; splash guards installed in wet zones.
- **LED lighting:** High-efficiency, shatterproof lighting installed throughout, with extra-lumen levels in food-prep zones for visibility and inspection.
- **Emergency lighting and signage:** Includes battery backups and illuminated exit signs compliant with international food facility codes.

### 3. Generator Interface and Solar Integration – \$105,000

- **Backup generator system:** 50–80 kW diesel generator, housed in a sound-proof, weather-protected shelter.
- **Automatic transfer switch (ATS):** Enables seamless power transition to maintain cold chain and IT systems during outages.
- **Solar-ready conduits and interface controls:** Pre-wired for rooftop solar PV installation in Phase 2 or by external donor.
- **Battery/inverter compatibility:** Built-in panels for future integration of lithium-ion or lead-acid battery bank.

#### 4. Fire Suppression and Safety Systems – \$40,000

- **Commercial hood-integrated fire suppression:** Automatic release systems in the community kitchen and poultry/fish areas.
- **Wall-mounted extinguishers and alarms:** Dry chemical and CO2 extinguishers located every 75 feet, with training provided to staff.
- **Electrical grounding and lightning arrestors:** Protection against tropical storm surges and high humidity-induced shorting.
- **Safety signage and PPE storage:** Clearly marked zones for evacuation, spill kits, gloves, eyewash stations, and emergency supplies.

This section ensures that water, sanitation, energy, and safety systems support uninterrupted, compliant operations even in the face of grid instability, high temperatures, or equipment-intensive processing. All specifications align with HACCP and Codex Alimentarius standards for food processing environments.

### C. Interior Finishing – \$625,000

This component ensures the internal spaces of the Food Innovation Center (FIC) meet rigorous global food safety standards for hygiene, durability, cleanability, and pest exclusion. All materials are selected to withstand heavy use in tropical conditions and to comply with HACCP, USDA, and Codex food processing guidelines. The budget accounts for full importation, specialized labor, and climate-adapted design.

#### 1. Hygienic Wall Systems – \$225,000

- **FRP (Fiberglass Reinforced Plastic) panels:** Installed in all wet zones (fish, poultry, kitchen, sanitation rooms). These are mold-resistant, chemical-tolerant, and easy to sanitize.
- **Food-safe epoxy wall coatings:** Applied in dry processing areas, office, training, and storage rooms. Includes antimicrobial additives and glossy finishes for better visibility of contaminants.
- **Corner guards and coving:** Seamless transitions between wall and floor surfaces to eliminate cleaning blind spots.

#### 2. Epoxy-Coated Flooring with Integrated Drainage – \$175,000

- **High-performance epoxy coatings:** Non-slip and chemical-resistant floors in all rooms. Built to withstand heavy foot traffic, water exposure, and equipment movement.
- **Anti-microbial aggregates:** Added to reduce pathogen accumulation and improve grip in wash-down areas.
- **Drainage design:** Precision sloped floors with integrated stainless steel trench drains in fish, poultry, and kitchen areas to prevent standing water.
- **Expansion joints and water barriers:** Prevent cracking due to humidity or frequent washdowns.

#### 3. Pest-Sealed Ceiling Systems – \$100,000

- **Waterproof, seamless ceiling panels:** Installed in food prep and storage rooms. Panels are joint-minimized to prevent insect nesting.
- **Reinforced ceiling insulation:** Includes moisture barriers to prevent condensation and mold growth.

- **Rodent- and insect-proof seals:** All ceiling fixtures and ventilation penetrations are sealed with food-safe silicone and mesh barriers.
- **Access hatches for maintenance:** Secure and gasketed to avoid open voids or entry points for pests.

#### 4. Internal Partitions, Doors, and Zoning – \$75,000

- **Clean-to-dirty workflow zoning:** Installation of partitions that guide hygienic workflow from raw to finished products.
- **Airtight doors with gaskets:** Stainless steel or PVC-coated food-grade doors for processing rooms.
- **Observation windows and light panels:** In staff training rooms and kitchens to monitor activity while maintaining sanitary barriers.
- **Magnetic hold-open systems:** Hands-free functionality for frequently trafficked doors.

#### 5. Fixtures, Restroom Finishes, and Food-Safe Cabinetry – \$50,000

- **Restroom fixtures:** Water-saving flush toilets, urinals, foot-operated sinks, hand dryers, and changing stations for sanitation team.
- **Stainless steel cabinetry:** Installed in R&D, kitchen, and sanitation rooms to hold small tools, PPE, and ingredients.
- **Lockable storage units:** For chemical storage and sensitive paperwork, including compliance binders and traceability records.
- **Public area finishes:** Non-toxic paints, window screens, and signage throughout administrative and training areas.

The interior finish package enables the FIC to meet global export-grade hygiene requirements while withstanding Micronesia’s high-humidity, salt-exposed environment. Every surface is designed for durability, pest control, and efficient sanitation—ensuring safe, long-term functionality of the facility.

## D. Refrigeration and Ventilation – \$940,000

This budget line ensures the Tier III Food Innovation Center (FIC) maintains robust cold-chain integrity and optimal air quality throughout the facility. Given FSM’s tropical climate and the high perishability of products including fish, poultry, and fresh produce, this investment supports modern, energy-efficient systems designed for resilience, food safety, and operational continuity.

#### 1. Cold Storage Systems – \$480,000

- **Walk-in Coolers and Freezers:**  
Two commercial-grade walk-in units (one freezer, one cooler) with polyurethane insulated panels, heavy-duty gaskets, and digital controllers. Includes stainless steel shelving for product separation and food-safe floors with internal drainage.
- **Hybrid CoolBot Cold Rooms:**  
Two insulated rooms fitted with CoolBot technology and high-BTU window A/C units. These serve as backup storage or specialized cold zones (e.g., for R&D samples, short-term harvest holding).
- **IQF (Individual Quick Freezing) System:**  
Entry-level IQF tunnel for rapid freezing of fish fillets or fruits, preserving quality and extending shelf life for local and export markets.

- **Battery-Logged Temperature Monitoring:**  
Networked temperature loggers with cloud-based dashboards for all cold units, meeting HACCP traceability requirements.

2. *Ventilation and Odor Control Systems – \$250,000*

- **Commercial Exhaust Hoods:**  
Installed over fryers, cooktops, and poultry/fish cleaning areas. Equipped with stainless steel grease filters and integrated fire suppression nozzles in kitchen and poultry zones.
- **Cross-Ventilation Design:**  
High-capacity ceiling and wall-mounted fans in staple crop and dry storage areas to promote airflow and reduce spoilage risk due to trapped humidity.
- **Dehumidifiers and Air Scrubbers:**  
Dehumidification units in fish, poultry, and storage rooms to control microbial growth and odor. Activated carbon scrubbers and UV treatment options to maintain air purity and mitigate off-gassing from processing.
- **Zonal Pressure Management:**  
Negative pressure maintained in poultry and fish rooms to contain contaminants, while clean areas (packaging, admin) maintain positive pressure to prevent ingress of airborne particles.

3. *Thermal Efficiency and Backup Systems – \$210,000*

- **Solar Integration Readiness:**  
Cold room compressors and ventilation systems pre-wired for solar or hybrid solar-diesel power. Rooftop structures accommodate future PV panel installation.
- **Insulation Upgrades:**  
Cold storage rooms and processing zones fitted with high-R insulation in walls and roofs, reflective foil barriers, and thermal gap seals around doorways to minimize energy loss.
- **Backup Generators and Switchgear:**  
One dedicated 25–30 kVA diesel generator with auto-transfer switch for all cold storage units, plus portable generator for partial facility backup.
- **Thermal Curtains and Air Locks:**  
Installed at cooler/freezer doorways to prevent temperature shock during frequent opening, improving energy efficiency and food safety.

Together, these refrigeration and ventilation systems enable the FIC to maintain cold chain standards essential for international food certification and local distribution reliability. With redundancy, modularity, and energy-aware design, the facility will operate year-round with minimal product loss—even in FSM’s challenging tropical environment.

E. *On-Site Project Management and Technical Oversight – \$375,000*

This component ensures the Food Innovation Center is constructed and commissioned according to international food facility standards, especially those aligned with U.S. FDA requirements, while also adapting effectively to the construction challenges unique to the Federated States of Micronesia (FSM).

### *1. Full-Time Construction Manager – \$200,000*

A dedicated, on-site construction manager will oversee all phases of the build from ground-breaking to commissioning.

Key responsibilities include:

- Day-to-day supervision of construction crews and subcontractors
- Ensuring compliance with design blueprints, safety protocols, and scheduling milestones
- Managing procurement timing, deliveries, and storage of imported materials
- Problem-solving in real-time to address site conditions, weather delays, or logistical disruptions
- Coordinating across plumbing, electrical, refrigeration, and finishing subcontractors to avoid delays or scope conflicts
- Providing regular reporting to the project team and funders on progress and risk

#### **Cost includes:**

- Monthly professional fee for 12 months
- Travel from a regional hub or the U.S. mainland
- Temporary housing allowance in FSM
- Daily per diem and local transportation

### *2. FDA-Aligned Food Facility Technical Advisor – \$125,000*

To ensure that the facility meets FDA-aligned design standards for hygienic zoning, materials, drainage, and equipment layout, a technical consultant will provide input during design finalization, supervise during construction, and assist in pre-commissioning validation.

Key deliverables include:

- Review of building and utility plans for compliance with HACCP, GMP, and food-safe facility standards
- Recommendations on material selection, process flow zoning, and critical control point layout
- Oversight during installation of equipment, wash-down zones, and cold storage
- Documentation and support for certification processes (e.g., USFDA, HACCP training, sanitation protocols)
- Support for standard operating procedures (SOPs) and cleaning workflows

#### **Cost includes:**

- Monthly consulting retainer across 9–12 months
- Three in-person site visits with airfare, housing, and meals
- Virtual review meetings, documentation, and SOP development

### *3. Quality Assurance and Construction Audits – \$50,000*

To maintain construction quality and minimize costly rework, the project will fund regular QA/QC reviews by an independent civil engineer or architect, ideally contracted through a regional partner.

This includes:

- Bi-weekly site inspections and written reports
- Review of materials used vs. bill of quantities
- Photographic documentation and field-testing of drainage, electrical, and floor finishing
- Approval checklists prior to release of milestone payments to contractors

Together, this budget line ensures that the FIC is built to specification, with strong oversight mechanisms, qualified personnel, and institutional memory. It provides the necessary assurance

to funders, regulators, and local stakeholders that the investment will result in a compliant, high-quality, and fully functional food-grade facility.

**Total Construction and Infrastructure: \$4,500,000**

<b>Component</b>	<b>Amount (USD)</b>
A. Foundation & Structure	\$1,845,000
B. Plumbing & Electrical	\$715,000
C. Interior Finishing	\$625,000
D. Refrigeration & Ventilation	\$940,000
E. Project Management & Oversight	\$375,000
<b>Total</b>	<b>\$4,500,000</b>

## 2. Equipment and Supplies for FIC: \$905,541.95

This equipment budget covers the procurement, shipping, and installation of specialized machinery tailored to the unique processing needs of a Tier III Food Innovation Center (FIC). Equipment spans across staple crop, poultry, fish, and community kitchen zones, and includes logistics tools and cold storage. We recognize that in Yap, fishing is slated to be separate from the FIC and to be outfitted into the Yap Fishing Authority facility. Note, there will be some purposeful duplication of equipment in the different Tiers with the most modern, largest capacity and extensive in this Tier III FIC.

In the FIC each room is outfitted with tools that combine **traditional Pacific Island processing techniques** with **modern food safety standards**. All key equipment includes installation support, spare parts, and traceability features to ensure long-term usability and regulatory compliance.

### A. Staple Crop & Vegetable/Fruit Processing

This zone supports the transformation of local staples such as breadfruit, taro, banana, and cassava into shelf-stable forms including chips, flour, and dried fruit.

Key Equipment:

- Produce washer and vegetable cutters (Nilma or Sammic).
- Solar or hybrid dryers for chips and fruit leathers.
- Flour grinder, commercial deep fryer, and chamber vacuum sealer.

- HACCP traceability systems and spare parts kits for uptime.

## B. Poultry Processing

Designed for clean, humane, and HACCP-aligned poultry handling, this room follows a clear “dirty-to-clean” linear flow.

Key Equipment:

- Slaughter cone station, defeathering machine, hot scalding tank.
- Chill tanks, evisceration and cutting tables, poultry saws.
- Vacuum sealing and barcode labeling systems.
- Backup tanks, overhead rail system, and sanitation toolkits.
- Cold storage for eggs

## C. Fish Processing

Built to support both fresh and preserved fish product lines, including traditional salt drying and smoking methods.

Key Equipment:

- Stainless-steel filleting and gutting tables with integrated water jets.
- Fish smokers and drying racks.
- Baader meat separator entry-level deboning unit and freezing tunnel (IQF).
- Salt tanks and hygiene kits for microbial control.

## D. Community Kitchen

This shared-use space enables recipe development, small-scale entrepreneurship, and bulk cooking demonstrations.

Key Equipment:

- Commercial oven, deep fryer, and gas cooktop with hood.
- Planetary mixer, blast chiller, steam kettle or tilt skillet.
- Commercial-grade dishwashing station and warming cabinet.

## E. Storage and Logistics

Essential for product preservation, transportation, and internal movement of goods, this zone supports the cold chain and dry storage systems.

Key Equipment:

- Walk-in cold room, commercial freezers, dry shelving units.
- Food-safe raw material bins, pallet jacks, and delivery coolers.
- Digital humidity and temperature monitoring systems.
- Modular racking systems for efficient layout management.

### **Total Equipment Investment (with Logistics Buffer):**

This total includes:

- Equipment purchase (based on verified vendor quotes)
- Estimated international shipping and customs handling
- Installation and calibration support (where needed)
- Buffer to mitigate unforeseen freight cost escalations

This equipment suite empowers the FIC to operate across multiple product streams (poultry, fish, fruit, and roots) while ensuring compliance with global hygiene standards. Each investment is

strategically chosen to enhance **food sovereignty, small business incubation, and workforce development** across the FSM.

### **Equipment & Supplies for a Tier III FDA-compliant Food Innovation Center in Yap:**

Note: The seafood processing equipment is intended for purchase, installation, and use at the Food Innovation Center (FIC) located within the Yap Fishing Authority facility. In contrast, additional equipment and supplies will be required for the processing, manufacturing, and packaging of all other non-seafood food products. Accordingly, the number of units listed reflects whether the equipment is needed at one or both sites, based on its intended function and placement. In many instances, the same type of equipment and supplies will be necessary at both FIC locations.

<b>Equipment</b>	<b>Price per Unit</b>	<b>Number of Units</b>	<b>Total without Cost Conversion</b>	<b>Total with 1.5x Cost Conversion</b>
<b>Staple Crop Processing Items</b>				
<a href="#">Staple Crop Slicer</a>	1,825.25	1	1,825.25	2,737.88
<a href="#">Flour Mill</a>	1,250.00	3	3,750.00	5,625.00
<b>Coconut Processing Items</b>				
<a href="#">Coconut Water Extractor</a>	2,200.00	1	2,200.00	3,300.00
<a href="#">Coconut Milk Extractor</a>	10,300.00	1	10,300.00	15,450.00
<a href="#">Coconut Sugar Processor</a>	3,500.00	1	3,500.00	5,250.00
<b>Fish &amp; Poultry Processing Items</b>				
<a href="#">Mannlake Scalding with Temp Control</a>	525	2	1,050.00	1,575.00
<a href="#">Fish Fillet Cutter</a>	2,000.00	2	4,000.00	6,000.00
<a href="#">Fish Cleaning, Scaling, Gutting</a>	1,600.00	2	3,200.00	4,800.00
<a href="#">Mainstreet Stainless Steel Floor Fryer</a>	749	2	1,498.00	2,247.00
<a href="#">Stainless Steel Triple Basins</a>	306.15	2	612.3	918.45
<a href="#">Avantco A-49R-HC 54" Reach in Refrigerator</a>	1,949.00	2	3,898.00	5,847.00
<a href="#">Chicken Feed (Streamline)</a>	2,500.00	1	2,500.00	3,750.00
<a href="#">Chicken Feed Production Line</a>	5,500.00	1	5,500.00	8,250.00
<a href="#">Feed Pellet Packager</a>	2,000.00	1	2,000.00	3,000.00

<a href="#">Robot Coupe R702VV 2 Continuous Feed Food Processor</a>	6,011.00	1	6,011.00	9,016.50
General Tier-III				
<a href="#">Tabletop Impulse Sealer - 20"</a>	200	2	400	600
<a href="#">Verticle Band Sealer</a>	890	2	1,780.00	2,670.00
<a href="#">Double Chamber Vacuum Packaging Machine</a>	4,000.00	1	4,000.00	6,000.00
<a href="#">Dehydrator Dryer</a>	22,600.00	1	22,600.00	33,900.00
<a href="#">Solar powered Cold Room</a>	10,000.00	2	20,000.00	30,000.00
<a href="#">Ventilated Stack and Nest Container</a>	24	50	1,200.00	1,800.00
<a href="#">Stainless Steel Worktables</a>	575.00	5	2,875.00	4,312.50
Food Safety Testing Checklist				
Food Safety Testing Supplies				300,000
<a href="#">Culture Plates</a>				0
<a href="#">Thermopen Thermometer</a>	299	1	299	448.5
<a href="#">Water Activity meter (Aquameter)</a>				0
<a href="#">Hygine monitor and Management system</a>	1,000.00	1		0
<a href="#">High sensitivity Allergen Tester</a>	284.65	1	284.65	426.98
<a href="#">Hand held temp adjusted Refractometer</a>	260	4	1,040.00	1,560.00
<a href="#">Thermometer Calibrator (4 point hot/cold)</a>	1,592.12	1	1,592.12	2,388.18
Bench-top refractometer	3,000.00	1	3,000.00	4,500.00
pH meter (with calibration kit)	2,500.00	1	2,500.00	3,750.00
Thermometers (digital + infrared)	300	2	600	900
Water Activity Meter and Moisture Meter	3,000.00	2	6,000.00	9,000.00
<a href="#">Check-Set IV Cold/Hot Calibrator</a>	1,592.12	2	3,184.24	4,776.36
<a href="#">AP550 Flat-Surface Label Applicator</a>	2,395.00	2	4,790.00	7,185.00
<a href="#">AP380 Label Applicator</a>	1,595.00	2	3,190.00	4,785.00
<a href="#">PL400 Pouch Labeler</a>	1,595.00	2	3,190.00	4,785.00
<a href="#">Barcode Thermal Ribbons</a>	56	2	112	168

<a href="#">Barcode Scanner L13687</a>	1,025.00	2	2,050.00	3,075.00
<a href="#">Barcode software</a>	790	2	1,580.00	2,370.00
<a href="#">Zebra ZQ511 Mobile Receipt Printer</a>	840	2	1,680.00	2,520.00
<a href="#">Zebra ZT620 industrial Barcode Printer</a>	6,200.00	1	6,200.00	9,300.00
Safety Equipment				
<a href="#">Porta Stream II Eyewash station</a>	460	6	2,760.00	4,140.00
<a href="#">Saline Concentrate Refill</a>	100	20	2,000.00	3,000.00
<a href="#">Dust Cover</a>	52	6	312	468
<a href="#">S Carton Uline Industrial Latex Gloves</a>	26	20	520	780
<a href="#">M Carton Uline Industrial Latex Gloves</a>	14	20	280	420
<a href="#">L Carton Uline Industrial Latex Gloves</a>	19	20	380	570
<a href="#">Class A First Aid Kits</a>	67	10	670	1,005.00
<a href="#">Class B First Aid Kits</a>	155	10	1,550.00	2,325.00
<a href="#">Class B+ First Aid Kits</a>	395	10	3,950.00	5,925.00
<a href="#">Uline Ice Wraparound Fog Armor Dispenser box</a>	94	4	376	564
<a href="#">3M Construction Harness</a>	185	4	740	1,110.00
<a href="#">Carton Polyethylene Apron</a>	22	12	264	396
<a href="#">Multi compartment Stainless Steel Dispensers</a>	250	6	1,500.00	2,250.00
Canning and Pickling Equipment				
<a href="#">Canner Aluminum Bath water Canner</a>	269.99	2	539.98	809.97
<a href="#">30 Gallon Large Round Canner</a>	1,451.25	1	1,451.25	2,176.88
Case <a href="#">Wide Mouth Ball Glass Mason Jars 32 oz</a>	16.44	100	1,644.00	2,466.00
10 Gallon <a href="#">Fermentation Crock</a>	199.99	2	399.98	599.97
<a href="#">Fermentation Weights</a>	43.97	20	879.4	1,319.10
<a href="#">Fermentation lid cloth covers</a>	13.93	25	348.25	522.38
<a href="#">Potable Aqua Water Purification Tabs with PA plus</a>	12.99	50	649.5	974.25
<a href="#">Stainless Steel Funnel</a>	10.49	10	104.9	157.35
<a href="#">11.5 Qt Canning Rack</a>	8.49	10	84.9	127.35
Additional Equipment				

<a href="#">Nilma Veg Wash</a>	4,000.00	1	4,000.00	6,000.00
<a href="#">Floor Frier Rig</a>	1,600.00	1	1,600.00	2,400.00
<a href="#">Semi Automatic Bucket Conveyor Pouch filling and sealing machine</a>	9,599.00	1	9,599.00	14,398.50
Chicken Processing Rig (Feathering, scalding, cooling and cone)	6,000.00	1	6,000.00	9,000.00
<a href="#">Slaughtering Table</a>	425	4	1,700.00	2,550.00
<a href="#">Vertical Electric Liquid and Paste Water bottle filling machine</a>	1,750.00	1	1,750.00	2,625.00
Butchers Table	1,000.00	6	6,000.00	9,000.00
<a href="#">Poultry cutting saw</a>	2,631.00	1	2,631.00	3,946.50
<a href="#">Cookshack SM360 Smoker Oven</a>	13,490.00	1	13,490.00	20,235.00
<a href="#">Oven and range 72"</a>	15,293.00	1	15,293.00	22,939.50
<a href="#">176lb Floor Electric Mixer</a>	7,123.00	1	7,123.00	10,684.50
<a href="#">Heavy DUty Steel shelving 96 x 24 x 72"</a>	1,445.00	10	14,450.00	21,675.00
Information Hub				
Mobile Platform app				0
<a href="#">Samsung 4TB SSD Hard drives</a>	439.99	5	2,199.95	3,299.93
Website				0
<a href="#">Dell Inspiron 27' All in one cpu</a>	1,189.98	2	2,379.96	3,569.94
<a href="#">4 Person L Desk Work station</a>	3,210.00	2	6,420.00	9,630.00
<a href="#">LG smart TV</a>	299	2	598	897
<a href="#">Norton Anti virus software</a>	19.99	2	39.98	59.97
<a href="#">Mesh Task Chairs</a>	165	12	1,980.00	2,970.00
<a href="#">Downtown conference tables (Powered) 192 x 48"</a>	1,560.00	2	3,120.00	4,680.00
<a href="#">Portable Projector Screen 107"</a>	525	2	1,050.00	1,575.00
<a href="#">Wall monitor Mount</a>	95	2	190	285
Kitchen Supplies				
<a href="#">Mobile ingredient bins</a>	343	5	1,715.00	2,572.50

<a href="#">Self ingredient Bin 200 cups</a>	243	5	1,215.00	1,822.50
<a href="#">Baking Pan</a>	216	5	1,080.00	1,620.00
<a href="#">Wire Grate</a>	168	5	840	1,260.00
<a href="#">Cambro Dish Racks</a>	42	5	210	315
<a href="#">Cambro Glass Racks</a>	80	5	400	600
<a href="#">Pan Dolly</a>	305	5	1,525.00	2,287.50
<a href="#">Uline Trash Cans</a>	74	5	370	555
<a href="#">Uline Trash can lids</a>	29	5	145	217.5
<a href="#">Biohazard Step On Waste Can</a>	131	6	786	1,179.00
<a href="#">Uline Thin trash can 23G</a>	45	6	270	405
<a href="#">Rubbermaid Slim Jim Lid Can/bottle</a>	52	5	260	390
<a href="#">Rubbermaid Slim Jim Lid paper</a>	52	5	260	390
<a href="#">Rubbermaid Slim Jim Swing top</a>	51	5	255	382.5
<a href="#">Stainless Dollie</a>	135	5	675	1,012.50
<a href="#">Handsfree Trash Can 55G</a>	255	6	1,530.00	2,295.00
<a href="#">Outdoor Landmark Series Trash Can Dome top 50G</a>	970	6	5,820.00	8,730.00
<a href="#">Fork liftable Transport tilt truck</a>	2,505.00	5	12,525.00	18,787.50
<a href="#">Hydraulic Platform Stacker</a>	2,695.00	5	13,475.00	20,212.50
<a href="#">130km low speed new energy double cab mini pick up truck</a>	9,999.00	5	49,995.00	74,992.50
<a href="#">Commercial Cutting Board</a>	152	10	1,520.00	2,280.00
<a href="#">Commercial Mixing 3qt</a>	62	6	372	558
<a href="#">Commercial Mixing 5qt</a>	89	6	534	801
<a href="#">Commercial Mixing 8qt</a>	125	6	750	1,125.00
<a href="#">Commercial Mixing 13qt</a>	94	6	564	846
<a href="#">Commercial Mixing 20qt</a>	150	6	900	1,350.00
<a href="#">Stainless Steel Steam Table Pans 3qt</a>	150	6	900	1,350.00
<a href="#">Stainless Steel Steam Table Pans 6qt</a>	250	6	1,500.00	2,250.00

<a href="#">Stainless Steel Steam Table Pans 10qt</a>	150	6	900	1,350.00
<a href="#">Stainless Steel Steam Table Pans 14qt</a>	175	6	1,050.00	1,575.00
<a href="#">Stainless Steam Table Pan Lids 1/6</a>	55	6	330	495
<a href="#">Stainless Steam Table Pan Lids 1/3</a>	85	6	510	765
<a href="#">Stainless Steam Table Pan Lids 1/2</a>	110	6	660	990
<a href="#">Stainless Steam Table Pan Lids Full</a>	205	6	1,230.00	1,845.00
<a href="#">Stainless Steel Scoops 8oz</a>	69	6	414	621
<a href="#">Stainless Steel Scoops 16oz</a>	75	6	450	675
<a href="#">Stainless Steel Scoops 32oz</a>	80	6	480	720
<a href="#">Stainless Steel Scoops 64oz</a>	86	6	516	774
<a href="#">Stainless Steel Scoops 96oz</a>	114	6	684	1,026.00
<a href="#">Stainless Steel Scoops 128oz</a>	122	6	732	1,098.00
<a href="#">Stainless Steel Scoops 160oz</a>	134	6	804	1,206.00
<a href="#">Stainless Steel Mixing Paddles 48"</a>	35	5	175	262.5
<a href="#">Mixing Polypropylene Paddles 40"</a>	65	5	325	487.5
<a href="#">Mixing Polypropylene Paddles 52"</a>	72	5	360	540
<a href="#">Hand Scraper 3 x 8"</a>	7	10	70	105
<a href="#">Hand Scraper 4 x 9"</a>	8	10	80	120
<a href="#">Stainless steel paper cutter 36"</a>	163	4	652	978
<a href="#">Unbleached Paper rolls 36"</a>	81	6	486	729
<a href="#">Handheld Induction Sealer and Caps</a>	340	5	1,700.00	2,550.00
<a href="#">Clear Straight-sided Glass jars with metal cap 8oz</a>	40.8	5	204	306

<a href="#">Clear Straight-sided Glass jars with metal cap 16oz</a>	54.6	5	273	409.5
<a href="#">Clear Straight-sided Glass jars with metal cap 32oz</a>	64.8	5	324	486
<a href="#">Amber Straight-Sided Glass Jars with Metal Cap 8oz</a>	40.8	5	204	306
<a href="#">Case Standard Glass Canning Jars 8oz</a>	14.4	5	72	108
<a href="#">Case Standard Glass Canning Jars 16oz</a>	18	5	90	135
<a href="#">Case Standard Glass Canning Jars 24oz</a>	20.4	5	102	153
<a href="#">Case Standard Glass Canning Jars 32oz</a>	22.8	5	114	171
<a href="#">Case Replacement Standard Canning Jar Lids</a>	81	5	405	607.5
<a href="#">Case Glass Spice Jars 2oz</a>	48	5	240	360
<a href="#">Case Glass Spice Jars 4oz</a>	27.6	5	138	207
<a href="#">Case Glass Spice Jars 8oz</a>	15.6	5	78	117
<a href="#">Case Glass Spice Jars 16oz</a>	18.6	5	93	139.5
<a href="#">Case Cubitainers</a>	60	5	300	450
<a href="#">Case of Square Utility Jugs</a>	34.2	5	171	256.5
<a href="#">Jug Pump</a>	10.5	5	52.5	78.75
<a href="#">Chemical Resistant Spray Bottles</a>	25.5	5	127.5	191.25
<a href="#">Case Replacement nozzles</a>	17.25	5	86.25	129.38
<a href="#">Bundle Egg Cartons</a>	90	10	900	1,350.00
<a href="#">Egg Filler Flat Case</a>	42	10	420	630
<a href="#">Williams Sonoma Prep Tools 15 Piece Gadget and Utensils Set</a>	279.95	5	1,399.75	2,099.63
<a href="#">Berry Basket</a>	75	5	375	562.5
Lab Ware				

<a href="#">Case Graduated Glass Dropper Bottles 1/2 oz</a>	48	5	240	360
<a href="#">Case Graduated Glass Dropper Bottles 1oz</a>	50.4	5	252	378
<a href="#">Case Graduated Glass Dropper Bottles 2 oz</a>	28.8	5	144	216
<a href="#">Case Graduated Glass Dropper Bottles 4oz</a>	33.6	5	168	252
<a href="#">Case Glass Beakers 100ml</a>	31	5	155	232.5
<a href="#">Case Glass Beakers 250ml</a>	40	5	200	300
<a href="#">Case Glass Beakers 400ml</a>	27	5	135	202.5
<a href="#">Case Glass Beakers 1,000 ml</a>	58	5	290	435
<a href="#">Case Test Tubes 8ml</a>	40	5	200	300
<a href="#">Case Test Tubes 16ml</a>	62	5	310	465
<a href="#">Case Test Tubes 25ml</a>	67	5	335	502.5
<a href="#">Case Test Tubes 50ml</a>	94	5	470	705
<a href="#">Test tube racks 13mm</a>	22	5	110	165
<a href="#">Test tube racks 16mm</a>	22	5	110	165
<a href="#">Test tube racks 20mm</a>	22	5	110	165
<a href="#">Test tube racks 25mm</a>	22	5	110	165
<a href="#">Glass Graduated Cylinders 10ml</a>	24	10	240	360
<a href="#">Glass Graduated Cylinders 25ml</a>	30	10	300	450
<a href="#">Glass Graduated Cylinders 50ml</a>	23	10	230	345
<a href="#">Glass Graduated Cylinders 100ml</a>	38	10	380	570
<a href="#">2" x 250' Parafilm M Lab Film</a>	44	5	220	330
<a href="#">4" x 125' Parafilm M Lab Film</a>	44	5	220	330
<a href="#">Case Whirl-Pak bags 2oz</a>	98	10	980	1,470.00
<a href="#">Case Whirl-Pak bags 4oz</a>	100	10	1,000.00	1,500.00
<a href="#">Case Whirl-Pak bags 18oz</a>	139	10	1,390.00	2,085.00

<a href="#">Case Whirl-Pak bags 24oz</a>	184	10	1,840.00	2,760.00
<a href="#">Case Whirl-Pak bags 69oz</a>	318	10	3,180.00	4,770.00
<a href="#">Pack Weighing Dishes (Aluminum) 20ml</a>	15	10	150	225
<a href="#">Pack Weighing Dishes (Aluminum) 40ml</a>	17	10	170	255
<a href="#">Pack Weighing Dishes (Aluminum) 80ml</a>	21	10	210	315
<a href="#">Safety wash bottles 500ml</a>	54	6	324	486
<a href="#">Safety Wash bottles 1,000ml</a>	64	6	384	576
<a href="#">Case Transfer Pipettes 3ml</a>	32	10	320	480
<a href="#">Case Transfer Pipettes 5ml</a>	32	10	320	480
<a href="#">Case Transfer Pipettes 7ml</a>	32	10	320	480
<b>Total Cost</b>				<b>905,541.95</b>

### 3. Administration, Training, and R&D: \$90,000

This component ensures that the Food Innovation Center (FIC) is not only a food processing hub, but also a functioning administrative, scientific, and educational facility. It supports reliable facility operations, digital coordination, quality assurance, and capacity building. Budget account for **importation of IT equipment, lab devices, and training technologies**, all of which are expensive to ship, set up, and maintain in Yap’s remote context.

#### A. Administrative Office – \$22,000

This 300 sq ft office will serve as the FIC's operational command center.

Key Components:

- Desks, chairs, and cabinets crafted locally (where possible) from coconut timber and bamboo, supplemented with imported ergonomic seating and filing systems.
- One laptop and one desktop (imported with surge protectors and extended warranties), along with a multi-function printer/scanner and wireless router.
- Dry-erase boards, inventory shelving, secure records cabinets, and visual planning boards.
- One split-unit AC and fans for humidity control—shipped in and professionally installed.

Increased costs reflect **air-freight of electronics**, furniture reinforcement for tropical humidity, and **backup components** to avoid downtime.

## B. Research and Development Laboratory – \$30,000

The R&D lab will occupy 150–200 sq ft and focus on food quality, safety, and new product development.

Key Equipment:

- Stainless-steel wash benches and sealed sinks (imported and corrosion-resistant).
- Microscope, incubators, moisture analyzers, and pH testing kits.
- Seal integrity testers and media for microbiological and shelf-life assessments.
- Lockable cold storage for reagent and sample integrity.
- PPE kits, fire extinguisher, and eyewash station.

All scientific instruments are assumed to be **imported from certified vendors**, with associated freight, calibration kits, and training for local staff.

## C. Training Room – \$13,000

This 12-person training room will host food safety, agribusiness, and entrepreneurship sessions.

Includes:

- Digital projector with retractable screen and multimedia input (HDMI, USB).
- Modular seating (some locally sourced, some imported) and cultural flexibility (pandanus mats, circle setups).
- Whiteboards, flip charts, and HACCP training posters.
- Lockable training kit cabinet and instructor desk.
- Ceiling fans and screened windows; optional outdoor annex area.

Cost reflects **shipping of AV tech and display equipment**, plus freight packaging for training kits. There will be an outdoor area extension adjacent to the building facility also designed for training and teaching and which can be used for product drop-off, but whereas that only requires a cement floor and traditional roof, separate costs not described but it would be embedded in building costs and design.

## D. Office Supplies & IT Infrastructure – \$25,000

This component enables day-to-day digital operations and ensures online traceability, compliance reporting, and coordination.

Inclusions:

- Two computers (one desktop, one rugged laptop), color printer, two routers.
- Satellite uplink or high-power mobile hotspot for remote island connectivity.
- Subscriptions to cloud-based inventory and HACCP platforms (e.g., OneDrive, Google Workspace, FoodReady).
- Office setup: UPS/power backups, stationery, binders, laminators, and tech support for setup.

Cost increase accounts for **connectivity upgrades, secure networking, and spare parts** to reduce downtime in areas with no IT vendors.

**Total for Section 3: \$90,000**

<b>Component</b>	<b>Cost</b>
A. Administrative Office	\$22,000
B. R&D Laboratory	\$30,000
C. Training Room	\$13,000
D. Office Supplies & IT Systems	\$25,000
<b>Total</b>	<b>\$90,000</b>

#### 4. Operational Readiness and Sustainability: \$185,000

This budget line ensures the Tier III FIC is not only constructed and equipped, but also staffed, supplied, and fully operational from the outset. The increase reflects **actual costs of launching a food facility in a remote island setting**, including freight-heavy input procurement, importing safety and training tools, utility surcharges, and bridging early cash flow gaps before local revenue stabilizes.

##### A. Initial Inventory (Raw Materials) – \$50,000

Start-up inventory must be sufficient for **test runs, staff training, product prototyping, and outreach events**. This inventory enables hands-on learning and early processing capacity.

Includes:

- Bulk purchase of vegetables and fruits: breadfruit, taro, sweet potato, cassava, banana, mango, coconut, etc.
- Poultry: local and regional sourcing of chickens for slaughter, packaging, and chilling tests.
- Fish: reef fish, tuna, and dried/salted fish inputs for fish room startup.
- Essential packaging: heat-sealable pouches, vacuum bags, PET bottles, labels, and cartons (mostly imported).
- Oil, spices, and salt for food prep during training runs and demos.
- Packaging supplies, labels, other local foods.

Cost accounts for **importing shelf-stable ingredients and packaging**, some of which are not available locally, and delivery to outer islands if needed.

##### B. Training and Staffing – \$95,000

Given FSM’s limited pool of food-safe processing specialists, additional funds are required to **recruit, train, and retain skilled staff**, as well as **import qualified trainers** for the startup phase.

Includes:

- Salaries for 6–8 months: operations manager, food technologist, sanitation worker, maintenance technician, and administrative/training assistant.

- Onboarding training from certified HACCP instructors (remote or regional).
- In-person or remote machine operation training from vendors (vacuum sealer, fryer, freezer, etc.).
- Bilingual training materials (video and print), culturally adapted for Yap.
- “Train-the-trainer” sessions to enable local continuity.

Budget also allows for **travel stipends or honoraria** for visiting trainers from Guam, Hawaii, or Philippines and/or other places as well as remote Zoom-based modules with supplemental hands-on days.

### C. Utilities and Operating Costs (Year 1) – \$40,000

Some utility costs are reduced due to **passive ventilation, solar integration, and CoolBot cold rooms**, but other cost components remain high due to:

- Importation of cleaning supplies,
- Generator fuel and maintenance, and
- Lack of public utility subsidies.

Includes:

- Electricity (generator fuel, solar integration, grid use where available).
- Water (potable and sanitation), plus greywater and wastewater disposal.
- Weekly deep cleaning, daily detergent/sanitizer supply, PPE restocking.
- Pest control, light maintenance, and minor replacements.
- Internet, phone service, and domain/hosting for a basic outreach site.

This amount is sufficient to keep the facility functional while operational revenues ramp up.

#### **Total for Section 4: \$185,000**

<b>Component</b>	<b>Cost</b>
A. Initial Inventory (Raw Materials)	\$50,000
B. Training and Staffing	\$95,000
C. Utilities and Operations (Year 1)	\$40,000
<b>Total</b>	<b>\$185,000</b>

### 5. Contingency Fund: \$75,000

To ensure the successful execution and uninterrupted progress of the Tier III Food Innovation Center (FIC), a contingency reserve of **\$75,000**—equivalent to approximately **6–7 percent of the total project cost**—has been allocated. This fund provides the flexibility and responsiveness needed to manage **unexpected cost escalations, delays, and infrastructure challenges** that are common in FSM’s remote and import-dependent setting.

#### **Rationale and Use:**

Contingency planning is essential in Pacific Island development, where shipping reliability, fuel volatility, skilled labor access, and weather unpredictability create frequent disruptions. This fund ensures that unforeseen issues can be addressed **without compromising key milestones or scaling back scope**.

**Examples of Use Cases:**

- **Construction-related variability:** Sudden price increases in cement, rebar, epoxy flooring, or steel framing due to global supply chain fluctuations, especially for materials shipped via Guam, Hawaii, or Philippines.
- **Shipping disruptions:** Extra costs for equipment re-routing, offloading delays, or container storage fees at FSM ports due to congestion or barge cancellations.
- **Installation challenges:** Unforeseen adaptations required to fit imported machinery into localized electrical, spatial, or ventilation configurations—often requiring custom retrofits or technician callouts.
- **Weather-related delays:** Tropical storms and flooding that stall labor mobilization, damage materials, or delay shipping, necessitating rescheduling or repairs.
- **Start-up bridging needs:** Temporary staff extension, additional generator rental, urgent replacement of a key part, or delayed subsidy disbursement from partners or government.

**Governance and Oversight:**

All disbursements from the contingency fund will be tracked and documented by the project finance team. Approval will require justification from the facility manager and clearance by the project steering committee or designated oversight board. If funds remain unused at the end of construction/start-up, they may be strategically reallocated to **staff development, food safety certifications, equipment upgrades and/or other needed purchases and unexpected costs**.

## B. Yap State Tier II Food Innovation Facilities (FIF) proposed to be built/renovated at Kanifay Elementary and Tamil Elementary.

B. FIFs Tier II Total Cost: \$2,724,070 (2,250,000 + 351,570 + 30,000 + 92,500)

**Yap State is proposing two FIFs at the Tier II level, proposed at costs of \$450/sq ft for two 2,500 sq ft facilities. Total cost for each would be \$1,125,000 (US). Thus, 2 such regional FIF's = \$2,250,000.**

### **Budget Narrative:**

#### 1. Construction and Infrastructure: \$1,125,000/each Tier II FIF.

This estimate reflects the cost of constructing a 2,500 square foot Tier II Food Innovation Facility (FIF) in Yap, using a benchmark rate of **\$450 per square foot**, aligned with FDA-compliant food-grade facility standards. The estimate includes imported materials, skilled labor, refrigeration, sanitary systems, climate resilience design, and project management.

##### A. Foundation and Structural Works – \$461,250

This component covers all civil works and vertical construction activities required to develop a fully enclosed, climate-resilient, food-safe structure. It reflects the reality of building in a remote Pacific Island context, where nearly all inputs—gravel, sand, cement, steel, skilled labor—must be imported and staged via complex logistics.

##### *1. Site Preparation and Slab Work – \$143,750*

- **Land clearing, grading, and compacting:** Using imported equipment or locally leased machinery.
- **Sub-base and reinforcement:** Placement of imported gravel, sand, and geotextiles to stabilize the ground and prevent moisture seepage.
- **Reinforced concrete slab:** 6-inch industrial-grade poured slab with rebar mesh, designed to withstand heavy food processing equipment and resist erosion in high-humidity conditions.
- **Drainage design:** Sub-slab slope for floor drains and integration with underground graywater or septic systems.
- **Shipping surcharges:** Includes shipping fees for over 600 tons of construction-grade aggregate and cement, plus demurrage and stevedoring costs at FSM ports.

##### *2. Structural Framing and Envelope – \$187,500*

- **Main steel frame and columns:** Galvanized steel I-beams and tubular trusses prefabricated offshore and shipped for on-site assembly.
- **Roof framing and support:** Trussed rafters designed to withstand cyclonic wind loads and intense rainfall.
- **Exterior and internal framing:** Combination of steel studs and treated timber (coconut or imported hardwood) for interior non-load-bearing partitions.

- **Anchoring and wind resistance:** Bolted foundations and hurricane ties installed to meet regional engineering codes.

### 3. Roofing System – \$62,500

- **Galvanized corrugated steel panels:** Durable and rust-resistant, with Class A fire rating.
- **Radiant insulation barrier and vapor shield:** Reduces heat transmission and protects indoor equipment from condensation.
- **Rainwater management:** Full guttering, downspouts, and cistern integration for rainwater harvesting.
- **Roof overhangs and soffits:** Provide passive shading and minimize wall exposure to driving rain.

### 4. Loading Bay and Exterior Finishes – \$42,500

- **Receiving and dispatch area:** Concrete apron with covered roof, sufficient for pallet delivery and product transfer.
- **Driveway grading and compaction:** Access for delivery trucks and service vehicles, including slope stabilization.
- **Exterior wall finishes:** Cement-rendered block or insulated sandwich panel siding, painted with mold-resistant, food-safe coatings.
- **Security features:** Exterior lighting, metal mesh window screens, and heavy-duty steel doors at delivery and emergency exits.

### 5. Construction Logistics and Material Handling – \$25,000

- **Crane rental and offloading services:** For handling prefabricated steel frames, HVAC units, and refrigeration modules.
- **Storage containers and on-site warehousing:** For securing equipment and materials over the multi-month build timeline.
- **Inter-island transport and labor mobilization:** Includes barge charters or airlift of specialized tools, generators, and technical staff.
- **Customs brokerage and insurance:** Required for high-value material imports and in-transit construction components.

This section ensures the physical backbone of the FIC is built to international food facility standards while addressing the climate, labor, and infrastructure challenges of the FSM context.

## B. Plumbing and Electrical Systems – \$178,750

This component ensures that the facility is hygienically operable, energy-resilient, and food-safety compliant. In a tropical, infrastructure-limited environment like FSM, plumbing and electrical systems must be both robust and adaptable to accommodate supply interruptions, high humidity, and heavy sanitation needs. The budget reflects full importation of components, installation labor, and contingency allowances.

### 1. Potable Water and Sanitation Systems – \$77,500

- **Facility-wide potable water lines:** Food-grade PEX or CPVC piping installed across all processing, storage, restroom, and office areas.
- **Dedicated hand-wash stations:** Minimum of two per processing room, equipped with foot- or elbow-operated faucets and paper towel dispensers.
- **Triple-compartment sinks:** Installed in the community kitchen, R&D lab, and sanitation zones for proper utensil and container cleaning.

- **Grease traps and floor drainage:** Stainless steel grease interceptors and epoxy-lined floor drains with proper slope, fully integrated into a graywater system.
- **Rainwater catchment and storage system:** Gutter-fed cisterns with basic filtration and UV or chlorination options for non-potable uses.
- **Septic system:** Onsite waste treatment facility designed to manage high volumes of wastewater from food processing and cleaning.

#### 2. *Electrical Distribution and Food-Safety Power Design – \$65,000*

- **Dedicated circuits for critical equipment:** Cold storage rooms, vacuum sealers, and dryers receive prioritized, isolated feeds with voltage stabilizers.
- **Processing zone separation:** Each room has its own electrical sub-panel to prevent overloads and simplify maintenance.
- **Food-safe electrical finishes:** All conduits, outlets, and panels sealed and moisture-protected; splash guards installed in wet zones.
- **LED lighting:** High-efficiency, shatterproof lighting installed throughout, with extra-lumen levels in food-prep zones for visibility and inspection.
- **Emergency lighting and signage:** Includes battery backups and illuminated exit signs compliant with international food facility codes.

#### 3. *Generator Interface and Solar Integration – \$26,250*

- **Backup generator system:** 50–80 kW diesel generator, housed in a sound-proof, weather-protected shelter.
- **Automatic transfer switch (ATS):** Enables seamless power transition to maintain cold chain and IT systems during outages.
- **Solar-ready conduits and interface controls:** Pre-wired for rooftop solar PV installation in Phase 2 or by external donor.
- **Battery/inverter compatibility:** Built-in panels for future integration of lithium-ion or lead-acid battery bank.

#### 4. *Fire Suppression and Safety Systems – \$10,000*

- **Commercial hood-integrated fire suppression:** Automatic release systems in the community kitchen and poultry/fish areas.
- **Wall-mounted extinguishers and alarms:** Dry chemical and CO2 extinguishers located every 75 feet, with training provided to staff.
- **Electrical grounding and lightning arrestors:** Protection against tropical storm surges and high humidity-induced shorting.
- **Safety signage and PPE storage:** Clearly marked zones for evacuation, spill kits, gloves, eyewash stations, and emergency supplies.

This section ensures that water, sanitation, energy, and safety systems support uninterrupted, compliant operations even in the face of grid instability, high temperatures, or equipment-intensive processing. All specifications align with HACCP and Codex Alimentarius standards for food processing environments.

### C. Interior Finishing – \$156,250

This component ensures the internal spaces of the Food Innovation Center (FIC) meet rigorous global food safety standards for hygiene, durability, cleanability, and pest exclusion. All materials are selected to withstand heavy use in tropical conditions and to comply with HACCP,

USDA, and Codex food processing guidelines. The budget accounts for full importation, specialized labor, and climate-adapted design.

*1. Hygienic Wall Systems – \$56,250*

- **FRP (Fiberglass Reinforced Plastic) panels:** Installed in all wet zones (fish, poultry, kitchen, sanitation rooms). These are mold-resistant, chemical-tolerant, and easy to sanitize.
- **Food-safe epoxy wall coatings:** Applied in dry processing areas, office, training, and storage rooms. Includes antimicrobial additives and glossy finishes for better visibility of contaminants.
- **Corner guards and coving:** Seamless transitions between wall and floor surfaces to eliminate cleaning blind spots.

*2. Epoxy-Coated Flooring with Integrated Drainage – \$43,750*

- **High-performance epoxy coatings:** Non-slip and chemical-resistant floors in all rooms. Built to withstand heavy foot traffic, water exposure, and equipment movement.
- **Anti-microbial aggregates:** Added to reduce pathogen accumulation and improve grip in wash-down areas.
- **Drainage design:** Precision sloped floors with integrated stainless steel trench drains in fish, poultry, and kitchen areas to prevent standing water.
- **Expansion joints and water barriers:** Prevent cracking due to humidity or frequent washdowns.

*3. Pest-Sealed Ceiling Systems – \$25,000*

- **Waterproof, seamless ceiling panels:** Installed in food prep and storage rooms. Panels are joint-minimized to prevent insect nesting.
- **Reinforced ceiling insulation:** Includes moisture barriers to prevent condensation and mold growth.
- **Rodent- and insect-proof seals:** All ceiling fixtures and ventilation penetrations are sealed with food-safe silicone and mesh barriers.
- **Access hatches for maintenance:** Secure and gasketed to avoid open voids or entry points for pests.

*4. Internal Partitions, Doors, and Zoning – \$18,750*

- **Clean-to-dirty workflow zoning:** Installation of partitions that guide hygienic workflow from raw to finished products.
- **Airtight doors with gaskets:** Stainless steel or PVC-coated food-grade doors for processing rooms.
- **Observation windows and light panels:** In staff training rooms and kitchens to monitor activity while maintaining sanitary barriers.
- **Magnetic hold-open systems:** Hands-free functionality for frequently trafficked doors.

*5. Fixtures, Restroom Finishes, and Food-Safe Cabinetry – \$12,500*

- **Restroom fixtures:** Water-saving flush toilets, urinals, foot-operated sinks, hand dryers, and changing stations for sanitation team.
- **Stainless steel cabinetry:** Installed in R&D, kitchen, and sanitation rooms to hold small tools, PPE, and ingredients.
- **Lockable storage units:** For chemical storage and sensitive paperwork, including compliance binders and traceability records.

- **Public area finishes:** Non-toxic paints, window screens, and signage throughout administrative and training areas.

The interior finish package enables the FIC to meet global export-grade hygiene requirements while withstanding Micronesia’s high-humidity, salt-exposed environment. Every surface is designed for durability, pest control, and efficient sanitation—ensuring safe, long-term functionality of the facility.

## D. Refrigeration and Ventilation – \$235,000

This budget line ensures the Tier II Food Innovation Facilities (FIFs) maintain robust cold-chain integrity and optimal air quality throughout the facility. Given FSM’s tropical climate and the high perishability of products like fish, poultry, and fresh produce, this investment supports modern, energy-efficient systems designed for resilience, food safety, and operational continuity.

### 1. Cold Storage Systems – \$120,000

- **Walk-in Coolers and Freezers:**  
Two commercial-grade walk-in units (one freezer, one cooler) with polyurethane insulated panels, heavy-duty gaskets, and digital controllers. Includes stainless steel shelving for product separation and food-safe floors with internal drainage.
- **Hybrid CoolBot Cold Rooms:**  
Two insulated rooms fitted with CoolBot technology and high-BTU window A/C units. These serve as backup storage or specialized cold zones (e.g., for R&D samples, short-term harvest holding).
- **IQF (Individual Quick Freezing) System:**  
Entry-level IQF tunnel for rapid freezing of fish fillets or fruits, preserving quality and extending shelf life for local and export markets.
- **Battery-Logged Temperature Monitoring:**  
Networked temperature loggers with cloud-based dashboards for all cold units, meeting HACCP traceability requirements.

### 2. Ventilation and Odor Control Systems – \$62,500

- **Commercial Exhaust Hoods:**  
Installed over fryers, cooktops, and poultry/fish cleaning areas. Equipped with stainless steel grease filters and integrated fire suppression nozzles in kitchen and poultry zones.
- **Cross-Ventilation Design:**  
High-capacity ceiling and wall-mounted fans in staple crop and dry storage areas to promote airflow and reduce spoilage risk due to trapped humidity.
- **Dehumidifiers and Air Scrubbers:**  
Dehumidification units in fish, poultry, and storage rooms to control microbial growth and odor. Activated carbon scrubbers and UV treatment options to maintain air purity and mitigate off-gassing from processing.
- **Zonal Pressure Management:**  
Negative pressure maintained in poultry and fish rooms to contain contaminants, while clean areas (packaging, admin) maintain positive pressure to prevent ingress of airborne particles.

### 3. Thermal Efficiency and Backup Systems – \$52,500

- **Solar Integration Readiness:**  
Cold room compressors and ventilation systems pre-wired for solar or hybrid solar-diesel power. Rooftop structures accommodate future PV panel installation.
- **Insulation Upgrades:**  
Cold storage rooms and processing zones fitted with high-R insulation in walls and roofs, reflective foil barriers, and thermal gap seals around doorways to minimize energy loss.
- **Backup Generators and Switchgear:**  
One dedicated 25–30 kVA diesel generator with auto-transfer switch for all cold storage units, plus portable generator for partial facility backup.
- **Thermal Curtains and Air Locks:**  
Installed at cooler/freezer doorways to prevent temperature shock during frequent opening, improving energy efficiency and food safety.

Together, these refrigeration and ventilation systems enable the FIFs to maintain cold chain standards essential for international food certification and local distribution reliability. With redundancy, modularity, and energy-aware design, the facility will operate year-round with minimal product loss—even in FSM’s challenging tropical environment.

### E. On-Site Project Management and Technical Oversight – \$93,750

This component ensures the Food Innovation Facilities are constructed and commissioned according to international food facility standards, especially those aligned with U.S. FDA requirements, while also adapting effectively to the construction challenges unique to the Federated States of Micronesia (FSM).

#### 1. Full-Time Construction Manager – \$50,0000

A dedicated, on-site construction manager will oversee all phases of the build from ground-breaking to commissioning.

Key responsibilities include:

- Day-to-day supervision of construction crews and subcontractors
- Ensuring compliance with design blueprints, safety protocols, and scheduling milestones
- Managing procurement timing, deliveries, and storage of imported materials
- Problem-solving in real-time to address site conditions, weather delays, or logistical disruptions
- Coordinating across plumbing, electrical, refrigeration, and finishing subcontractors to avoid delays or scope conflicts
- Providing regular reporting to the project team and funders on progress and risk

#### Cost includes:

- Monthly professional fee for 12 months
- Travel from a regional hub or the U.S. mainland
- Temporary housing allowance in FSM
- Daily per diem and local transportation

#### 2. FDA-Aligned Food Facility Technical Advisor – \$31,250

To ensure that the facility meets FDA-aligned design standards for hygienic zoning, materials, drainage, and equipment layout, a technical consultant will provide input during design finalization, supervise during construction, and assist in pre-commissioning validation.

Key deliverables include:

- Review of building and utility plans for compliance with HACCP, GMP, and food-safe facility standards
- Recommendations on material selection, process flow zoning, and critical control point layout
- Oversight during installation of equipment, wash-down zones, and cold storage
- Documentation and support for certification processes (e.g., USFDA, HACCP training, sanitation protocols)
- Support for standard operating procedures (SOPs) and cleaning workflows

**Cost includes:**

- Monthly consulting retainer across 9–12 months
- Three in-person site visits with airfare, housing, and meals
- Virtual review meetings, documentation, and SOP development

*3. Quality Assurance and Construction Audits – \$12,500*

To maintain construction quality and minimize costly rework, the project will fund regular QA/QC reviews by an independent civil engineer or architect, ideally contracted through a regional partner.

This includes:

- Bi-weekly site inspections and written reports
- Review of materials used vs. bill of quantities
- Photographic documentation and field-testing of drainage, electrical, and floor finishing
- Approval checklists prior to release of milestone payments to contractors

Together, this budget line ensures that the FIFs are built to specification, with strong oversight mechanisms, qualified personnel, and institutional memory. It provides the necessary assurance to funders, regulators, and local stakeholders that the investment will result in a compliant, high-quality, and fully functional food-grade facility.

**Total Construction and Infrastructure or Remodelling for Tier II:**

<b>Component</b>	<b>Amount (USD) for each Tier II FIF</b>	<b>Amount (USD) for both Tier II FIFs</b>
<b>A. Foundation &amp; Structure</b>	<b>\$461,250</b>	<b>\$922,500</b>
<b>B. Plumbing &amp; Electrical</b>	<b>\$178,750</b>	<b>\$357,500</b>
<b>C. Interior Finishing</b>	<b>\$156,250</b>	<b>\$312,500</b>
<b>D. Refrigeration &amp; Ventilation</b>	<b>\$235,000</b>	<b>\$470,000</b>
<b>E. Project Management &amp; Oversight</b>	<b>\$93,750</b>	<b>\$187,500</b>
<b>Total</b>	<b>\$1,125,000</b>	<b>\$2,250,000</b>

## 2. Equipment & Supplies for the Tier II FIFs: \$351,570

Equipment	Price per Unit	Number of Units	Total without Cost Conversion	Total with 1.5x Cost Conversion
Staple Crop Processing Items				
<a href="#">Machine Coconut Opener</a>	300.00	10	3,000.00	4,500.00
<a href="#">Oven/range</a>	1,000.00	5	5,000.00	7,500.00
<a href="#">Wok</a>	17.00	10	170.00	255.00
<a href="#">Burner</a>	4.30	10	43.00	64.50
<a href="#">Steel Tray</a>	10.00	100	1,000.00	1,500.00
<a href="#">Tray Rack</a>	90.00	10	900.00	1,350.00
<a href="#">Flesh tool</a>	3.00	10	30.00	45.00
<a href="#">Industrial Juicer</a>	600.00	2	1,200.00	1,800.00
<a href="#">Oil Extractor</a>	800.00	2	1,600.00	2,400.00
<a href="#">Machete</a>	28.00	20	560.00	840.00
<a href="#">Coconut Flour Machine</a>	800.00	2	1,600.00	2,400.00
<a href="#">Liberty Stainless Steel Taps</a>	84.00	20	1,680.00	2,520.00
<a href="#">Sugaring Bucket</a>	51.94	40	2,077.60	3,116.40
<a href="#">28' Fiberglass Extension Ladder</a>	460.00	4	1,840.00	2,760.00
<a href="#">Winco 12 in Sieve Baking Sheet</a>	24.01	20	480.20	720.30
<a href="#">Lakshmi Coconut Milk Extractor</a>	210.80	2	421.60	632.40
<a href="#">Coconut Packager</a>	1,650.00	2	3,300.00	4,950.00
<a href="#">Coconut Oil press</a>	168.75	2	337.50	506.25
<a href="#">Manual Coconut Milk press</a>	90.00	2	180.00	270.00
<a href="#">Solar Dryer or Dehumidifier Dried Fruit</a>	210.00	10	2,100.00	3,150.00
<a href="#">Stainless Steel Worktables</a>	575.00	10	5,750.00	8,625.00
Fish & Poultry Processing Items				
<a href="#">Mannlake Scalding with Temp Control</a>	525.00	1	525.00	787.50
<a href="#">Fish Fillet Cutter</a>	2,000.00	1	2,000.00	3,000.00
<a href="#">Fish Cleaning, Scaling, Gutting</a>	1,600.00	1	1,600.00	2,400.00
<a href="#">Mainstreet Stainless Steel Floor Fryer</a>	749.00	2	1,498.00	2,247.00
<a href="#">Stainless Steel Triple Basins</a>	306.15	1	306.15	459.23

<a href="#">Avantco A-49R-HC 54" Reach in Refrigerator</a>	1,949.00	2	3,898.00	5,847.00
<a href="#">Chicken Feed (Streamline)</a>	2,500.00	2	5,000.00	7,500.00
<a href="#">Chicken Feed Production Line</a>	5,500.00	2	11,000.00	16,500.00
<a href="#">Feed Pellet Packager</a>	2,000.00	2	4,000.00	6,000.00
<a href="#">Robot Coupe R702VV 2 Continuous Feed Food Processor</a>	6,011.00	2	12,022.00	18,033.00
Food Safety Testing Checklist				
<a href="#">Benchtop Ph Meter</a>	1,035.00	1	1,035.00	1,552.50
<a href="#">Thermopen Thermometer</a>	299.00	1	299.00	448.50
<a href="#">Hand held temp adjusted Refractometer</a>	260.00	4	1,040.00	1,560.00
<a href="#">Thermometer Calibrator (4 point hot/cold)</a>	1,592.12	2	3,184.24	4,776.36
Thermometers (digital + infrared)	300.00	10	3,000.00	4,500.00
Safety Equipment				
<a href="#">Half Face respirator</a>	43.00	4	172.00	258.00
<a href="#">Porta Stream II Eyewash station</a>	460.00	2	920.00	1,380.00
<a href="#">Goggles</a>	22.00	20	440.00	660.00
<a href="#">S Carton Uline Industrial Latex Gloves</a>	26.00	20	520.00	780.00
<a href="#">M Carton Uline Industrial Latex Gloves</a>	14.00	20	280.00	420.00
<a href="#">L Carton Uline Industrial Latex Gloves</a>	19.00	20	380.00	570.00
<a href="#">Class A First Aid Kits</a>	67.00	4	268.00	402.00
<a href="#">Class B First Aid Kits</a>	155.00	4	620.00	930.00
<a href="#">Class B+ First Aid Kits</a>	395.00	4	1,580.00	2,370.00
<a href="#">Uline Ice Wraparound Fog Armor Dispenser box</a>	94.00	4	376.00	564.00
<a href="#">Carton Polyethylene Apron</a>	22.00	10	220.00	330.00
Canning and Pickling Equipment				
<a href="#">Canner Aluminum Bath water Canner</a>	269.99	4	1,079.96	1,619.94
<a href="https://www.allamericancanner.com/41-Quart-Pressure-Canning-Kit.htm">https://www.allamericancanner.com/41-Quart-Pressure-Canning-Kit.htm</a>	677.99	2	1,355.98	2,033.97
<a href="#">Wide Mouth Ball Glass Mason Jars 32 oz</a>	1.37	400	548.00	822.00
<a href="#">Fermentation Crock</a>	85.49	2	170.98	256.47
<a href="#">Fermentation Weights</a>	43.97	50	2,198.50	3,297.75
<a href="#">Fermentation lid cloth covers</a>	13.93	50	696.50	1,044.75
<a href="#">Potable Aqua Water Purification Tabs with PA plus</a>	12.99	200	2,598.00	3,897.00
<a href="#">Stainless Steel Funnel</a>	10.49	25	262.25	393.38
<a href="#">11.5 Qt Canning Rack</a>	8.49	100	849.00	1,273.50

<a href="#">Canning Labels</a>	6.49	10	64.90	97.35
<a href="#">1000 sheets of 4 rectangular labels</a>	109.99	1	109.99	164.99
<b>Hatchery Equipment</b>				
<a href="#">2560 Egg Incubator Kit</a>	6,119.99	2	12,239.98	18,359.97
<a href="#">Chick Brooder 3 Layer H: 15"</a>	799.99	4	3,199.96	4,799.94
<a href="#">Grow out Pen 5 Layer H: 9.5"</a>	699.99	4	2,799.96	4,199.94
<a href="#">Walk in 15ft Chicken run</a>	1,999.99	2	3,999.98	5,999.97
<a href="#">Over Ez Tarp for walk in 8 foot chicken run</a>	199.99	6	1,199.94	1,799.91
<a href="#">Over Ez Chicken Coop Jumbo</a>	3,999.00	2	7,998.00	11,997.00
<a href="#">Nesting Pads</a>	39.99	10	399.90	599.85
<a href="#">Eaton Natural Hemp Bedding 8lb</a>	24.99	10	249.90	374.85
<a href="#">Silo Feeder (40LB) 3 pack</a>	699.99	10	6,999.90	10,499.85
<a href="#">High Country Plastics 270lbs feed bin with stand</a>	312.99	4	1,251.96	1,877.94
<a href="#">3 section breeding pen</a>	239.99	4	959.96	1,439.94
<a href="#">Heater &amp; Thermostat for Box Brooder 110V</a>	114.99	4	459.96	689.94
<a href="#">Chick Brooder heating Plate Temperature Controller</a>	19.99	4	79.96	119.94
<a href="#">Thermo-Chicken 12.5 in. x 18.5 in 40-Watt Heated Pad</a>	71.98	4	287.92	431.88
<a href="#">Solar Powered Automatic Chicken Coop Door with remote</a>	89.99	4	359.96	539.94
<a href="#">Wise mountable feeder 22lbs poultry &amp; Game feeder</a>	59.99	6	359.94	539.91
<a href="#">Wise mountable drinker 3 Gallon poultry and game waterer</a>	69.99	6	419.94	629.91
<a href="#">Pencron Expandable portable power station 1920WH</a>	679.00	2	1,358.00	2,037.00
<a href="#">24000 Watt Dual Fuel Air cooled Standby Generator</a>	6,398.10	2	12,796.20	19,194.30
<a href="#">Global Industrial Stainless Steel Veterinary Scale</a>	515.00	2	1,030.00	1,545.00
<a href="#">Global industrial replacement AC adapter</a>	19.75	4	79.00	118.50
<a href="#">Global Industrial Stainless steel cleaner &amp; Polish</a>	68.95	12	827.40	1,241.10
<a href="#">Rayovac AAA 24 Battery Contractor Pack</a>	12.24	25	306.00	459.00
<a href="#">Electronic Weighing Poultry Scale, Chicken weighing Bag with sling</a>	23.99	4	95.96	143.94
<a href="#">Poultry First Aid Kit</a>	104.99	10	1,049.90	1,574.85

<a href="#">Chicken Ointments Best of show by Manna Pro</a>	43.99	10	439.90	659.85
<a href="#">Coop Cleaning Supply Kit</a>	59.99	20	1,199.80	1,799.70
<a href="#">OverEZ Chicken Waterer 12 Gallon</a>	79.99	4	319.96	479.94
<a href="#">Case of 250 cartons for eggs</a>	169.99	12	2,039.88	3,059.82
Tier-II Information Hub				
<a href="#">Samsung 4TB SSD Hard drives</a>	439.99	2	879.98	1,319.97
<a href="#">Dell Inspiron 27' All in one cpu</a>	1,189.98	2	2,379.96	3,569.94
<a href="#">4 Person L Desk Work station</a>	3,210.00	2	6,420.00	9,630.00
<a href="#">LG smart TV</a>	299.00	2	598.00	897.00
<a href="#">Norton Anti virus software</a>	19.99	2	39.98	59.97
<a href="#">Mesh Task Chairs</a>	165.00	4	660.00	990.00
<a href="#">Downtown conference tables (Powered) 192 x 48"</a>	1,560.00	2	3,120.00	4,680.00
<a href="#">Wall monitor Mount</a>	95.00	2	190.00	285.00
Kitchen Supplies				
<a href="#">Self ingredient Bin 200 cups</a>	243.00	4	972.00	1,458.00
<a href="#">Baking Pan</a>	216.00	4	864.00	1,296.00
<a href="#">Wire Grate</a>	168.00	4	672.00	1,008.00
<a href="#">Cambro Dish Racks</a>	42.00	4	168.00	252.00
<a href="#">Cambro Glass Racks</a>	80.00	4	320.00	480.00
<a href="#">Pan Dolly</a>	305.00	2	610.00	915.00
<a href="#">Uline Trash Cans</a>	74.00	4	296.00	444.00
<a href="#">Uline Trash can lids</a>	29.00	4	116.00	174.00
<a href="#">Biohazard Step On Waste Can</a>	131.00	4	524.00	786.00
<a href="#">Uline Thin trash can 23G</a>	45.00	4	180.00	270.00
<a href="#">Rubbermaid Slim Jim Lid Can/bottle</a>	52.00	4	208.00	312.00
<a href="#">Rubbermaid Slim Jim Lid paper</a>	52.00	4	208.00	312.00
<a href="#">Rubbermaid Slim Jim Swing top</a>	51.00	4	204.00	306.00
<a href="#">Stainless Dollie</a>	135.00	4	540.00	810.00
<a href="#">Handsfree Trash Can 55G</a>	255.00	4	1,020.00	1,530.00
<a href="#">Outdoor Landmark Series Trash Can Dome top 50G</a>	970.00	4	3,880.00	5,820.00
<a href="#">Fork liftable Transport tilt truck</a>	2,505.00	2	5,010.00	7,515.00
<a href="#">Hydraulic Platform Stacker</a>	2,695.00	2	5,390.00	8,085.00
<a href="#">130km low speed new energy double cab mini pick up truck</a>	9,999.00	2	19,998.00	29,997.00

<a href="#">Commercial Cutting Board</a>	152.00	4	608.00	912.00
<a href="#">Commercial Mixing 3qt</a>	62.00	4	248.00	372.00
<a href="#">Commercial Mixing 5qt</a>	89.00	4	356.00	534.00
<a href="#">Commercial Mixing 8qt</a>	125.00	4	500.00	750.00
<a href="#">Commercial Mixing 13qt</a>	94.00	4	376.00	564.00
<a href="#">Commercial Mixing 20qt</a>	150.00	4	600.00	900.00
<a href="#">Stainless Steel Steam Table Pans 3qt</a>	150.00	4	600.00	900.00
<a href="#">Stainless Steel Steam Table Pans 6qt</a>	250.00	4	1,000.00	1,500.00
<a href="#">Stainless Steel Steam Table Pans 10qt</a>	150.00	4	600.00	900.00
<a href="#">Stainless Steel Steam Table Pans 14qt</a>	175.00	4	700.00	1,050.00
<a href="#">Stainless Steam Table Pan Lids 1/6</a>	55.00	4	220.00	330.00
<a href="#">Stainless Steam Table Pan Lids 1/3</a>	85.00	4	340.00	510.00
<a href="#">Stainless Steam Table Pan Lids 1/2</a>	110.00	4	440.00	660.00
<a href="#">Stainless Steam Table Pan Lids Full</a>	205.00	4	820.00	1,230.00
<a href="#">Stainless Steel Scoops 8oz</a>	69.00	4	276.00	414.00
<a href="#">Stainless Steel Scoops 16oz</a>	75.00	4	300.00	450.00
<a href="#">Stainless Steel Scoops 32oz</a>	80.00	4	320.00	480.00
<a href="#">Stainless Steel Scoops 64oz</a>	86.00	4	344.00	516.00
<a href="#">Stainless Steel Scoops 96oz</a>	114.00	4	456.00	684.00
<a href="#">Stainless Steel Scoops 128oz</a>	122.00	4	488.00	732.00
<a href="#">Stainless Steel Scoops 160oz</a>	134.00	4	536.00	804.00
<a href="#">Stainless Steel Mixing Paddles 48"</a>	35.00	2	70.00	105.00
<a href="#">Mixing Polypropylene Paddles 40"</a>	65.00	2	130.00	195.00
<a href="#">Mixing Polypropylene Paddles 52"</a>	72.00	2	144.00	216.00
<a href="#">Hand Scraper 3 x 8"</a>	7.00	2	14.00	21.00
<a href="#">Hand Scraper 4 x 9"</a>	8.00	2	16.00	24.00
<a href="#">Stainless steel paper cutter 36"</a>	163.00	2	326.00	489.00
<a href="#">Unbleached Paper rolls 36"</a>	81.00	4	324.00	486.00
<a href="#">Handheld Induction Sealer and Caps</a>	340.00	4	1,360.00	2,040.00
<a href="#">Clear Straight-sided Glass jars with metal cap 8oz</a>	40.80	2	81.60	122.40

<a href="#">Clear Straight-sided Glass jars with metal cap 16oz</a>	54.60	2	109.20	163.80
<a href="#">Clear Straight-sided Glass jars with metal cap 32oz</a>	64.80	2	129.60	194.40
<a href="#">Amber Straight-Sided Glass Jars with Metal Cap 8oz</a>	40.80	2	81.60	122.40
<a href="#">Case Standard Glass Canning Jars 8oz</a>	14.40	2	28.80	43.20
<a href="#">Case Standard Glass Canning Jars 16oz</a>	18.00	2	36.00	54.00
<a href="#">Case Standard Glass Canning Jars 24oz</a>	20.40	2	40.80	61.20
<a href="#">Case Standard Glass Canning Jars 32oz</a>	22.80	2	45.60	68.40
<a href="#">Case Replacement Standard Canning Jar Lids</a>	81.00	2	162.00	243.00
<a href="#">Case Glass Spice Jars 2oz</a>	48.00	2	96.00	144.00
<a href="#">Case Glass Spice Jars 4oz</a>	27.60	2	55.20	82.80
<a href="#">Case Glass Spice Jars 8oz</a>	15.60	2	31.20	46.80
<a href="#">Case Glass Spice Jars 16oz</a>	18.60	2	37.20	55.80
<a href="#">Case Cubitainers</a>	60.00	2	120.00	180.00
<a href="#">Case of Square Utility Jugs</a>	34.20	2	68.40	102.60
<a href="#">Jug Pump</a>	10.50	2	21.00	31.50
<a href="#">Chemical Resistant Spray Bottles</a>	25.50	2	51.00	76.50
<a href="#">Case Replacement nozzles</a>	17.25	2	34.50	51.75
<a href="#">Bundle Egg Cartons</a>	90.00	2	180.00	270.00
<a href="#">Egg Filler Flat Case</a>	42.00	2	84.00	126.00
<a href="#">Williams Sonoma Prep Tools 15 Piece Gadget and Utensils Set</a>	279.95	2	559.90	839.85
<a href="#">Berry Basket</a>	75.00	2	150.00	225.00
<b>Total Cost</b>				<b>351,570</b>

### 3. Administration, Training, and R&D: \$15,000 for each Tier II FIF

This component ensures that the Food Innovation Facilities (FIFs) also serve as functioning administrative and training facilities. It supports reliable facility operations, digital coordination, quality assurance, and capacity building. Budget account for **importation of IT equipment and training technologies**, all of which are expensive to ship, set up, and maintain in Yap's remote context.

#### A. Administrative Office – \$5,500

This 300 sq ft office will serve as each FIF's operational command center.

Key Components:

- Desks, chairs, and cabinets crafted locally (where possible) from coconut timber and bamboo, supplemented with imported ergonomic seating and filing systems.
- One laptop and one desktop (imported with surge protectors and extended warranties), along with a multi-function printer/scanner and wireless router.
- Dry-erase boards, inventory shelving, secure records cabinets, and visual planning boards.
- One split-unit AC and fans for humidity control—shipped in and professionally installed.

Increased costs reflect **air-freight of electronics**, furniture reinforcement for tropical humidity, and **backup components** to avoid downtime.

#### B. Research and Development Laboratory – \$7,500

The R&D lab will occupy 150–200 sq ft and focus on food quality, safety, and new product development.

Key Equipment:

- Stainless-steel wash benches and sealed sinks (imported and corrosion-resistant).
- Microscope, incubators, moisture analyzers, and pH testing kits.
- Seal integrity testers and media for microbiological and shelf-life assessments.
- Lockable cold storage for reagent and sample integrity.
- PPE kits, fire extinguisher, and eyewash station.

All scientific instruments are assumed to be **imported from certified vendors**, with associated freight, calibration kits, and training for local staff.

#### C. Training Room – \$3,250

This 12-person training room will host food safety, agribusiness, and entrepreneurship sessions.

Includes:

- Digital projector with retractable screen and multimedia input (HDMI, USB).
- Modular seating (some locally sourced, some imported) and cultural flexibility (pandanus mats, circle setups).
- Whiteboards, flip charts, and HACCP training posters.
- Lockable training kit cabinet and instructor desk.
- Ceiling fans and screened windows; optional outdoor annex area.

Cost reflects **shipping of AV tech and display equipment**, plus freight packaging for training kits. There will be an outdoor area extension adjacent to the building facility also designed for training and teaching and which can be used for product drop-off, but whereas that only requires a cement floor and traditional roof, separate costs not described but it would be embedded in building costs and design.

#### D. Office Supplies & IT Infrastructure – \$6,250

This component enables day-to-day digital operations and ensures online traceability, compliance reporting, and coordination.

Inclusions:

- Two computers (one desktop, one rugged laptop), color printer, two routers.
- Satellite uplink or high-power mobile hotspot for remote island connectivity.
- Subscriptions to cloud-based inventory and HACCP platforms (e.g., OneDrive, Google Workspace, FoodReady).
- Office setup: UPS/power backups, stationery, binders, laminators, and tech support for setup.

Cost increase accounts for **connectivity upgrades, secure networking, and spare parts** to reduce downtime in areas with no IT vendors.

#### Total for Section 3: \$90,000

Component	Amount (USD) for each Tier II FIF	Amount (USD) for both Tier II FIFs
A. Administrative Office	\$5,500	\$11,000
B. Training Room	\$3,250	\$6,500
C. Office Supplies and IT Infrastructure	\$6,250	\$12,500
<b>Total</b>	<b>\$15,000</b>	<b>\$30,000</b>

#### 4. Operational Readiness and Sustainability: \$46,250

This budget line ensures the Tier III FIC is not only constructed and equipped, but also staffed, supplied, and fully operational from the outset. The increase reflects **actual costs of launching a food facility in a remote island setting**, including freight-heavy input procurement, importing safety and training tools, utility surcharges, and bridging early cash flow gaps before local revenue stabilizes.

##### A. Initial Inventory (Raw Materials) – \$12,500

Start-up inventory must be sufficient for **test runs, staff training, product prototyping, and outreach events**. This inventory enables hands-on learning and early processing capacity.

Includes:

- Bulk purchase of vegetables and fruits: breadfruit, taro, sweet potato, cassava, banana, mango, coconut, etc.
- Poultry: local and regional sourcing of chickens for slaughter, packaging, and chilling tests.
- Fish: reef fish, tuna, and dried/salted fish inputs for fish room startup.
- Essential packaging: heat-sealable pouches, vacuum bags, PET bottles, labels, and cartons (mostly imported).
- Oil, spices, and salt for food prep during training runs and demos.
- Packaging supplies, labels, other local foods.

Cost accounts for **importing shelf-stable ingredients and packaging**, some of which are not available locally, and delivery to outer islands if needed.

## B. Training and Staffing – \$23,750

Given FSM’s limited pool of food-safe processing specialists, additional funds are required to **recruit, train, and retain skilled staff**, as well as **import qualified trainers** for the startup phase.

Includes:

- Salaries for 6–8 months: operations manager, food technologist, sanitation worker, maintenance technician, and administrative/training assistant.
- Onboarding training from certified HACCP instructors (remote or regional).
- In-person or remote machine operation training from vendors (vacuum sealer, fryer, freezer, etc.).
- Bilingual training materials (video and print), culturally adapted for Yap.
- “Train-the-trainer” sessions to enable local continuity.

Budget also allows for **travel stipends or honoraria** for visiting trainers from Guam, Hawaii, or Philippines and/or other places as well as remote Zoom-based modules with supplemental hands-on days.

## C. Utilities and Operating Costs (Year 1) – \$10,000

Some utility costs are reduced due to **passive ventilation, solar integration, and CoolBot cold rooms**, but other cost components remain high due to:

- Importation of cleaning supplies,
- Generator fuel and maintenance, and
- Lack of public utility subsidies.

Includes:

- Electricity (generator fuel, solar integration, grid use where available).
- Water (potable and sanitation), plus greywater and wastewater disposal.
- Weekly deep cleaning, daily detergent/sanitizer supply, PPE restocking.
- Pest control, light maintenance, and minor replacements.
- Internet, phone service, and domain/hosting for a basic outreach site.

This amount is sufficient to keep the facility functional while operational revenues ramp up.

<b>Component</b>	<b>Amount (USD) for each Tier II FIF</b>	<b>Amount (USD) for both Tier II FIFs</b>
A. Initial Inventory (Raw Materials)	\$12,500	\$25,000
B. Training and Staffing	\$23,750	\$47,500
C. Utilities and Operating Costs	\$10,000	\$20,000
<b>Total</b>	<b>\$46,250</b>	<b>\$92,500</b>

**C. Yap State Tier I Food Innovation Facilities (FIF)**  
 proposed to be built/renovated in all 10 main island municipalities.

C. FIFs Tier I Total Cost: \$61,728.78 (10,000 + 51,728.78)

**1. Construction and Infrastructure: \$10,000**

This cost represents simple construction of new spaces or renovation on existing structures for Tier I collection and processing facilities. This is envisioned as an open yet roofed structure using local materials for building of posts and roof built upon on a raised cement floor. There will be ten total Tier I facilities on Yap Proper, with each municipality having one. Each one will cost about \$1,000 to build.

**2. Equipment & Supplies for Tier I Village Food Innovation Facilities in Yap: \$51,728.78**

Equipment	Price per Unit	Number of Units	Total without Cost Conversion	Total with 1.5x Cost Conversion
General Processing Item				
<u>Manual Veg Slicer</u>	90.00	5	450.00	675.00
<u>Solar Dryer or Dehumidifier Dried Fruit</u>	210.00	10	2,100.00	3,150.00
<u>Stainless Steel Commercial Work Table</u>	674.18	10	6,741.80	10,112.70
<u>Manual Taro</u>	50.00	10	500.00	750.00
<u>Hand Grinder</u>	20.00	10	200.00	300.00
<u>Knives</u>	30.00	15	450.00	675.00
<u>Pedal Generator Stationary</u>	255.00	10	2,550.00	3,825.00
<u>Coconut Mesh Bag</u>	35.00	10	350.00	525.00
<u>Portable Solar generator</u>	200.00	10	2,000.00	3,000.00
<u>Compostable Gallon Resealable Bag</u>	16.00	10	160.00	240.00
Coconut Processing Items				
<u>Flesh tool</u>	3.00	15	45.00	67.50

<u>Machete 20 pieces</u>	559.80	20	11,196.00	16,794.00
<u>Coconut Flour Machine</u>	800.00	1	800.00	1,200.00
<u>Liberty Stainless Steel Taps</u>	84.00	10	840.00	1,260.00
<u>Sugaring Bucket</u>	51.94	10	519.40	779.10
<u>28' Fiberglass Extension Ladder</u>	460.00	3	1,380.00	2,070.00
<u>Winco 12 in Sieve Baking Sheet</u>	24.01	10	240.10	360.15
<u>Manual Coconut Milk press</u>	90.00	10	900.00	1,350.00
Fishing Equipment				
<u>Powerpro Braided Fishing Line</u>	16.99	20	339.80	509.70
<u>Promar Hook Resist Fishing nets</u>	21.99	20	439.80	659.70
<u>Gamakatsu Baitholder Fishing Hook</u>	11.49	100	1,149.00	1,723.50
<u>3 Gallon Tamco Fabricated HDPE Rectangular Tank with cover</u>	226.99	5	1,134.95	1,702.43
<b>Total Cost</b>				<b>51,728.78</b>

## Grand Total: \$8,841,340.73 USD

The total estimated investment for the Tier III Food Innovation Center (FIC) plus all the equipment and supplies for Tier I and Tier II Food Innovation Facilities (FIF) in the Federated States of Micronesia shown above. This figure reflects a comprehensive, procurement-ready cost that includes design, construction, equipping, staffing, operational launch, and contingency allowances. It is based on a realistic per-square-foot estimate of \$750 for a 6,000 sq ft FDA-aligned food-grade facility, factoring in FSM's geographic, logistical, and infrastructural constraints. With two regional FIF estimated at \$450/sq ft for 2,500 sq ft facilities total cost for each would be \$1,125,000 x 2 such regional FIF's totals= \$2,250,000. All equipment and supplies included above. Grand total for a FIC and two regional FIF is **\$8,841,340.73**.

This total incorporates:

- **Construction and Infrastructure** – \$4,500,000 for the FIC  
FDA-aligned food-safe construction using imported materials, skilled labor, robust HVAC/plumbing/electrical systems, and strict quality oversight. Includes refrigeration, ventilation, interior finishing, and technical project management tailored for Yap state.
- **Processing Equipment** for Tier I, II and Tier III – \$4,494,296.54

- Specialized tools and machines for staple crop, fish, poultry, and community kitchen processing. Includes walk-in cold rooms, dryers, fryers, vacuum sealers, and sanitation systems, each chosen for usability and hygiene compliance.
- **Administration, R&D, and Training Facilities** – \$120,000  
Office setup, IT infrastructure, R&D lab equipment, and training room tools to support quality control, food safety, innovation, and local entrepreneurship.
- **Operational Readiness and Staffing** – \$231,250  
Start-up inventory of raw materials, early staffing, machine training, food safety certification sessions, and year-one utilities.
- **Contingency Reserve** – \$75,000  
Strategic buffer to manage cost fluctuations, freight issues, weather delays, or adaptation needs during construction and commissioning.

### **Strategic Justification:**

This investment creates a **fully compliant and climate-resilient processing facility** designed for value addition, hygiene, and long-term resilience. It also builds **local capacity** by pairing modern technology with Pacific Island processing traditions. The FIC is:

- **Scalable** – It serves as a national model for replication in other states and Pacific nations.
- **Community-rooted** – It is integrated with local farming, fishing, and small enterprise development.
- **Regulatory-ready** – Designed to meet FDA, HACCP, and Codex food facility standards.
- **Climate-smart** – Incorporates solar readiness, passive ventilation, and efficient refrigeration to reduce carbon footprint and operating costs.

**This \$8.8 million investment is not just ‘a building’—but a number of food processing facilities to serve as collection and aggregation centers as well as the manufacturing and value-addition of local foods to strengthen Yap State local food system-based response to Yap’s and FSM’s food security, economic diversification, and rural development challenges.**

## References and Works Cited

Adefila, A. O., Ajayi, O. O., Toromade, A. S., & Sam-Bulya, N. J. (2024). Integrating traditional knowledge with modern agricultural practices: A sociocultural framework for sustainable development. *Journal of Sustainable Agriculture and Development*.

Agarwal, V., Malhotra, S., Dagar, V., & M. R, P. (2023). Coping with public-private partnership issues: A path forward to sustainable agriculture. *Socio-Economic Planning Sciences*, 89, 101703. <https://doi.org/10.1016/j.seps.2023.101703>

American Poultry Association. (2022, October 5). 2025 APA Canadian National Meet. <https://amerpoultryassn.com/2022/10/feed-and-water-management/>

Arenas-Navarro, I., Montes, E. D., Serrano-Pinilla, S. M., & Rueda-Ordoñez, D. A. (2020). Development of a rainwater harvesting model for broiler farms. *Revista UIS Ingenierías*, 19(2), 127-134.

Besbes, B., Thieme, O., Rota, A., Guèye, E. F., & Alders, R. G. (2012). Technology and programmes for sustainable improvement of village poultry production. In *Alternative systems for poultry: Health, welfare and productivity* (pp. 110-127). CABI.

Brass, C., Scott, C., Bright, A., & Rayner, A. C. (2015). Chicken Run: A chicken-centred design research project. *The Virtuous Circle*, (00), 00-00.

Chen, J. (2024, September 12). *Corporate governance: Definition, principles, models, and examples*. Investopedia. <https://www.investopedia.com/terms/c/corporategovernance.asp>

Diambra-Odi, H., & Hollyer, J. (2017). *20-egg layers model* (Animal Agriculture Publication No. AA003). College of Natural & Applied Sciences, University of Guam. [https://www.uog.edu/\\_resources/files/extension/publications/Chicken\\_Laying\\_Fact\\_Sheet\\_3\\_17.pdf](https://www.uog.edu/_resources/files/extension/publications/Chicken_Laying_Fact_Sheet_3_17.pdf)

Federated States of Micronesia. (2024). *Third national communication and first biennial update report to the United Nations Framework Convention on Climate Change*. <https://unfccc.int/documents/628168>

Fukumoto, G. (2009). *Livestock Management Small-Scale Pastured Poultry Grazing System for Egg Production*. <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/LM-20.pdf>

Glatz, P., Ayalew, W., Black, I., Pandi, J., Deklin, J., Mazi, M., ... & Solomon, E. (2013). *Improving the profitability of village broiler production in PNG*.

Jamaluddin, F., Saleh, N. M., Abdullah, A., Hassan, M. S., Hamzah, N., Jaffar, R., Abdul Ghani Aziz, S. A., & Embong, Z. (2023). Cooperative Governance and Cooperative Performance: A Systematic Literature Review. *SAGE Open*, 13(3). <https://doi.org/10.1177/21582440231192944> (Original work published 2023)

Malchow, J., Berk, J., Puppe, B., & Schrader, L. (2019). Perches or grids? What do rearing chickens differing in growth performance prefer for roosting? *Poultry Science*, 98(1), 29-38.

Maluf, R. S. (2021). Decentralized food systems and eating in localities: A multi-scale approach. *Revista de Economia e Sociologia Rural*, 59, e238782.

Martin Cerezo, M. L., López, S., van Dorp, L., Cui, R., Hamburger, J., Rieux, A., ... & Larson, G. (2023). Population structure and hybridisation in a population of Hawaiian feral chickens. *Heredity*, 130, 154-162. <https://doi.org/10.1038/s41437-022-00589-z>

Martinez, S. (2010). *Local food systems; concepts, impacts, and issues*. Diane Publishing.

McCall, W. (1980). *Hawaii Cooperative Extension Service Chicken Manure*. <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/GHGS-02.pdf>

*Micronesia*. Technical Report to the Federated States of Micronesia, Micronesia Conservation Trust and the Green Climate Fund. <https://rd.gov.fm/food-security>

Novković, S., Miner, K., McMahon, C. (2023). Cooperative Governance in Context. In: Novković, S., Miner, K., McMahon, C. (eds) *Humanistic Governance in Democratic Organizations*. Humanism in Business Series. Palgrave Macmillan, Cham. [https://doi.org/10.1007/978-3-031-17403-2\\_4](https://doi.org/10.1007/978-3-031-17403-2_4)

The Observatory of Economic Complexity. (n.d.). Micronesia (FSM) exports, imports, and trade partners. <https://oec.world/en/profile/country/fsm>

Pacheco, W., Gulizia, J., & Downs, K. (2022). *Backyard and Small Poultry Flock Management Series: Feeding the Laying Hen*. Alabama Cooperative Extension System.

Peter, Z., & Leif, B. S. (2003). *Food Preservation Techniques: Woodhead Publishing Series in Food Science, Technology and Nutrition* [Doctoral dissertation]. CRC Press.

Poland, G. (2019). Preventative healthcare. In *AVA Manual of Backyard Poultry Medicine and Surgery* (pp. 51-58). British Small Animal Veterinary Association.

Poulton, C., & Macartney, J. (2012). Can public-private partnerships leverage private investment in agricultural value chains in Africa? A preliminary review. *World Development*, 40(1), 96-109. <https://doi.org/10.1016/j.worlddev.2011.05.017>

Poultry Hub Australia. (2020, December 13). Disease.

<https://www.poultryhub.org/all-about-poultry/health-management/disease>

Poultry Hub Australia. (2022, October 20). Chicken.

<https://www.poultryhub.org/all-about-poultry/species/chicken>

Ramaswamy, H. S., & Marcotte, M. (2005). *Food processing: Principles and applications*. CRC Press.

Rutgers, The State University of New Jersey. (2024). *Baseline assessment in support of climate-resilient food security for farming households across the Federated States of Micronesia*.

<https://rd.gov.fm/gcf>

Rutgers, The State University of New Jersey. (2024). *Agriculture and food security vulnerability assessment: A companion to the baseline assessment in support of climate-resilient food security for farming households across the Federated States of Micronesia*. <https://rd.gov.fm/gcf>

ResearchGate, 2011-2023. Multiple case studies from Africa and developing nations demonstrate successful PPP models in agricultural development.

Sari, S. N., Aritonang, R., & Sumarlin, S. (2021). Smart chicken coop control and monitoring system design automatically with smartphone notifications. *Brilliance: Research of Artificial Intelligence*, 1(2), 38-46.

Schmidt, R. H., & Erikson, D. J. (2005). Sanitary design and construction of food processing and handling facilities: FSHN0408/FS120, 5/2005. *Edis*, 2005(5).

Scholl, M., & Sherwood, A. (2014, January). *Four Pillars of Cooperative Governance*. Columinate. <https://columinate.coop/four-pillars-of-cooperative-governance-cg/>

Spielman, D.J., von Grebmer, K. Public–Private Partnerships in International Agricultural Research: An Analysis of Constraints. *J Technol Transfer* 31, 291–300 (2006).

<https://doi.org/10.1007/s10961-005-6112-1>

Wilson, H. R., Wilcox, C. J., Voitle, R. A., Baird, C. D., & Dorminey, R. W. (1975).

Characteristics of White Leghorn chickens selected for heat tolerance. *Poultry Science*, 54(1), 126-130. <https://doi.org/10.3382/ps.0540126>

United Nations. (2025). *UN International Year of Cooperatives 2025*. IYC 2025.

<https://2025.coop/>

Young-Uhk, S. (2011). *Utilization of the Tilapia Invasive Species as a Low-Cost Protein Feed to Improve Egg Production*. USDA Sustainable Agriculture Research and Education Projects, FW09-312.