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 Chuuk State:

Local Food Processing for Increased Health, Economic Growth and Job Creation

RUTGERS

Chuuk State Food Systems Solutions Framework

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FOREWORD

Chuuk State welcomes this Food Systems Solutions Framework designed to address our people's specific food system development aspirations as identified from this project's extensive stakeholder engagement.

Chuukese culture emphasizes communal living, kinship ties, and the symbolic importance of food and shared meals. Unfortunately, food security has become a major challenge due to increased reliance on expensive imported foods and declining local production. Traditional staple crops like breadfruit and taro, coconuts, and subsistence fishing have historically been crucial for our people's nutrition, but their consumption has decreased, leading to nutritional deficiencies and a rise in diet-related diseases. Food security is further threatened by the high cost of imported foods, limited market access, climate change's impact on our agriculture and fishing sectors, and the strain of transitioning from a subsistence economy to a Western cash economy.

This Food Systems Solution Framework provides a path forward to build upon our rich tradition of locally processed staple foods such as pounded breadfruit (kon), fermented breadfruit (epwet) pounded taro root (puna) and dried and salted fish and seafoods. Food processing remains a major source of income for many of our residents who inhabit 46 islands spread across our vast ocean state.

Local food production is vital for Chuuk's food security, and necessary to strengthen our self-reliance, create jobs, increase nutrition and reduce our dependence on vulnerable global supply chains. Furthermore, promoting local farming and fishing helps to preserve cultural heritage and empowers communities, especially those who live in remote areas of our state.

We thank all our committed Chuuk stakeholders who contributed to this important Food Systems Solutions Framework with specific thanks to the Chuuk State Legislature, Chuuk State Department of Agriculture and the Chuuk Women's Council. I also wish to thank the FSM Department of Resources and Development, the Rutgers Food Systems Science Team and the US Department of Commerce Economic Development Administration. Chuuk State looks forward to implementing this Food System Solutions Framework for the benefit of our people now and for generations to come.

Honorable Alexander Narruhn
Governor, Chuuk State, Federated States of Micronesia
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This report includes the results of the 10 stakeholder specific surveys and extensive in-state food system development meetings and convenings used to capture the voices of the widest range of community members and ensure that this framework was co-designed and developed with each FSM state. Particular attention was given to ensure voices of those from the outer islands were included in their respective state discussions.

Key Food Systems Solutions Project Leadership and Research Collaborators:

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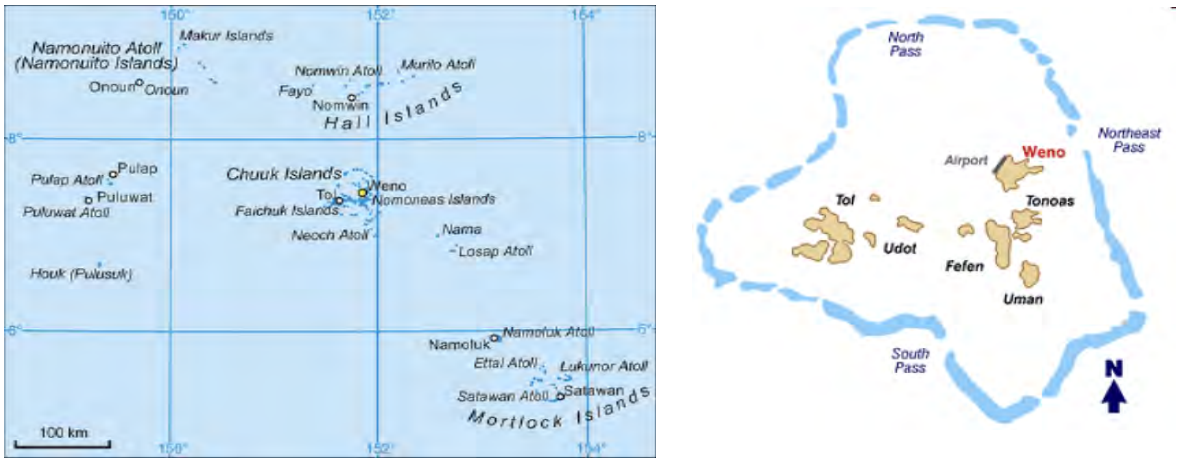
Executive Summary

Food Systems Solutions Framework for Chuuk State, Federated States of Micronesia



Map of Chuuk State, Courtesy of the Hawai'i Nutrition Center

Chuuk State, the most populous state in the Federated States of Micronesia (FSM), is an archipelago of high volcanic and low coral islands with 49 inhabited communities. Despite its cultural richness and history of traditional, local processed foods, Chuuk faces persistent challenges: geographic dispersion, transportation barriers, high poverty levels, and dependence on costly and inconsistent food imports.

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 Chuuk 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 Chuuk State Food Systems Solutions Framework 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.

The strategic vision for Chuuk's food system development centers on building a diversified, resilient, and self-reliant food economy that leverages the state's traditional crops, breadfruit, taro, coconut, and banana, alongside abundant marine resources. By upgrading processing infrastructure, strengthening technical

skills, and enabling efficient market linkages, Chuuk can reduce food waste, improve nutrition, create new jobs, and protect cultural foodways. Key culturally significant foods such as pounded breadfruit (*kon*), pounded taro (*puna*), fermented breadfruit (*epwet*), salted seafood, and preserved octopus remain central to community identity and will serve as the foundation for innovation in flours, chips, oils, milk, dried products, and other instant or ready-to-cook substitutes for imported foods. This framework thus integrates Chuuk'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
A tiered infrastructure model is proposed to expand food processing capacity across Chuuk at multiple levels. At the household and village scale, sixty-three small facilities will provide low-level processing such as fish preservation, coconut dehusking, flour milling, and juice pressing. These will reduce waste and add value at the point of production. Medium-scale facilities, five in total, will focus on solar-powered processing of staple crops into flours, chips, and oils, with capabilities for drying, slicing, and packaging. At the highest level, two advanced centers will anchor the system. On Weno, a maritime processing hub will consolidate the fisheries sector with cold storage, ice production, blast freezing, smoking ovens, and fish aggregation systems. On Tonoas, a central Food Innovation Center will manage advanced processing, food safety testing, teaching kitchens, and disaster-response storage. Collectively, these facilities will enhance aggregation, reduce transportation costs, improve food safety, and generate higher-value products. The total projected investment for all tiers is $14.98 million.

Enabling Growth Activity 2: Improved Information Systems to Support Decision-Making
Stakeholders identified the need for a Chuuk State Food Systems Mobile App to connect producers, markets, and consumers. Developed in partnership with iSolutions, the app will allow inventory tracking, product promotion, and knowledge sharing. Because many producers live on outer islands, the app will feature offline functionality to allow information uploads without continuous internet access. Advances in satellite technology such as Starlink will further reduce connectivity gaps. By building on cultural foundations, this technology will support efficiency and coordination while reinforcing the value of local products and practices. Content for such an app can be housed for free public access on the Chuuk State government's website.

Enabling Growth Activity 3: Education, Training, and Technical Support
This framework prioritizes training at every stage of implementation. Producers expressed strong interest in improving agricultural skills such as seed saving, composting, soil management, and climate-resilient crop production. They also requested training in aquaculture, including sustainable fishing methods, reef rehabilitation, and hatchery management. Food processing training will include both traditional preservation techniques and modern approaches to quality control and value-added production. Trainers themselves noted capacity gaps in greenhouse technologies, irrigation systems, cold storage, and renewable energy integration. Business and marketing training will further support entrepreneurship, financial literacy, and compliance with regulations. Finally, health and nutrition education will promote greater integration of local foods into daily diets, ensuring that production gains translate into healthier communities.

Enabling Growth Activity 4: Enhanced Community Management and Policy Advocacy
Sustained impact requires more than infrastructure and training; it also depends on local ownership, gender-inclusive leadership, and supportive policies. To enhance community management of food production in Chuuk, Micronesia, a participatory approach is needed, involving training farmers in sustainable and integrated systems, engaging youth in local food advocacy, improving access to credit for smallholder farmers, fostering collaboration between government and NGOs, and improving local food safety and marketing practices through education and accessible infrastructure. The Chuuk Women’s Council has already demonstrated the potential of women-led initiatives in food processing and will

continue to play a central role in scaling these efforts. Community-driven governance structures will ensure that Food Innovation Centers are not only technically functional but also socially sustainable, building accountability and trust across islands.

The anticipated outcomes of this framework are wide-ranging. Economically, Chuuk will see stronger resilience through the creation of new enterprises, expanded job opportunities, and higher-value local products such as flours, chips, coconut oil, dried fruits, and seafood. In terms of food security and nutrition, the framework will encourage greater reliance on local staples and reduce dependence on imports. Climate adaptation measures will help protect marine and agricultural resources while improving disaster preparedness through enhanced food storage. Importantly, the framework will safeguard cultural traditions, reinforce community identity, and expand the role of women in leadership, training, and entrepreneurship.

In conclusion, the Chuuk State Food Systems Solutions Framework provides a roadmap to transform local food production and processing into a driver of resilience, health, and cultural preservation. Through strategic investment in infrastructure, modernized digital systems, comprehensive training, and community-led governance, Chuuk is positioned to move toward a self-reliant, climate-resilient, and prosperous future where local foods sustain both livelihoods and identity.

Local Market in Weno, Chuuk sells pounded breadfruit (kon) and fermented breadfruit (epwet)

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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 (GCFSAP020 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

The FSS project is designed to support community-led food system development by strengthening and sustaining local food markets. It does so by focusing on four interrelated and mutually reinforcing activities that enable growth.

FOUR ENABLING GROWTH ACTIVITIES SUPPORT LOCAL FOOD PRODUCTION:

First, the project aims to expand supply through **a tiered network of Food Innovation Centers**, supported by training programs that help farmers increase both the volume and quality of their production. Second, it facilitates efficient market matching between buyers and sellers while reducing search costs through a **user-friendly information-sharing mobile platform**. This platform features buyer and seller chat functions, real-time inventories of surplus produce, and mapped delivery points to connect producers with markets. Third, the project emphasizes the development of **education and technical training** to support the operations of Food Innovation Centers and strengthen the local food supply chain. Finally, it promotes **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. Demand is further stimulated through targeted policy interventions, such as state-led local food procurement mandates.

Enabling Growth Activity 1: Development of Flexible Food Innovation Centers

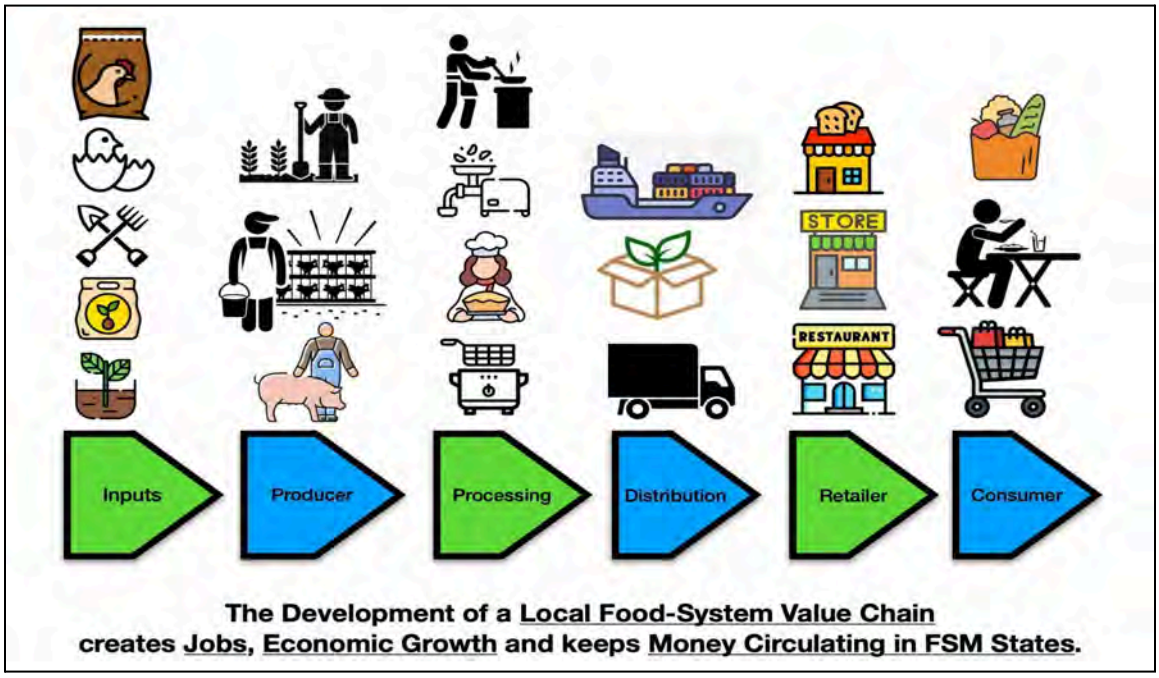
Enabling Growth Activity 2: Improved Information Systems to support Decision-Making

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

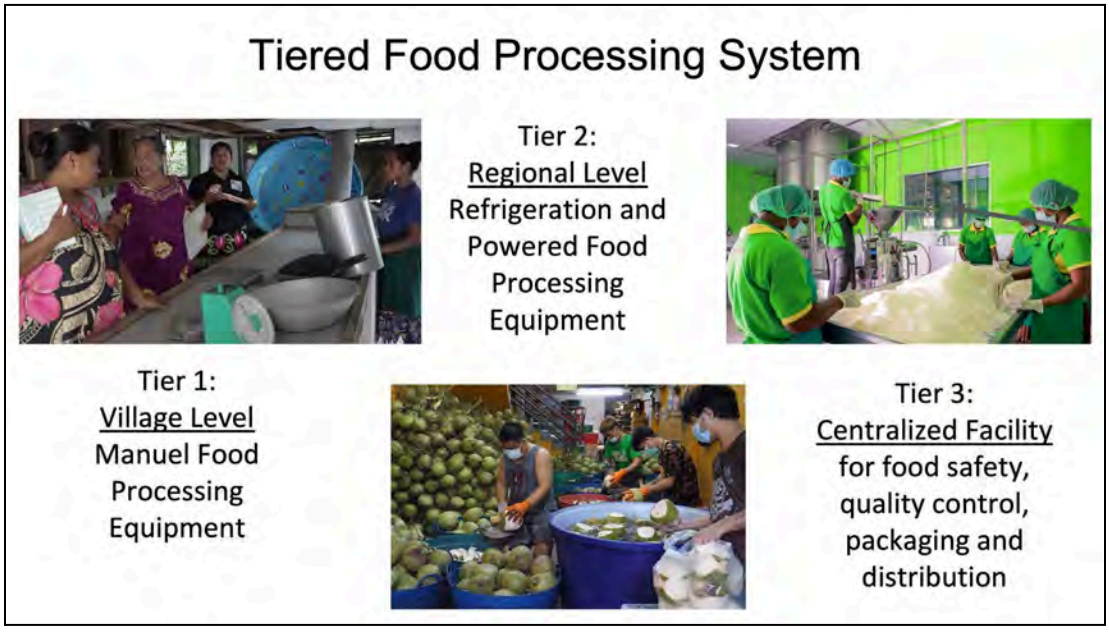
Enabling Growth Activity 3: Improved Education, Training and Technical Support

Enabling Growth Activity 4: Enhanced Community Management and Policy Advocacy

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
Total		**$1,871,278**	**$2,622,984**	**$5,732,255**

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 plays a vital role in addressing food insecurity, reducing health disparities, and empowering communities to meet their own needs. In the context of food systems, this approach actively involves community members in the research process, ensuring that projects are place-based, culturally relevant, practical, and broadly supported. It also fosters trust and strengthens relationships between researchers and the community, contributing to the long-term sustainability of interventions.

To capture the aspirations of FSM's farmers, fishers, and other key stakeholders in local food

production, a community-based participatory mixed methods approach was developed and implemented. Guided by the United Nations' *Rethinking our Food Systems: A Guide for Multi-Stakeholder Collaboration* and working in close partnership with local NGOs and community groups in each FSM state, ten FSS survey tools were created. These tools included both quantitative and open-ended questions to gather comprehensive data from food system stakeholders across all four states. A summary of the FSS community surveys are below.

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

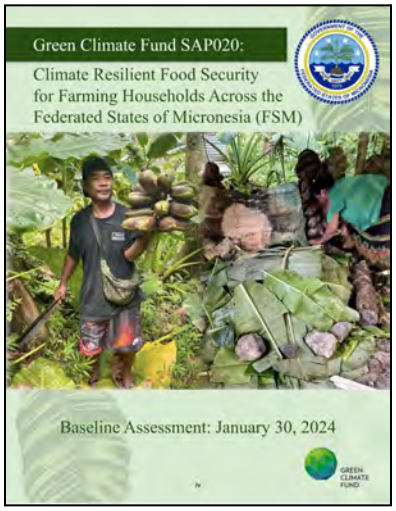
In 2024, 947 new mixed methods surveys of farmers/food producers were conducted by local enumerators conducted in local languages for this Food Systems Solutions project.

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.

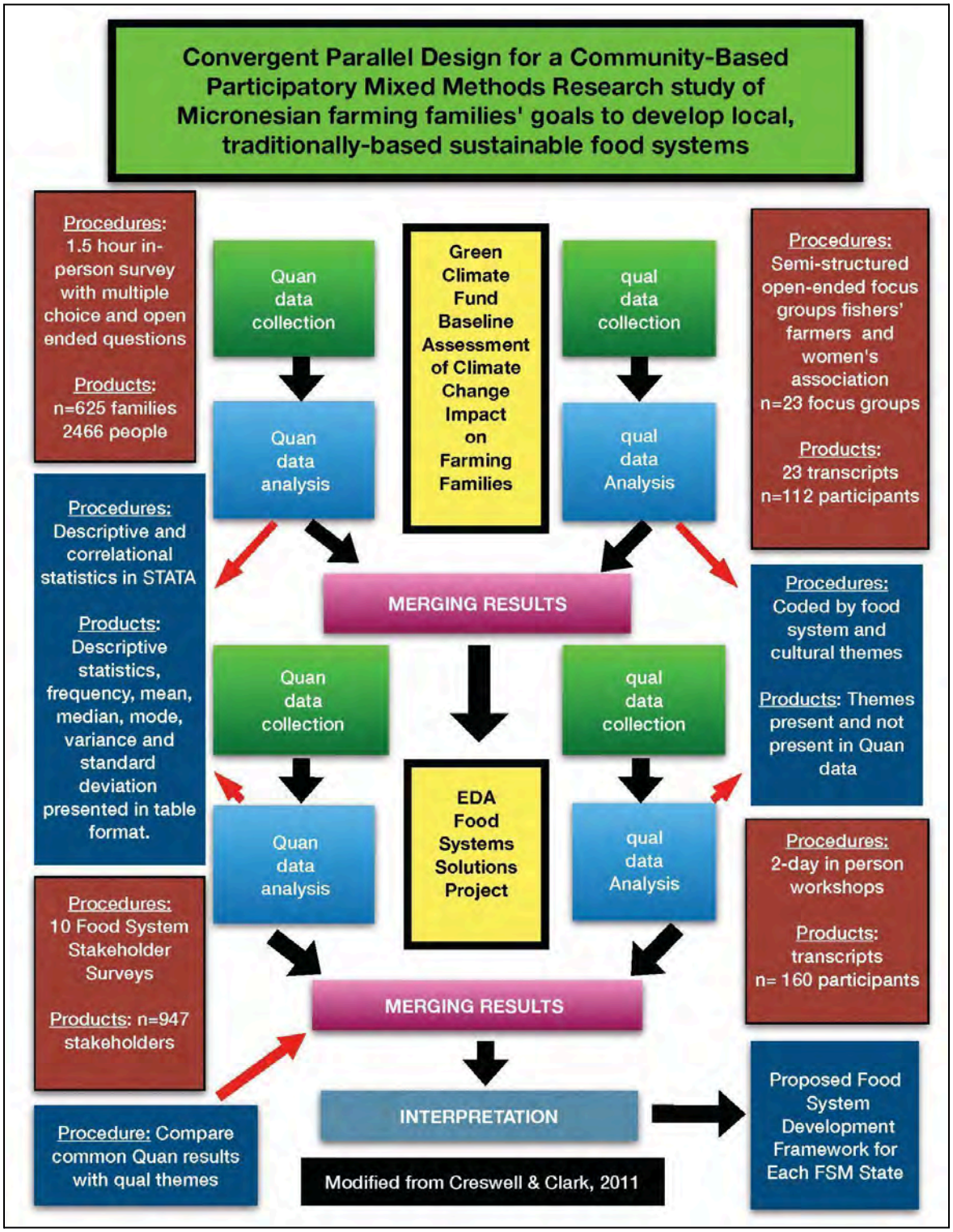
Comparing FSS data to GCFSAP020 data of climate change impact on more than 600 farming families



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 GCFSAP020 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 System 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.

The Chuuk team was composed of three men from the Chuuk Department of Agriculture, one woman from the Disaster Control and Management Office, and seven women from the Chuuk Women’s Council (CWC). The CWC was the formal NGO collaborative partner in Chuuk. Several steps were undertaken by the team in order to prepare for going out to the field to conduct the 10 different survey tools. First, all 11 enumerators completed the Collaborative Institutional Training Initiative (CITI) with Rutgers, The State University of New Jersey, prior to conducting the surveys. Second, the team reviewed the surveys and agreed to keep them in English but use the Chuukese language when interviewing respondents. The FSM team in concert with the Rutgers Food Systems Science Team and the CWC met together and made sure that everyone understood the contents of the surveys, practiced the questions and possible answers and how best to capture the participant responses. The Chuuk based team decided in advance which Chuukese words to use for certain English terms. Third, the team put together a general list of farmers and fishers to target for interviews and identified the islands and communities they were from.

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:

Chuuk farmer Barbara Nachuo from Etten and her granddaughter at their market stand in Weno, enjoying epwet, locally made fermented breadfruit

Part I: Chuuk 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 from Chuuk'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 the Chuuk Women's Council (CWC), a local NGO that oversaw the Food Systems Solutions (FSS) survey collection in Chuuk and ensured that all enumerators received CITI IRB certification through the Rutgers System.

2024 Chuuk State Food Systems Solutions Survey summary:

Producer Survey: 70 surveys conducted
Consumer Survey: 67 surveys conducted
Community Management Leader Survey: 23 surveys conducted
Food Distributors and Retailers: 36 surveys conducted

- **Local markets:** 12 surveys conducted
- **Restaurants:** 24 surveys conducted

Trainer Surveys: 13 surveys conducted
Information Content Providers Survey: 11 surveys conducted
Information Infrastructure Provider Survey: 2 surveys conducted
Technical IT Survey: 4 surveys conducted
Policymaker Survey: 26 surveys conducted

Expanding Food Systems Solutions (FSS) P roject's Qualitative Data with 2-Day Stakeholder Workshops/Convenings:

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. 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 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 Chuuk FSS convenings, notable attendees included: Honorable Secretary of FSM R&D Elina Akinaga, FSM Senator Perpetua Konman, Assistant Secretary Menoleen Jacob-Oswalt, Chuuk State Director of Marine Resources Kirisos Victus, Roger Mori Special Assistant to the Governor, Land Commissioner Dominic Always, Mayor Ana Akira, Enjoy Rain, Curtis Graham, Fabro Andrew UFO Fefen, Orphy Fitim, Harmen Mailo, Charlie Tommy, Judy

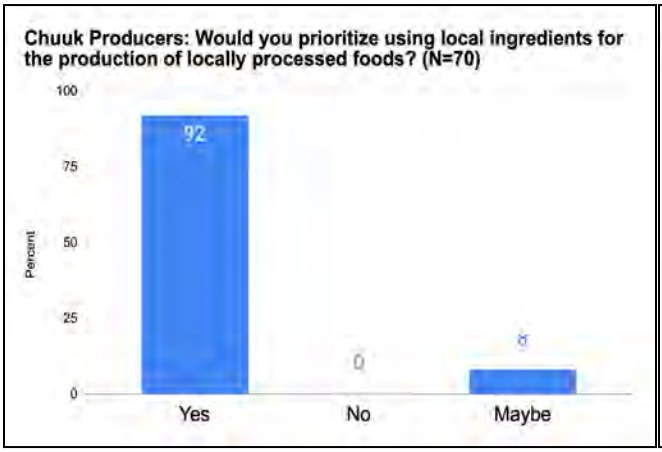
Robert President Kichewesap Fefen, Shanalin Lee Ling Blue Prosperity Micronesia, and Tiffany Ngo Waitte Foundation.

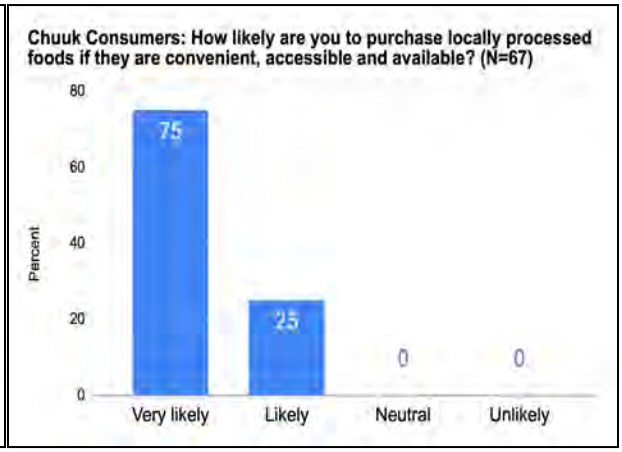
In Chuuk, the FSS team from Rutgers and FSM R&D met regularly with the Chuuk Women's Council, the formal NGO partner that served as a lead coordinator for the implementation of our surveys and data collection related to this project.

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

During the convening/workshop, Chuuk community members expressed interest in strengthening their state's economy through the increased production and processing of local foods. A variety of stakeholders and local leaders discussed the importance of recirculating money within their communities to support farmers and fishers, create local jobs, and increase nutrition and health for the people of Chuuk. There is a strong stakeholder momentum to prepare and process local food crops to create import substitution to strengthen the economy, create jobs, increase local nutrition, and reduce the number of food-related non-communicable diseases.

Chuuk 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. While local food is consumed and sold in Chuuk, stakeholders shared that farming is not a secure means of earning a reliable income, especially with factors such as market fluctuations, unpredictable weather, and a lack of means to process and preserve food products. The FSS Chuuk stakeholder results indicated a strong perception that local food processing of local staple crops would strengthen and support traditional Chuukese culture. From FSS surveys:

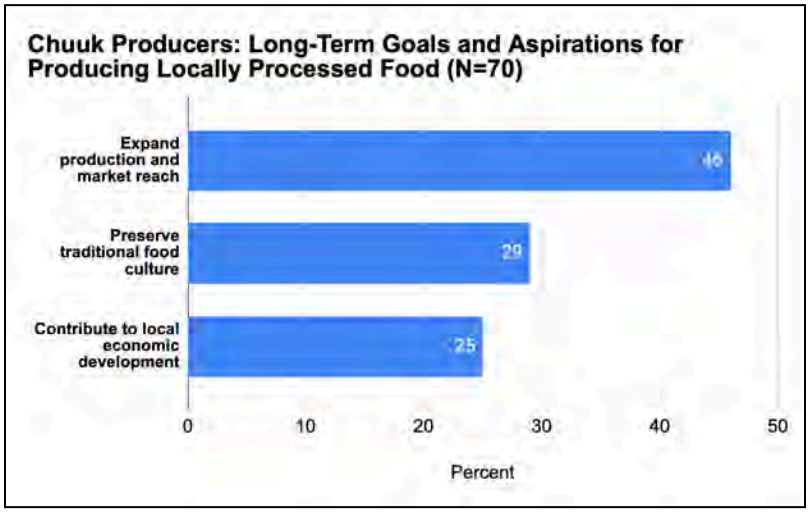


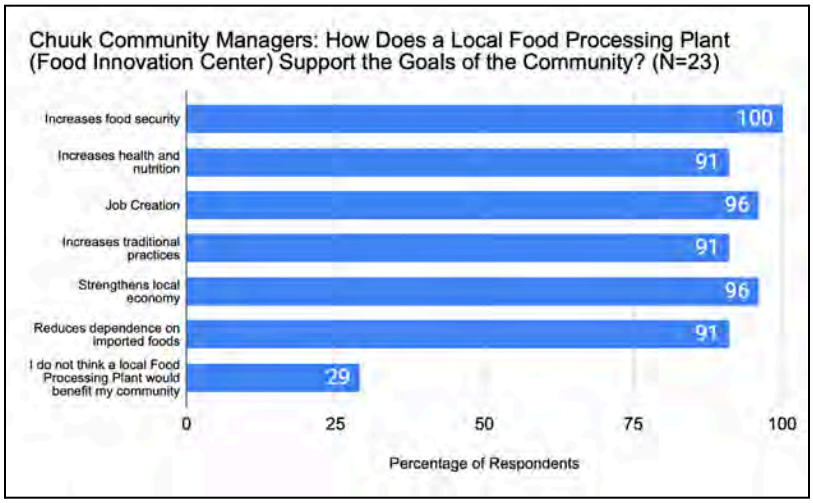


Chuuk's food producers highlight the preservation of traditional culture as the main long-term goal of producing locally processed foods.

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

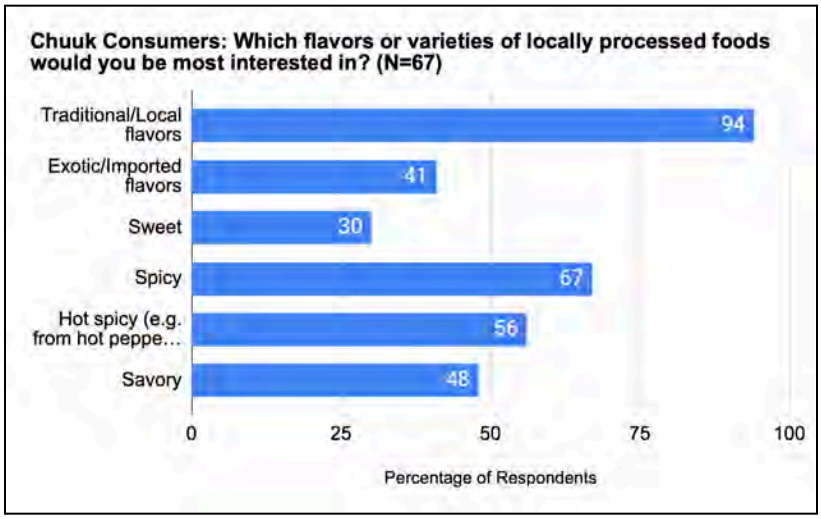
Chuuk stakeholders surveyed showed overwhelming support for the development of food processing of local staple crops ***within Chuuk's cultural framework*** to provide regular and nutritious import substitution.



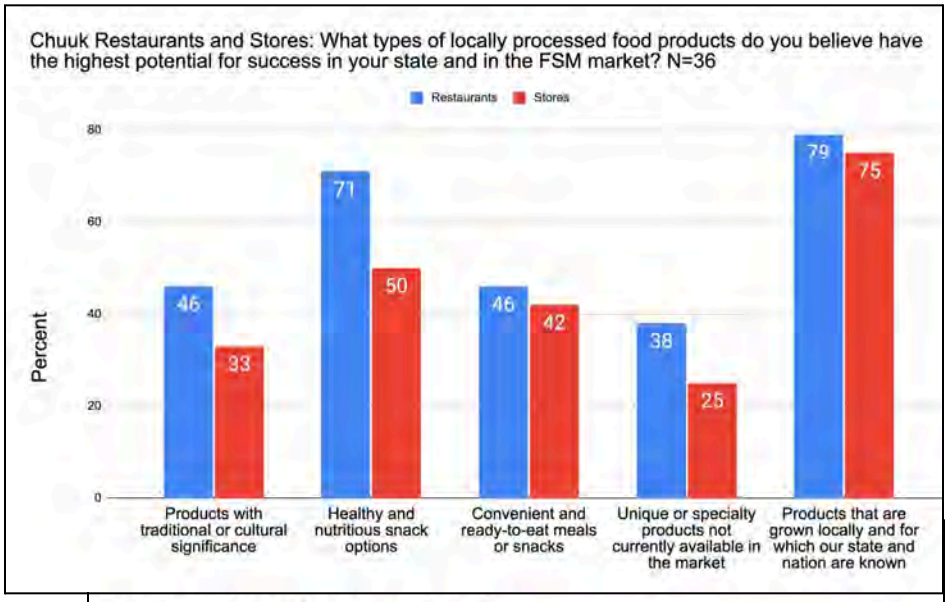


Chuuk's community managers are confident that a food innovation center, where large-scale processing and storage will be located, will actually increase traditional practices, again by prioritizing traditionally grown crops.

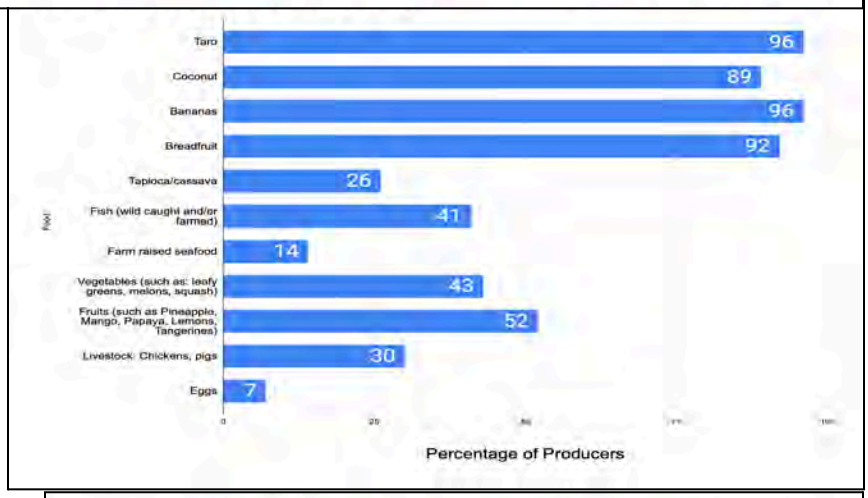
Consumers in Chuuk are the most interested in purchasing and consuming products with traditional and local flavors, highlighting an exceptional market opportunity for producers, restaurants, and stores in the state.



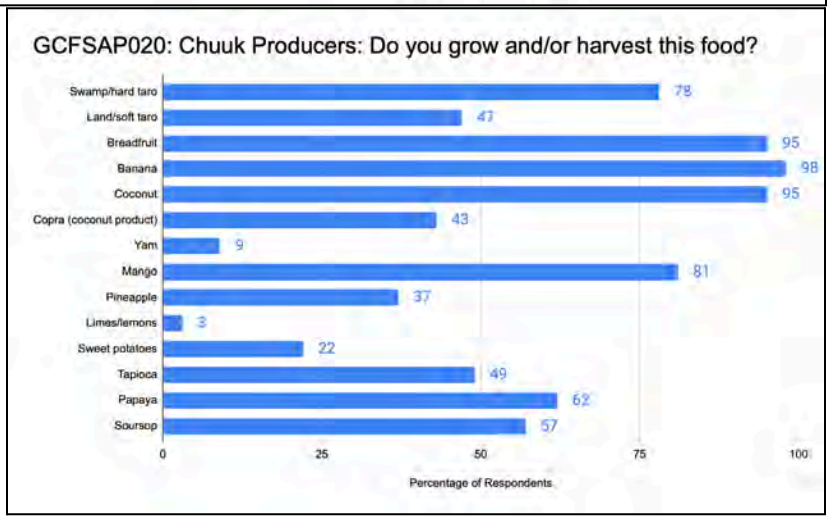
Chuuk's restaurants and stores have identified locally grown foods and products for which Chuuk is known as those with the highest market potential. Products with traditional and cultural significance were also highlighted as products with high market potential.

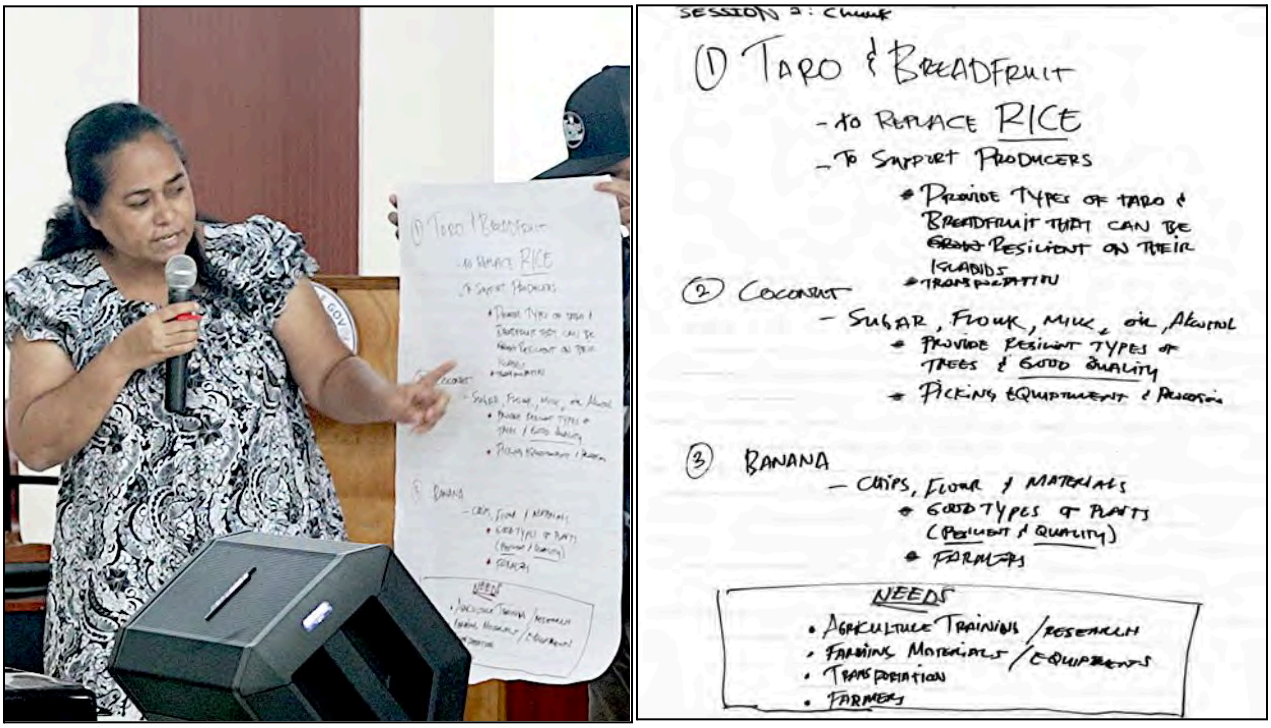


Based on the GCFSAP020 and FSS survey data, Chuuk food producers share the **local staple food crops that they currently harvest and can supply to local food processing facilities.**



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





"To support the producers, ***we need types of taro and breadfruit that are resilient and able to grow all year round*** *on the islands... We want a* ***good coconut variety that can help the farmers or producers to grow all year round with the same size so that they can be climbed easily****... We hope that we can get* ***bananas that are big, long, and can grow all year round*** *on the island."*
-FSM National Senator Perpetua Konman

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

Product	Chuuk Main Island	
	Producers (70 surveys)	Consumers (67 surveys)
Breadfruit chips	95%	87%
Taro chips	16%	79%
Banana chips	98%	76%
Dried fish	41%	75%
Coconut cooking oil	68%	73%

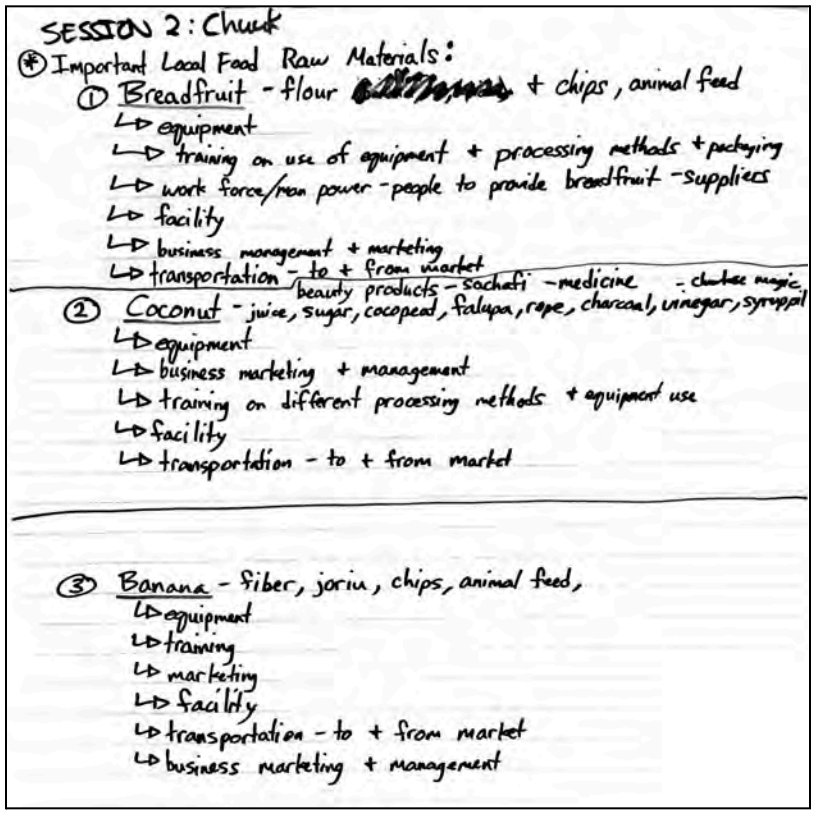
Hot sauce	30%	73%
Coconut milk	53%	70%
Pickled vegetables	50%	67%
Dried fruits	66%	61%
Breadfruit flour	64%	60%
Salted fish	43%	60%
Taro flour	71%	55%
Coconut flour	63%	55%
Dried vegetables	38%	53%
Rope/mats/fiber	23%	52%
Breads and baked goods	56%	49%
Smoked fish	25%	48%
Coconut products (sugar)	43%	43%
Dried spices	44%	40%
Vinegar	18%	24%
Tapioca	26%*	

*"Our team came up with local crops like **breadfruit, coconut and banana** that can be processed to replace so many imported foods. Breadfruit can make **flour, chips, and animal feed**. There are so many uses of our coconuts: **juice, sugar, cocopeat, falupa, rope, charcoal, vinegar, wine, syrup, beauty products, medicine, Chuukese magic**. For **banana, fiber, wine, alcohol, chips, animal feed**."*

– Curtis Graham, College of Micronesia Land Grant Extension Agent

Transforming staple crops into commodities:

49% of surveyed consumers are requesting baked goods, and 56% of producers are interested in processing these foods. 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, cooking oil, and milk.** 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.

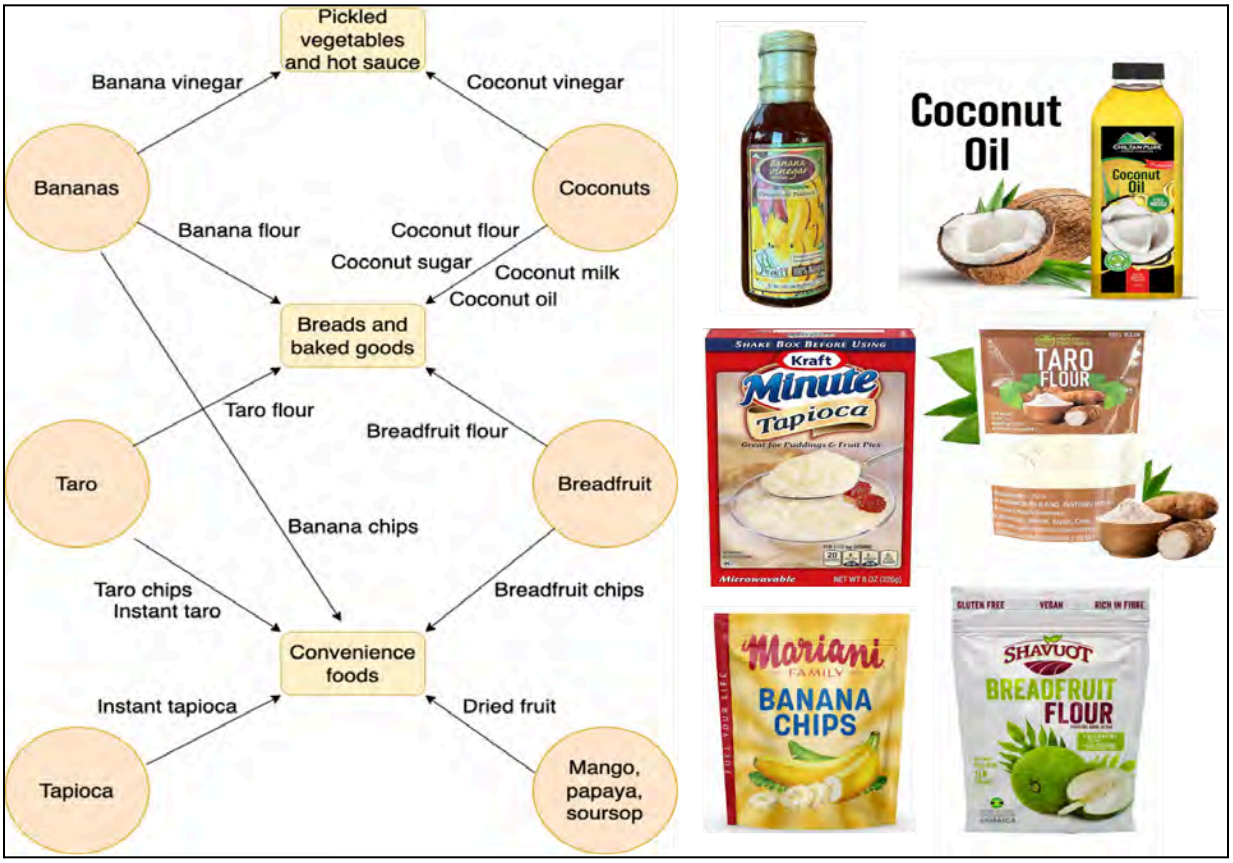


Chuuk Stakeholders identified the potential of the state's abundant coconuts, taro, and breadfruit to provide locally produced ingredients needed for baked goods.

Product	Chuuk State	
	Producer Preferences (70 surveys)	**Consumer Preferences (67 surveys)**
Breads and baked goods	**56%**	**49%**
Taro flour	64%	60%
Breadfruit flour	63%	55%
Coconut flour	41%	55%
Coconut cooking oil	68%	73%
Coconut milk	53%	70%
Coconut products (sugar)	43%	43%

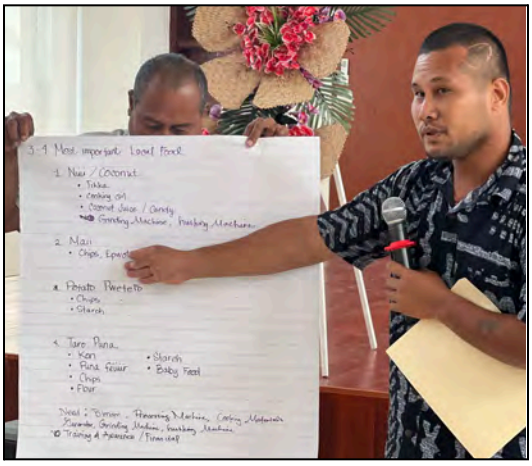
Coconut cooking oil was ranked as the most preferred food that can be produced and processed locally and within much of Chuuk state.

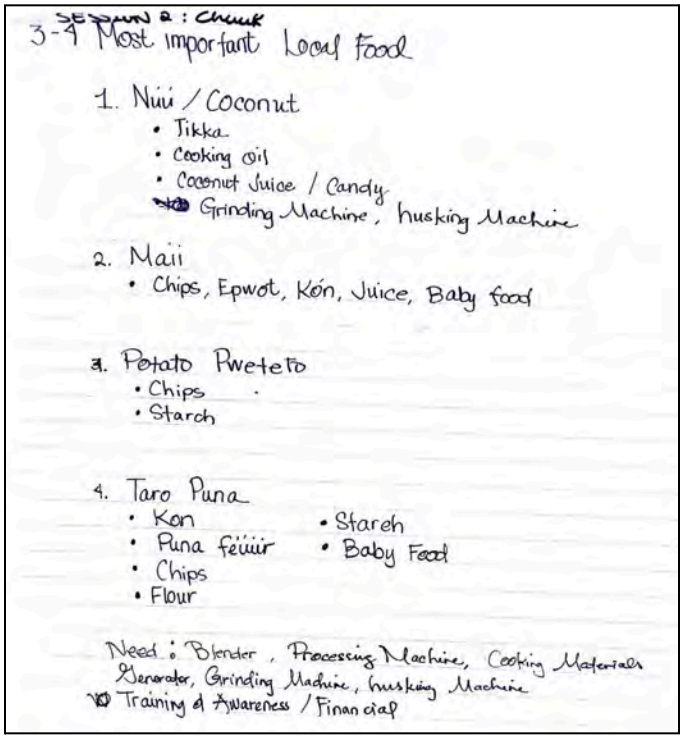
Local Staple Crops That Can Provide Raw Ingredients for Highly Desired Processed Foods as per FSS Survey/Convening Data:



Import substitution with similar, locally sourced products was highlighted throughout the GCFSAP020 and FSS surveys. 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 cow's milk both for daily consumption and for use in cooking. GCFSAP020 Survey respondents were asked if they are interested in **replacing imported cow milk products with coconut milk.**

Questions	Resp.	YAP		Pohnpei		Kosrae		Chuuk		All	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Would you be interested in consuming more locally produced coconut milk products 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
…imported milk products 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

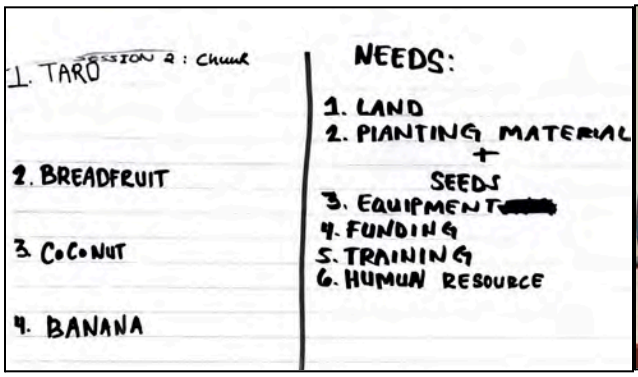




*"**From coconut, we can make tikka, cooking oil, juice and candy**, but we need a grinding machine and a husking machine. From **breadfruit, we can make chips, epwet, con, juice, and baby food**. From potatoes, we can make **chips and starch.** From taro, we can make **kon, starch, baby food, chips, and flour.** To make all of these foods we need a blender, processing machines, cooking materials, generators, grinding machines, husking machines, training and awareness, and financial aid."* **- Local Farmer**

"Chuuk is known for high rates of non-communicable diseases that are the result of the unhealthy imported food that we buy from the stores. This is why it's important that we increase consumption of local produce such as fish, breadfruit, banana, tapioca, eggplant, cucumber, lettuce and kangkong (water spinach) that provide us with a healthy diet. But we will need funds to construct the processing facilities and then we will need people who can keep the facilities operational."

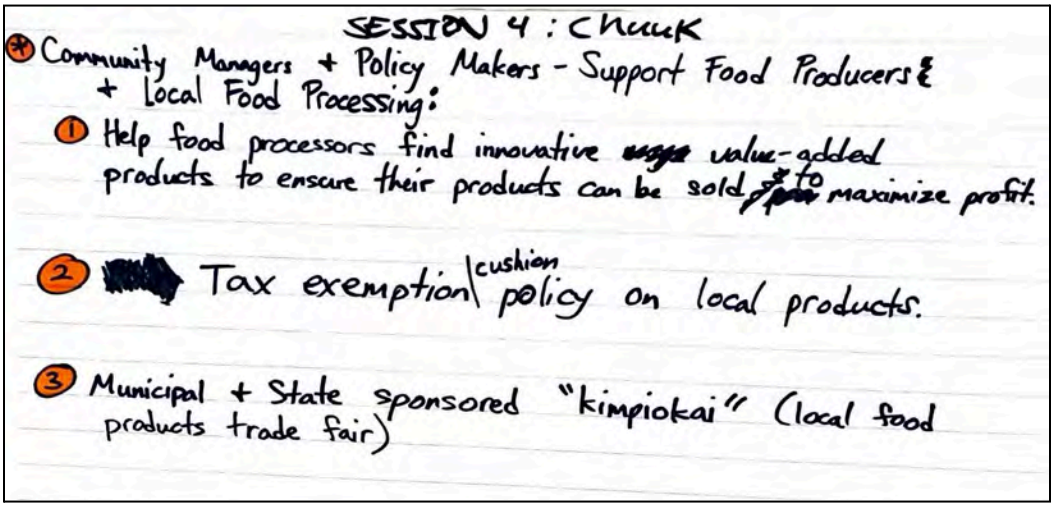
- Director of Chuuk State Department of Marine Resources, Kirisos Victus



"First, we need to identify the ***land where producers can plant and grow the crops and*** *second, we need the* ***planting materials, seeds and seedlings.*** *The third is we need* ***equipment for the planting, processing and packaging, and lastly we need training*** *in the area of farming so people will be able to do the work so the crops will be very good."* **- Mr. Enjoy Rain, Chuuk State, Chief of Marine Resources**

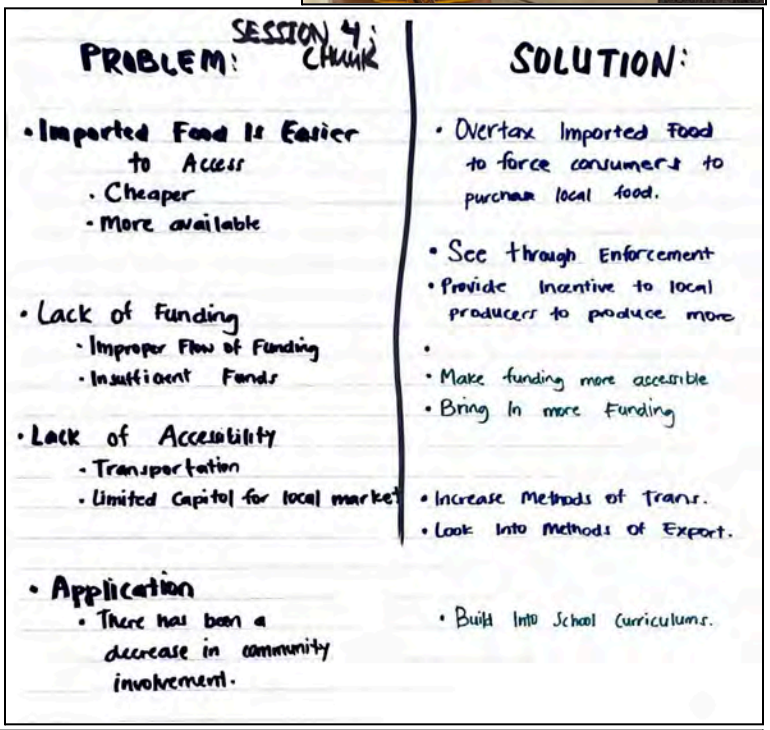
The Role of Policymakers and Community Leaders

"Community managers can support producers and local food processing by ***helping food producers find innovative, value-added products to help maximize profit and sustainability****, and also by looking into policies that can provide* ***tax exemption or tax cushion****. Community managers should also help host* ***local food product trade fairs****."*
- Curtis Graham, COM Land Grant

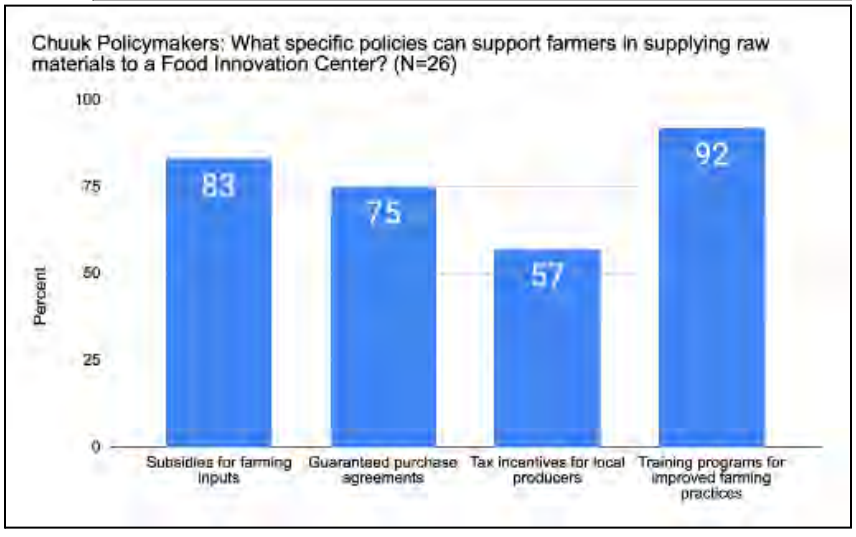


"Policymakers should begin to ***over-tax imported food to force consumers to purchase local food,*** *and see through the enforcement of policies that already exist, such as the* ***Price Control Commission***. ***Incentives should be provided to local producers to produce more food for the local community***. *Policymakers should* ***make funding more accessible to the community.*** *It is also important to begin* ***increasing methods of transportation for food products between and on islands.*** *Lastly, here has been a decrease in community involvement in farming, so one of the solutions we thought of was to* ***build into school curricula, farming days or just teaching the students how to farm so that they have those practices."***

- Shanalin Lee Ling, Blue Prosperity Micronesia FSM R&D

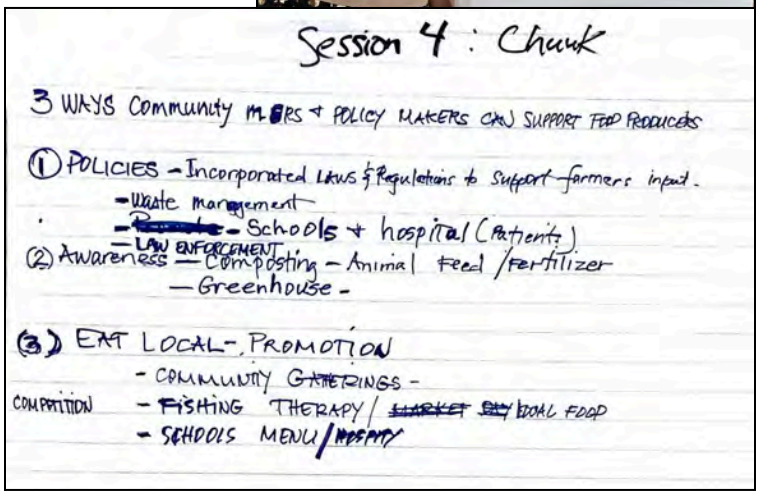


Policy makers report they can contribute to a stronger food system in multiple ways. **There is a strong interest in increasing community involvement with local leaders and policy development.** Focusing on what producers need via training, infrastructure, selling, and security is largely supported by policymakers as they strengthen ties to local involvement.

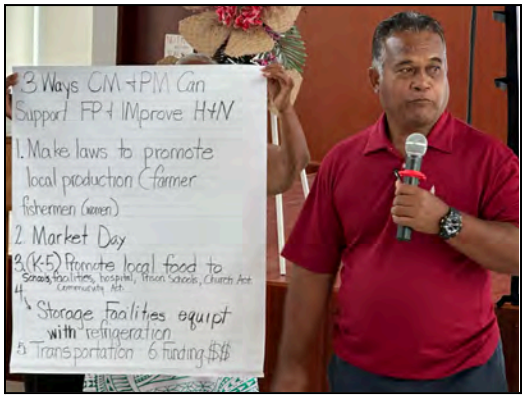


Bringing Local Foods to Schools

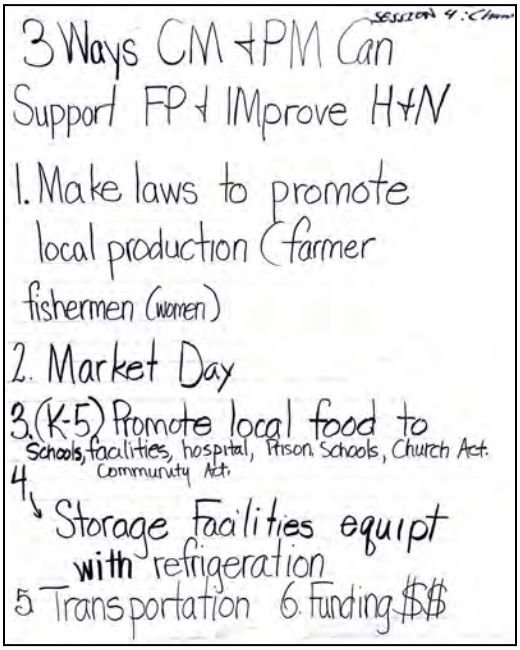
During the FSS convening in Chuuk, it was suggested that these foods be implemented in meals at local schools to encourage consumption of these fruits from a young age. Implementation of policies to require schools and other community spaces to use and provide local foods as a certain percentage of their meals would encourage higher rates of consumption for these foods, as well as an increase in the use of these ingredients in a more diverse range of recipes and processing methods, leading to an overall higher appreciation for these foods, especially in younger Chuukese people.

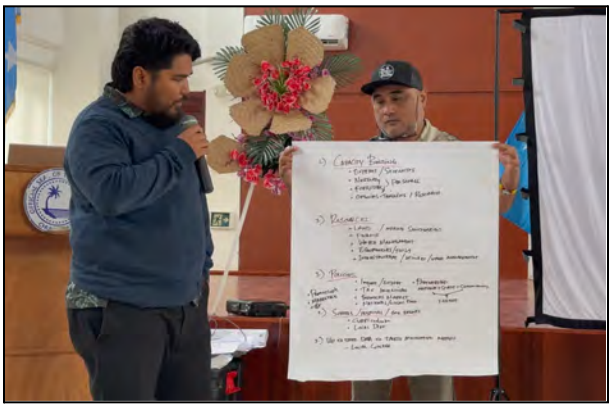


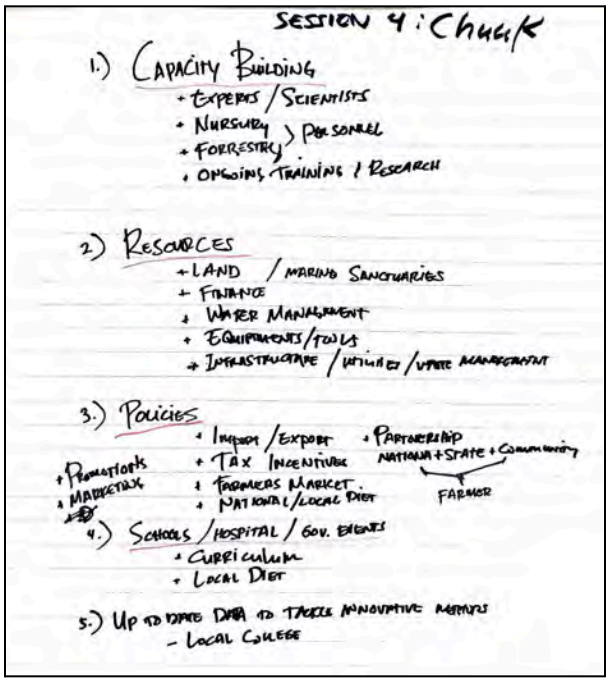
"At the schools, the policymakers should incorporate laws to include local foods in their menus. Even the hospital should promote local food."
- Joyce Sewell, Chuuk EPA



"*We should promote that all schools, hospitals, churches, and community activities* ***provide local food at their lunches and events****."*
- Harmen Mailo, Chuuk Dept of Agriculture







"Tax incentives should be implemented for local businesses to use local and buy local, especially with food plates *because we have a lot of conferences, or schools. If* ***there's a tax incentive to go local, which our policy makers can certainly do, it will help our businesses and encourage them to buy locally...*** *But also* ***making rules such as conference foods must be 60% local foods and things on their plate, grown there...*** *We should also create some kind of* ***national local diet so that we can also implement that into schools*** *to encourage people to eat local and not just spam and rice and chicken."*

- Christopher Eustaquio, Chuuk Governor's Office

FSS Chuuk Consumers surveyed indicated that they are very likely to purchase locally produced products that can replace imported products, such as local coconut cooking oil instead of imported vegetable oil.

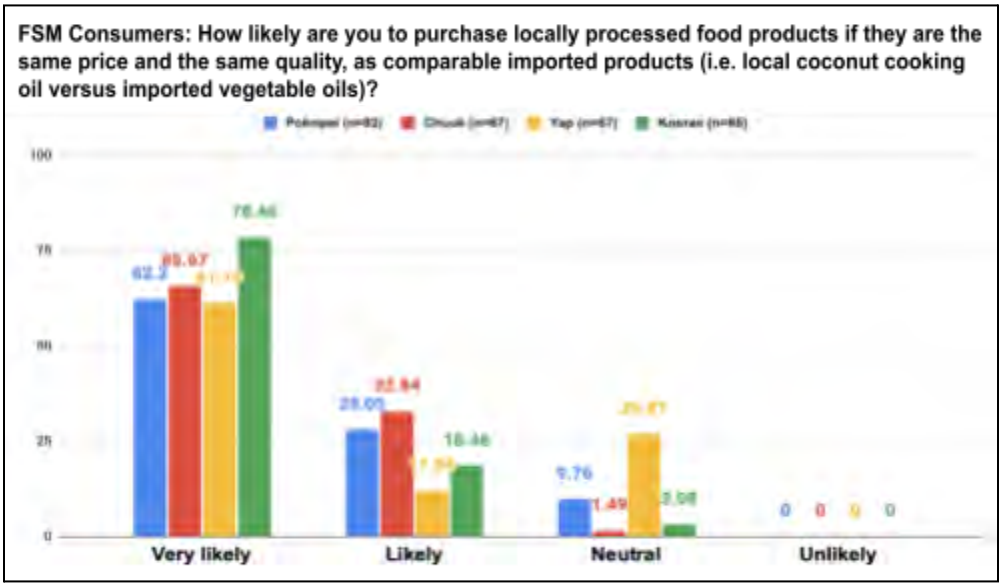


Photo: HLKJacob

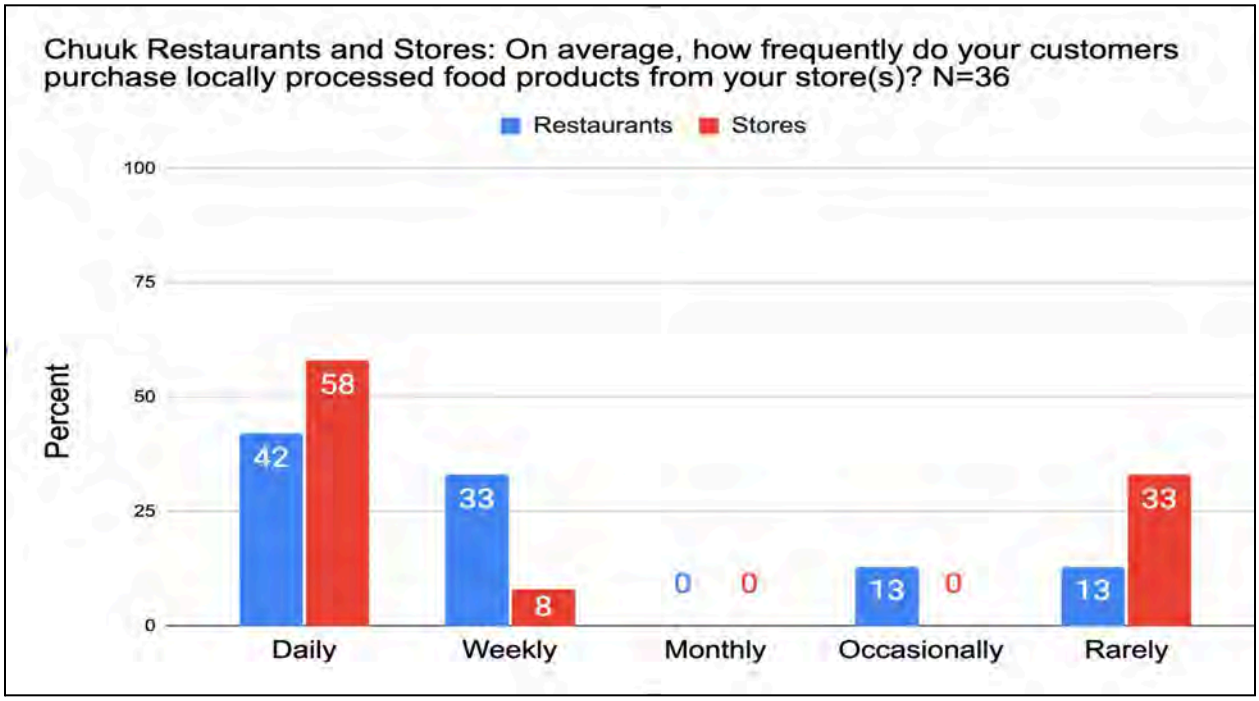
Stakeholders shared that Chuuk State is already working with FSM Petroleum Corp.'s Coconut for Life (C4L) initiative, starting with the development of the **Integrated Coconut Processing Facility on Tonoas.** The goal of this project is to revitalize the FSM's coconut export industry, bringing coconut production plants and materials to Chuuk. **This infrastructure could support coconut processing for much-needed local food products to replace imported foods.**

Fabro Andrew, *President of Fefen island's UFO NGO leads a discussion about what farming families need to produce local foods for processing.*

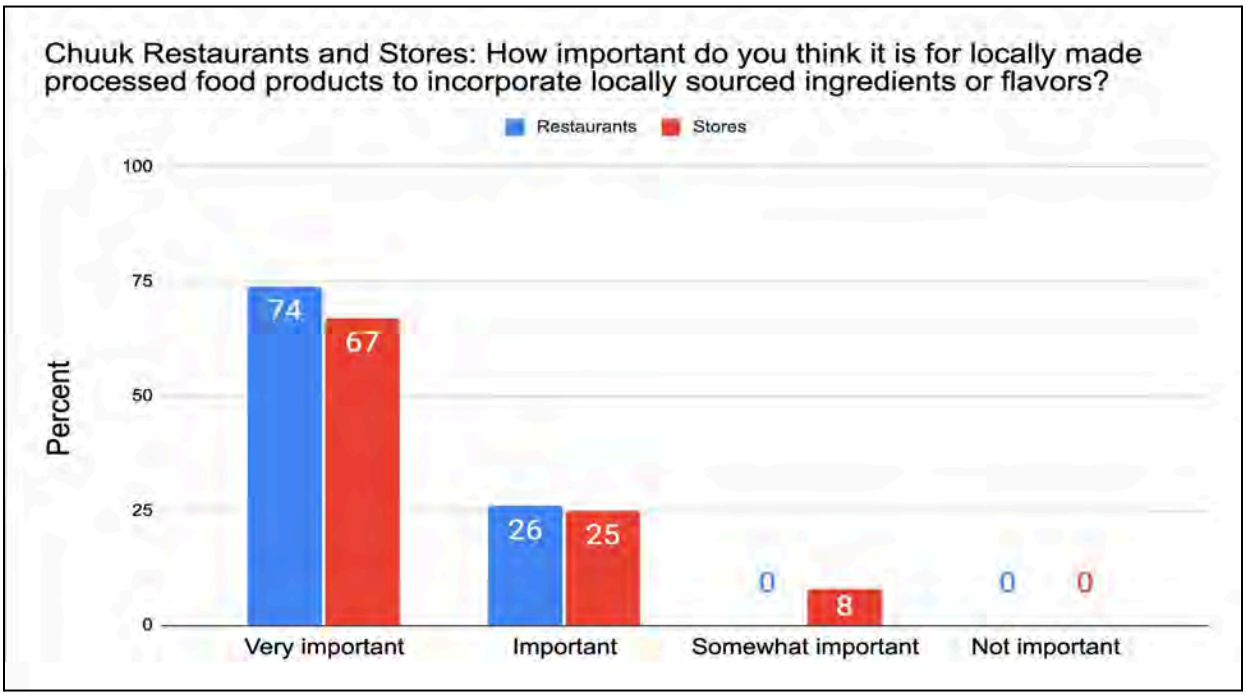
Building Upon Chuuk State's Current Local Food Production and Processing

Chuuk has a greater amount of locally processed foods sold in their in Weno markets than other states in the FSM. Small markets in Weno are regularly filled with locally processed foods such as pounded taro and breadfruit (kon), fermented breadfruit (epwet) and a variety of salted fish and seafood and bottled octopus and sea cucumber.

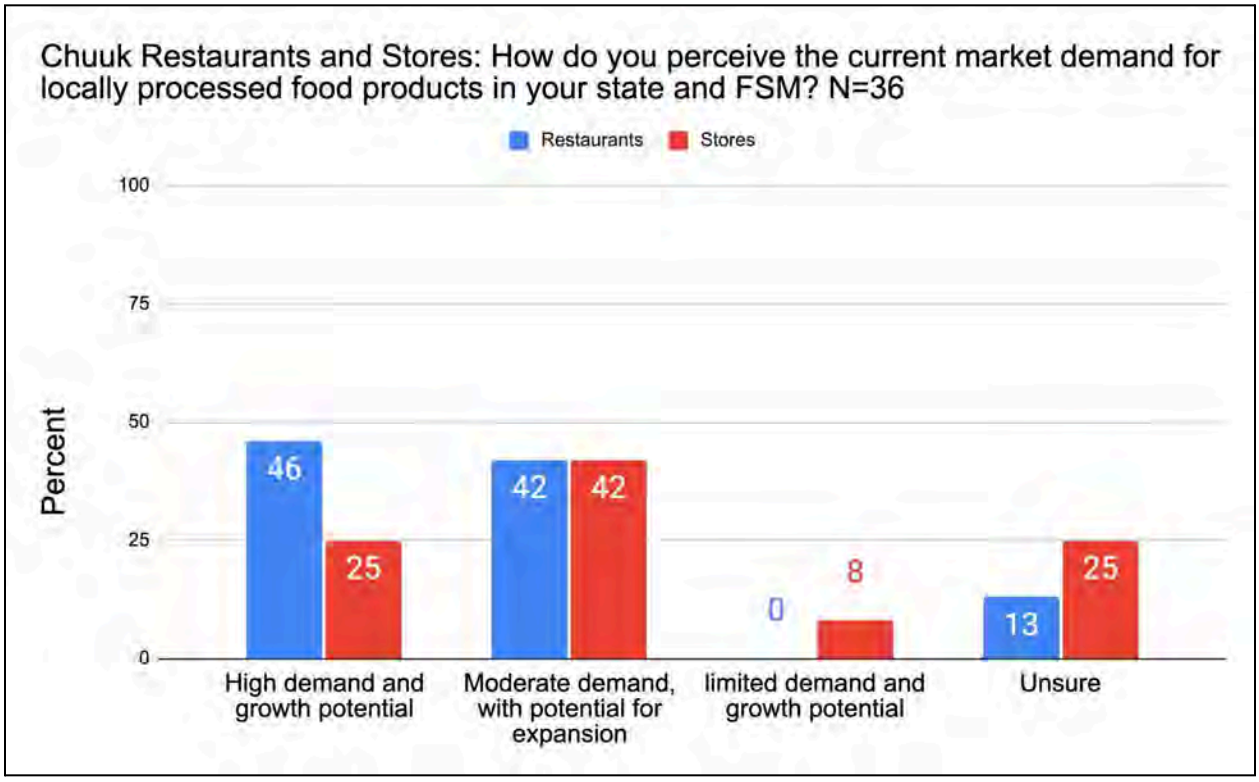
FSS surveys indicate that 42% of Chuukese restaurant customers and 58% of store customers purchase locally processed food on a daily basis. This is **evidence of market demand** for locally processed food as well as **a workforce that is currently processing local food**.



Restaurant/store owners believe customers prefer processed foods made from local ingredients.



Chuuks Restaurant and Store owners see a high to moderate demand for locally processed food with the potential for growth and expansion.



Building Upon Traditional Chuukese Preservation Methods

From the FSS stakeholder and convening responses, there is strong cultural preference for local foods and traditional methods of food preservation are still practiced. This data indicates Chuuk States' unique potential to build upon traditional preservation methods that may be less widley practiced in the other FSM states. Salting, drying, fermentation, and leaf wrapping are particularly notable food preservation methods that have been historically used to ensure food security in a remote, island environment with no access to refrigeration.

Particularly notable is the Chuukese method of preserving pounded, fermented breadfruit in leaf wrappings, creating a traditional food called *epwet*. In Chuuk State, this method was developed

to ensure a steady food supply during times of scarcity, such as storms or droughts. Breadfruit is cooked, pounded, and stored in earth pits, where it ferments and becomes shelf-stable for months or even years. This process transforms the breadfruit into a sour, dough-like paste, and increases its nutritional value with the addition of gut-healthy microbes. Fermented breadfruit can last for a year or more and can be consumed at various stages through the fermentation process, depending on cultural and taste preferences, and need (Ragone, 2002).

Epwet has many nutritional benefits, but is also an extremely versatile functional food which can be leveraged in modern food systems to create new products and promote public health in Chuuk. The fermentation process used to create breadfruit produces lactic acid bacteria, which can contribute to improved gut health, similar to other probiotic foods such as yogurt and kimchi. Lactic acid bacteria can help to enhance digestive health, immune function, and bring overall balance to the gut microbiome (Tamang et al., 2016).

Additionally, fermentation reduces the glycemic index of starchy foods, meaning that epwet and other fermented breadfruit products have a lower glycemic index than fresh breadfruit, making it beneficial for diabetics or those managing their blood sugar, and for those on weight management diets (Wee & Henry, 2020).

Breadfruit is also naturally gluten-free, making epwet a great option for those with celiac disease or gluten sensitivities. In modern diets, fermented breadfruit can be used as an alternative for traditional sourdough starters and other baking needs (Jones et al., 2011).

Fermentation can also increase the bioavailability of amino acids, and pairing fermented breadfruit with legumes (such as traditional taro and coconut dishes) can form a complete protein, making it suitable for vegetarian or plant-based meals. A study by Olaitan et al. (2015) studied the nutritional and physicochemical changes during the natural fermentation of breadfruit, and found that the protein content of breadfruit increased during the initial 72 hours, enhancing its nutritional profile. The study also found an overall decrease in moisture and starch content, which can help to improve the shelf stability and digestibility of the end product (Olaitan et al., 2015).

A study by Liu (2016) found that certain cultivars of breadfruit, such as Ma’afala, contain a higher overall essential amino acid content compared to other staple crops, such as wheat, corn, rice, soybean, and yellow

pea. This suggests that breadfruit, especially fermented breadfruit, can serve as a high-quality protein source in modern diets (Liu, 2016).

With all of its benefits, epwet can be used to make fermented breadfruit spreads and dips (similar to hummus), meal prep components (i.e. a base for bowls and plant-based patties), and even freeze-dried probiotic powders for daily nutritional enhancements.

To align this traditional fermentation process with modern food safety standards, multiple steps could be taken to make fermented foods like epwet marketable. For instance, when fermenting, a consistent salt concentration between 2.25 and 5% should be maintained to inhibit harmful bacteria and promote beneficial lactic acid bacterial growth. PH levels should also be regularly checked so that the end product has a pH between 3.4 and 3.6, to ensure an acidic acid to prevent spoilage.

Keeping information asymmetry in mind when it comes to food safety is especially important. Information asymmetry refers to one party (the producer or seller in this context) having more information about the safety and quality of food than the consumer. This information imbalance can lead to serious public health concerns, market failures, and erosion of consumer trust. While creating new products and building new Chuukese brands, it is important that food safety includes heavy emphasis on labeling, regulation, and certification to allow consumers to make safe and informed choices.

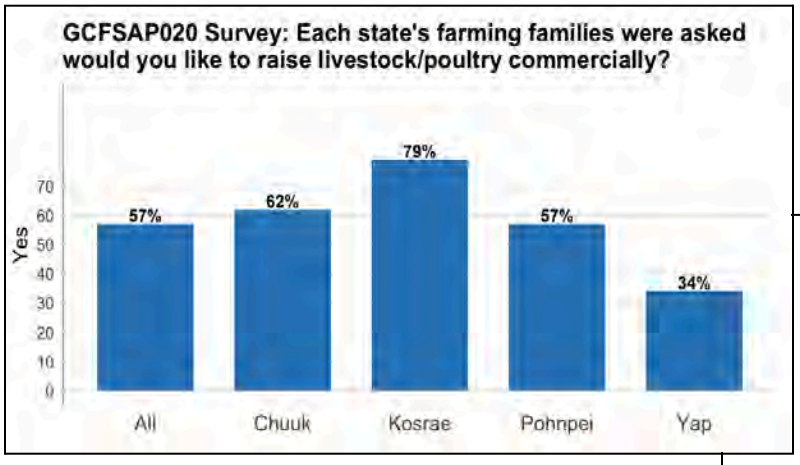
Modern preservation techniques can be used to produce this traditional food with enhanced levels of food safety and longer shelf lives. High-Pressure Processing (HPP) can be used to apply high pressure to the product to inactivate pathogens without significant heat, which can preserve nutritional and sensory qualities while maintaining the food's natural freshness. HPP can be applied to a wide range of food products, including liquids, semi-solids, and solids. However, because this process does not inactivate bacterial spores, treated products should be refrigerated post-processing (Balasubramaniam & Janahar, 2022). Epwet and other fermented breadfruit products can also be freeze dried, removing moisture from the product to inhibit microbial growth and extends shelf life while maintaining quality. Because there is no heat treatment step in the freeze-drying process, it does not kill illness-causing microorganisms. However, fresh food that has been properly processed and maintained at the correct salt concentration and pH levels can be effectively and safely freeze dried to be stored for later use. A freeze-dried fermented breadfruit product could make an incredible shelf-stable ingredient for a number of dishes, as well as a great nutritional supplement to be added to a variety of foods and drinks to increase the vitamin, amino acid, and probiotic content of daily meals (Poulton & Macartney, 2012).

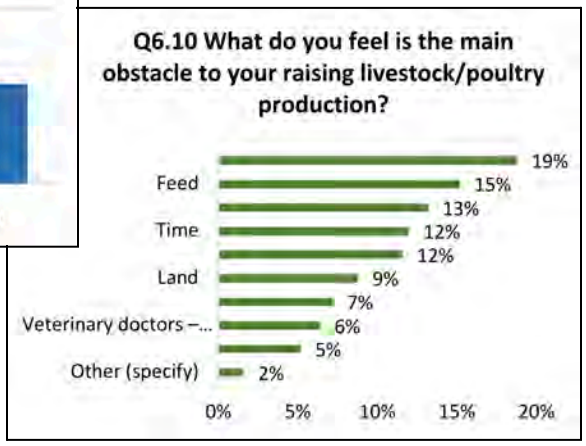
Historically, epwet reflects the ingenuity and resilience of island communities. Without refrigeration, they rely on fermentation to preserve food safely. This traditional practice not only supports food security but also reinforces communal bonds and knowledge-sharing. Today, epwet highlights the value of natural preservation methods that align with modern food safety principles, such as controlling pH and preventing microbial spoilage. As global systems face climate and supply challenges, traditional foods like epwet offer sustainable, low-tech models for preserving food and maintaining food resilience.

Interest in Livestock/Poultry Farming:

"Chuukese love to eat a lot of chicken but we import this chicken meat because the cost of the feed makes it too expensive to raise chickens ourselves. But we can make food for all of the chickens here in Chuuk if we use waste management to make the animal feed from our food waste."
- Joyce Sewell, Chuuk EPA

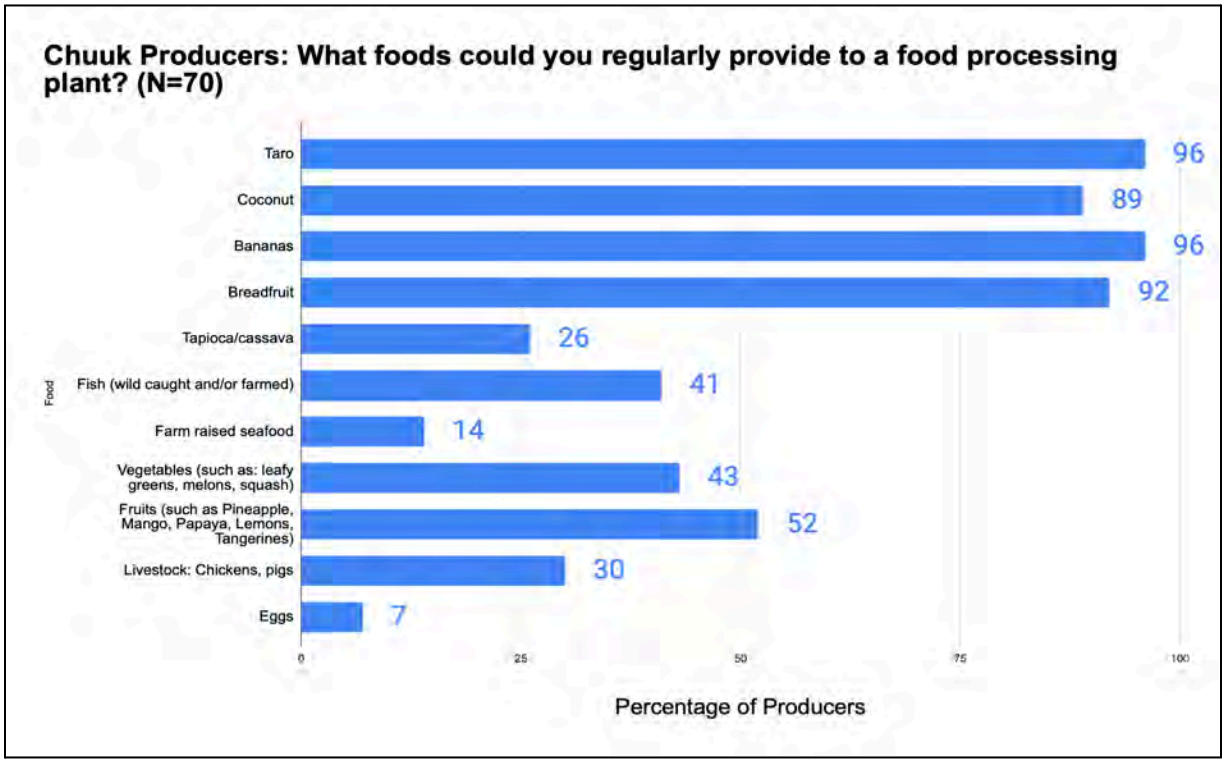
The GCFSAP020 Baseline Assessment (2024) found that 62% of Chuuk farmers surveyed would like to raise livestock/poultry commercially but also identified **feed as the largest obstacle to livestock and poultry farming.**





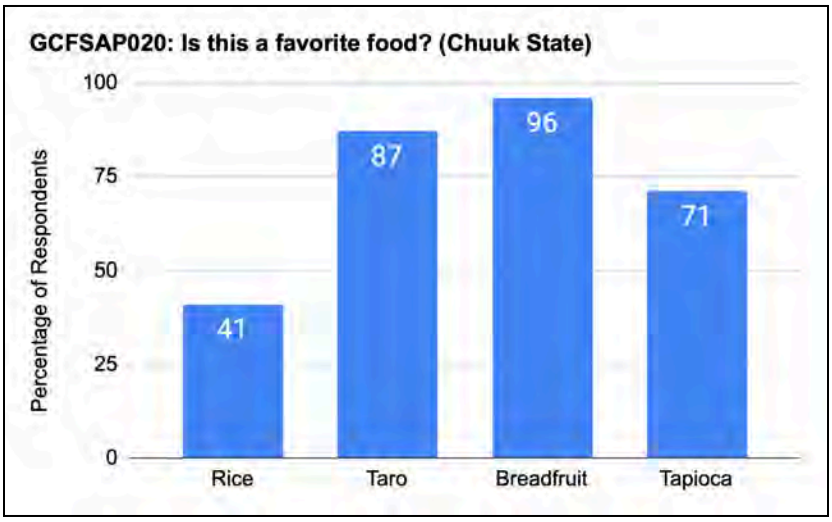
Staple Crops that Chuuk Food Producers Could Regularly Provide to a Local Processing Plant (results of FSS food producer survey):

Chuuk farmers feel confident that they can regularly supply many local staple crops to local food processing facilities.

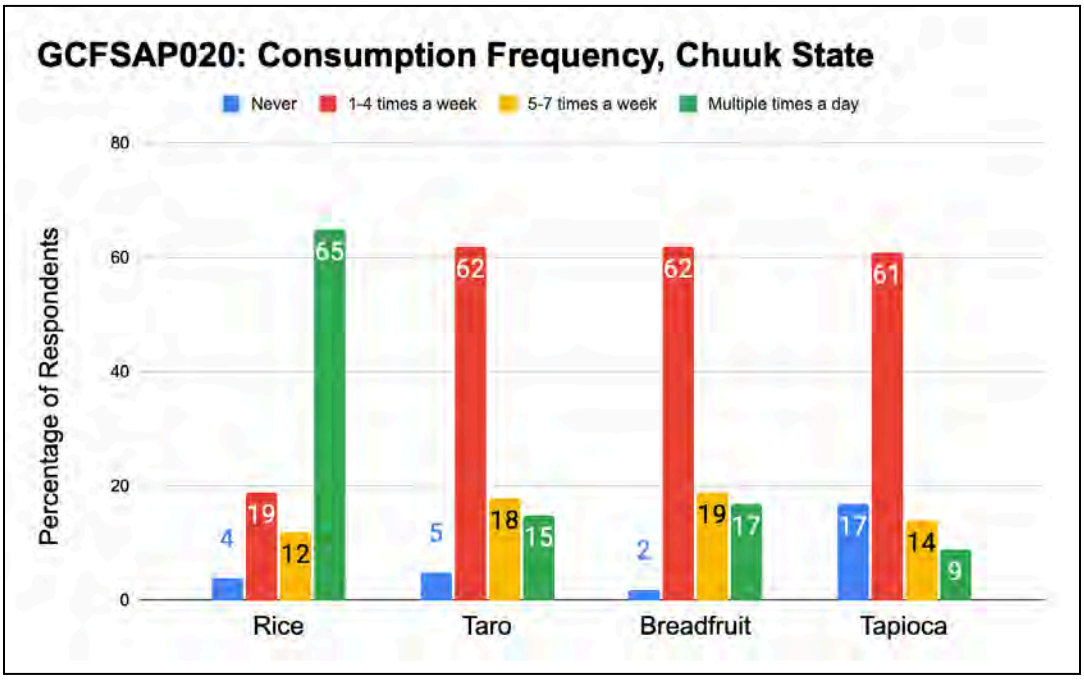


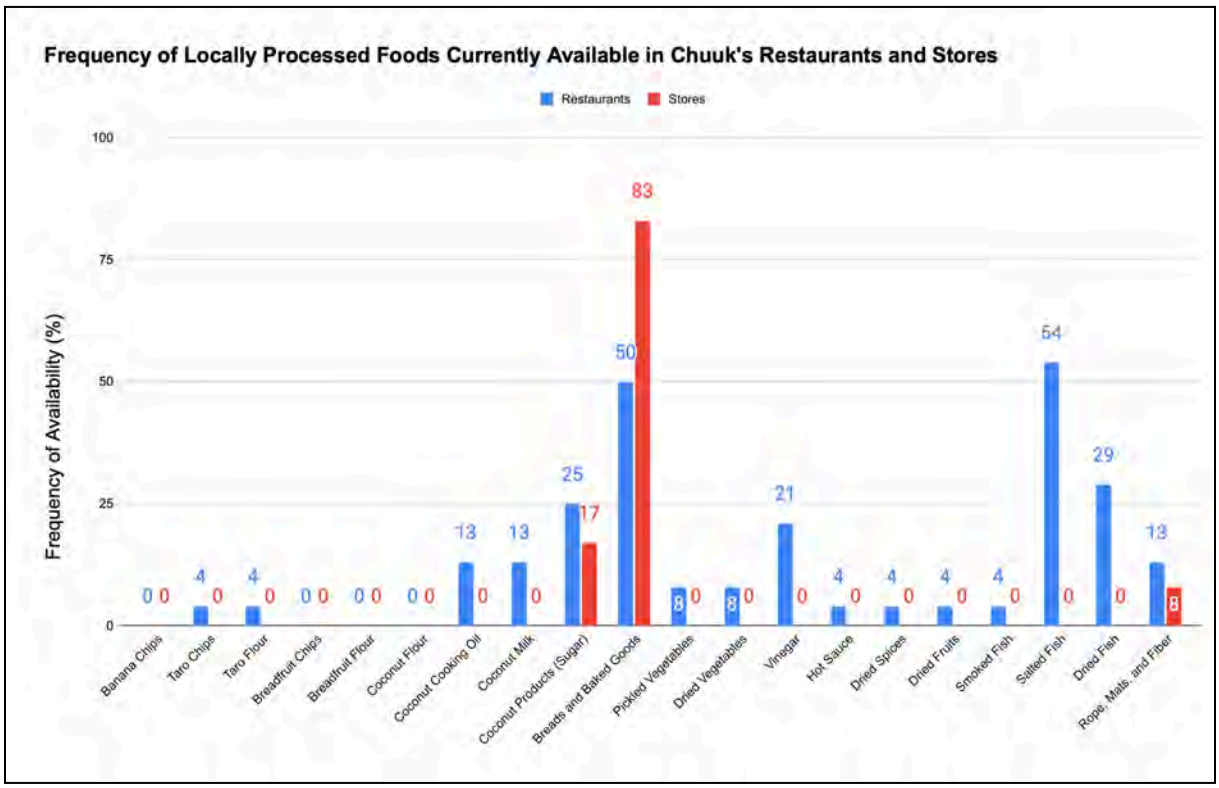
Rice is often consumed for convenience rather than preference.

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



Chuuk FSS stakeholder data imply that rice is consumed most often, not because it is desired but because preferred local starch crops are less available.

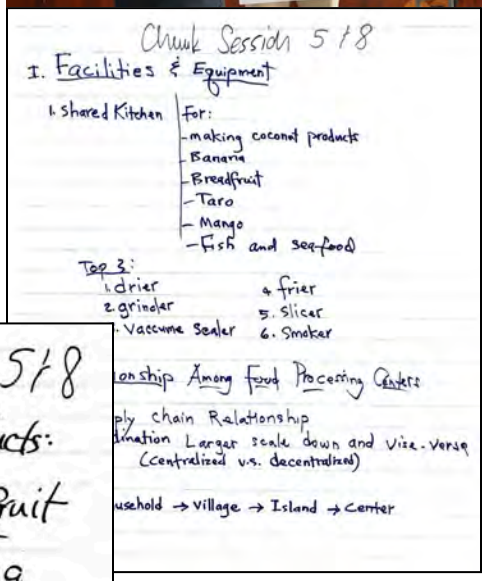


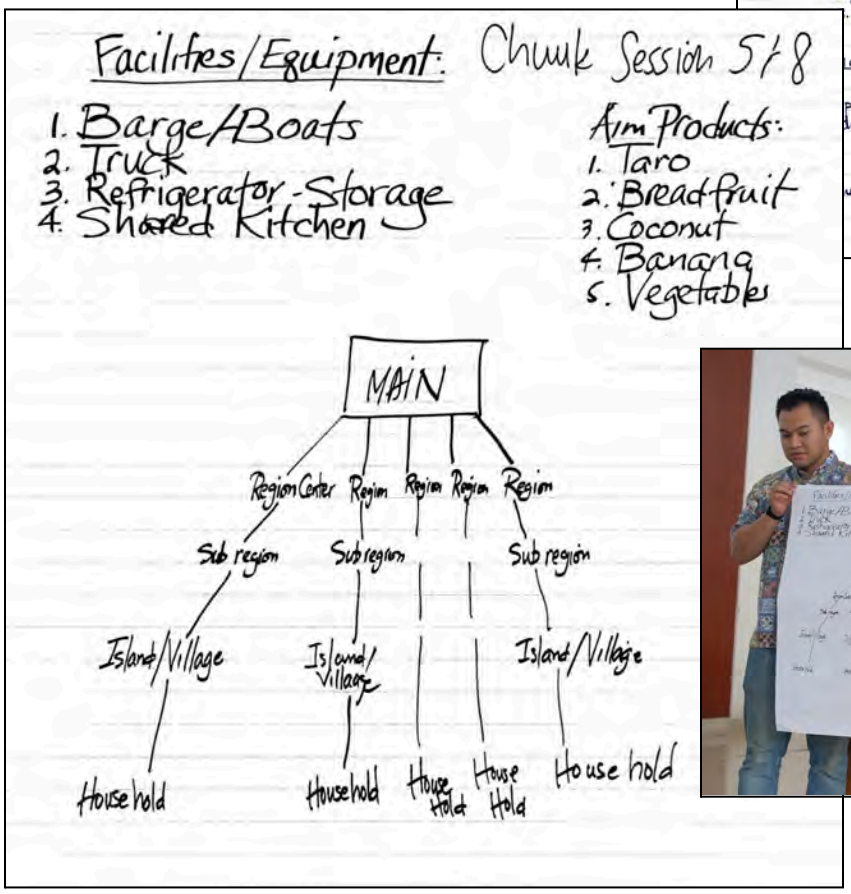


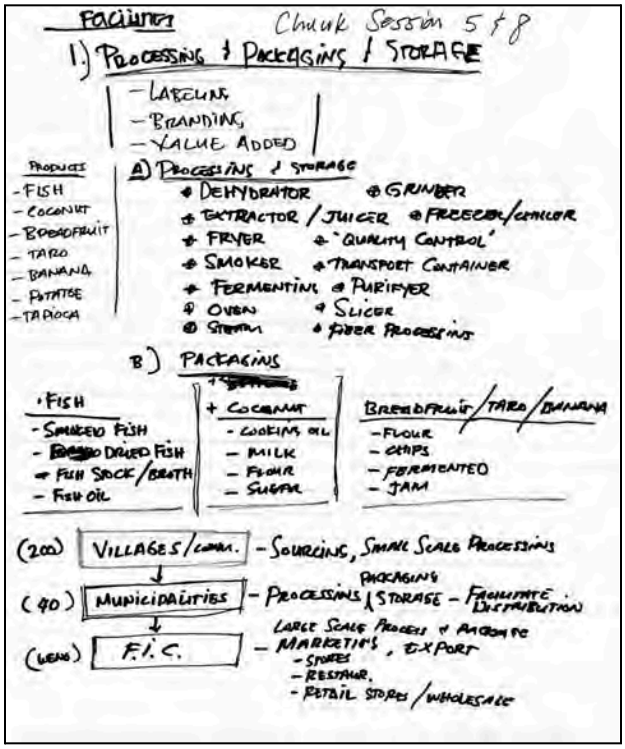
Chuuk State stakeholders expressed a need for a <u>Tiered and Decentralized</u> approach to local food production and value-addition.

"In terms of the relationships amongst food processing centers, the Food Innovation Centers should have a ***supply chain relationship as well as coordination between each step in the supply chain*** *(household, village, island, then finally the FIC).* ***Communication and information access is crucial for this.****"* – **Harmen Mailo**

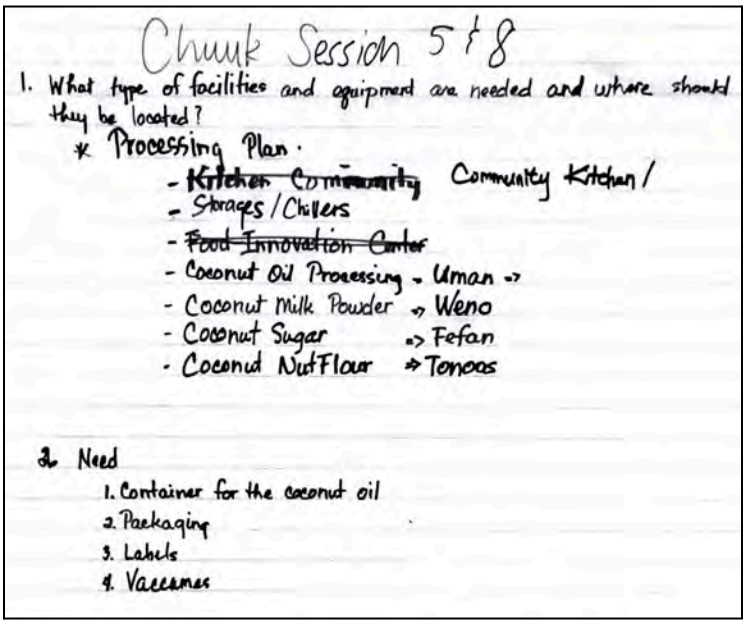
"Our islands are scattered, and we need to bring products from site to site. ***We need ports for boats, trucks in Weno to get the products from the boats to the markets, and storage to keep the food fresh during transport****."* **- Director Kirisos Victus**







"The processing chain would start at the village level, with sourcing and small-scale processing. Then, the food would be brought to municipalities where packaging, processing, storage, and distribution would take place. Finally, the products would reach the FIC where large scale processing and packaging, marketing, exporting to stores, restaurants, retail stores, and wholesale would be made possible." **- Christopher Eustaquio, Chuuk Governor's Office**



"Uman would be a good place for coconut oil processing, Weno would be a good place for coconut milk powder, Fefan would be good for coconut sugar, and Tonoas would be good for coconut flour."

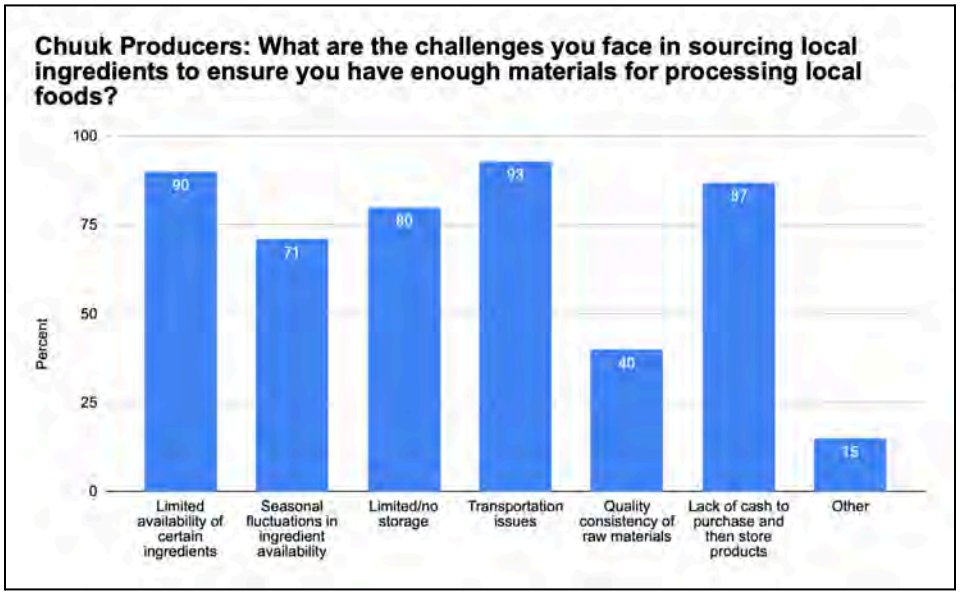
- Local Farmer

Outer Island Production and Processing and Transportation:

*"**Another problem is a lack of accessibility, such as transportation**. Here in Chuuk, a lot of people use boats to go from the outer islands to the main island where the local markets are...* **Policy makers are requesting to increase methods of transportation,** whether that's looking into having bigger ships or ferries that could help communities bring their products up to the mainland.*"* – ***Shanalin Lee Ling, Blue Prosperity Micronesia***

A main issue in Chuuk is the lack of transportation methods and pathways that exist for producers to transport their goods. Transportation between outer islands and Weno is not always accessible due to limited ocean vessels, the price of gas, insufficient methods of food preservation, and a lack of electricity and communication between the islands. It was also noted by many convening attendees that equipment for shipping and transporting, such as containers and refrigerators are greatly needed by producers in Chuuk.

When asked the main challenges they face in sourcing local ingredients, 93% of Chuukese producers reported transportation issues as a barrier.



When community managers were asked what challenges they face in accessing markets, 83% of them reported limited transportation infrastructure as an issue.

Importantly, while Chuuk food producers are confident they can supply food processing centers, 81% of community managers (N=23) said that *'lack of own supply to sell my products'* was a challenge to accessing the markets.

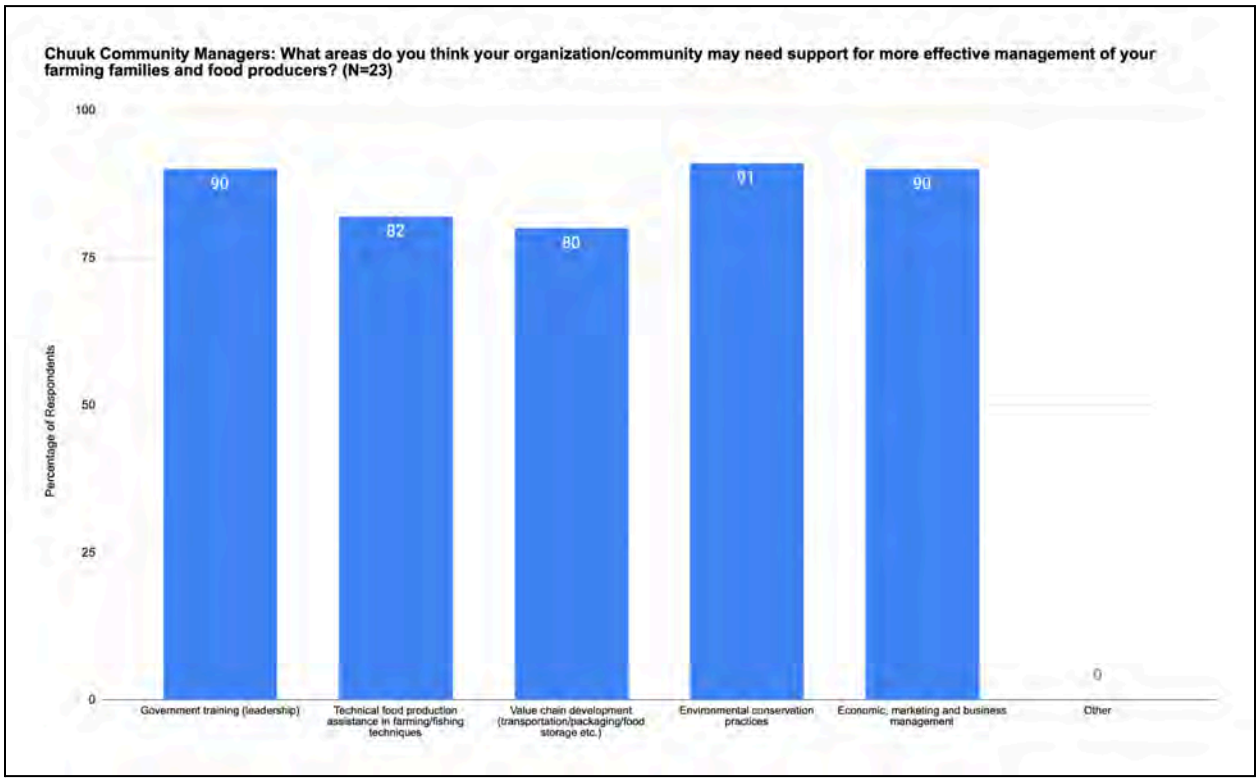
Another large barrier for production is the lack of access that outer island communities have to refrigeration. Thus, outer islands may prefer to focus on foods for local consumption like dried fruits and vegetables, salted fish, coconut sugar, and milk to be consumed immediately. Outer islands may consider processing non-perishable items such as ropes, mats, and fibers made from banana and betelnut leaves for transport and sale on the main island of Weno or for export.

With a solar power grid currently being established on Fefan, Parem, Udot, and Tonoros, Food Innovation Centers can be located on these islands as well as Weno. Udot has very high-quality breadfruit and is known for their production of koromon, a pounded taro with coconut. Udot may be a good location to focus on breadfruit production and processing. Polle Island is also known for an abundance of taro but currently is without electricity.

A significant challenge to local food production is the shortage of technical expertise in product development, as reported by 97% 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, 54% of

restaurant owners and 50% of store owners mentioned a shortage of trained workers, reflecting a workforce gap that may further hinder productivity and the consistent quality of local products.

Community managers in Chuuk highlighted that training and support is needed in a wide range of areas to provide more effective management for farming families and food producers.



Training programs are crucial to the success of food systems development. FSS convening stakeholders described past projects that only focused on new infrastructure, and as soon as the equipment broke down, production quickly declined because the expertise required for technical issues was not present in the community.

Providing food 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 workforce.

It will be necessary to ensure that trainers themselves have adequate training on topics of interest to producers and the FSS surveys addressed these challenges while also surveying local trainers.

Farmers on Fefan island produce their own local coconut oil.

FSS Survey Results: Training requested by Chuuk Food Producers

	Training Requested (>50% of surveyors requested) from Producer Survey (N=70)	**Trainers Needed (<50% of trainers knowledgeable) from Trainer Survey (N=13)**
Agricultural	General crop production/agriculture training/crop planting timing Local/traditional agriculture/fishery knowledge (agroforestry, etc.) Seed collection, seed saving, growing from seed, vegetative propagation Improving soil quality, working with soils, types of soils, testing, soil amendments Making local fertilizer/compost and ways to store and apply compost (solid and compost tea)	Growing sakau (kava) *all trainers were sufficient in the requested training
Livestock	General livestock management Making local pig and chicken feed How to use a woodchipper	*all trainers were sufficient in the requested training
Aquaculture	How to fish, fishing safety, search and rescue Local/traditional fishing knowledge, moon-phase calendar Sustainable fishing, spawning knowledge, male/female identification	Making local Fish Aggregating Devices (FADs) using local materials
Food processing	Traditional food processing techniques Quality control	*all trainers were sufficient in the requested training
Agricultural technology	Greenhouse growing with protected systems Hydroponics Nursery management Hydroponics Hatchery Irrigation technologies	Greenhouse growing with protected systems Hydroponics Aquaculture Hatcheries Cold storage (affordable lower cost) Inclusion of solar power Irrigation technologies
Climate change	Climate change adaptation (save crops from sea level rise, saltwater inundation, heavy rain) Climate resilient crops Sustainable farming and land management	Invasive species management Techniques in rehabilitation or improving coral reefs and coastal land preservation Tools to measure and track the weather

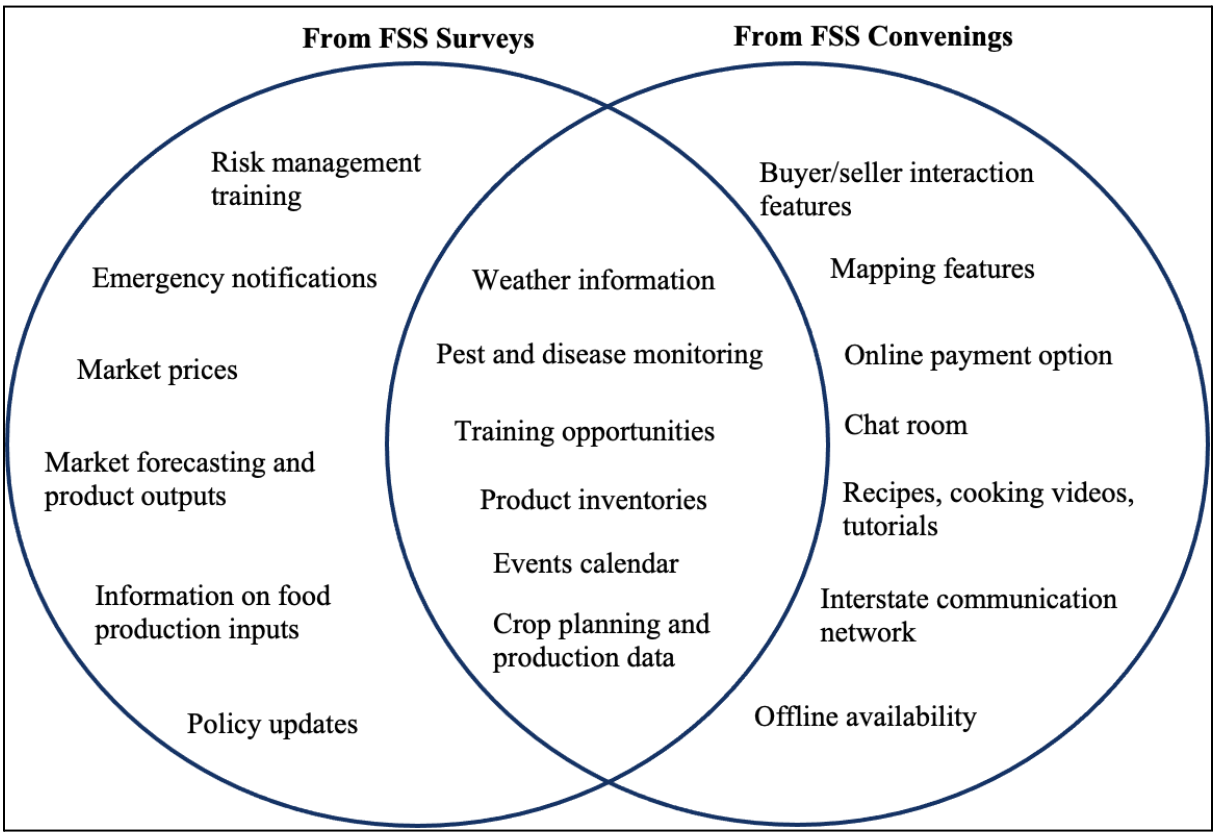
	Ways to access emergency weather information and emergency responses for water, safety, etc. Invasive species management Techniques and approaches to reducing soil erosion Restorative forestry Coral reef rehabilitation and coastal land preservation Water collection and storage	
Business management	How to run a business, management, leadership, business plan How to prepare application for a loan or investment How to inform others of your business and ways to generate business Training on applicable laws/regulations	*all trainers were sufficient in the requested training
Health and nutrition	Food preservation/processing/packaging/marketing/handling How to market products (make sellable) Value added/niche markets	Value added/niche markets
	General health and nutrition How to prepare (easy) dishes with local foods (fish)	How prepare (easy) dishes with local foods (fish)

The Importance of Developing a Chuuk State Food System Mobile App:

Chuuk stakeholders identify the need for a food systems app to strengthen communication and information between producers, markets, and consumers. The Food Systems Solution Convenings included conversations with Hiroyuki Mori, Operations Manager for iSolutions, an information technology company based in Weno. iSolutions would play an imperative role in developing the Chuuk State specific food system mobile app.

The FSS surveys identified current connectivity gaps specifically with Chuuk'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. **This new age technology is meant to build upon the foundation of traditional culture and farming practices, not to replace it. Increasing communication and availability of information will allow those involved in the food system to share their ideas and products with each other more effectively than ever before.**

Stakeholder Preferences for a Chuuk Food System Mobile App:



*"For the app, we recommend **how-to videos, weather updates, online ordering**. For the information hub, we recommend **a radio station, social media platforms, telecom announcements and text messages for farmers, tracking systems, and shared food processing plants**."*

- Cruz Paulus, CRS Staff

*"The app should include a **discussion page** where buyers, producers, and the general public can chat about their needs, challenges, or requests. There should also be a **map** which includes the locations of each farm, and that farm's currently available products."*

- Curtis Graham and Barbara Nachuo

Sustaining a **centralized online information hub** ensures effective communication and for stakeholder groups alike to work together. **Having features like offline availability also ensures that food producers on remote islands can upload their product information and inventory without having to pay each time for connectivity.**

Conclusion: FSS Project Chuuk State Evidence-Based Stakeholder Goals:

This FSS project provides evidence-based recommendations for the implementation of FSM state-specific food system development and food processing. These suggestions are based on stakeholder input and intended to support increased local food production and processing, improved market integration, enhanced community-led management, training, and capacity building and stronger inter-state coordination. Ultimately, the project aspires to help Chuuk 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 Chuuk community's recommendations.

Part II: Chuuk Food Systems App

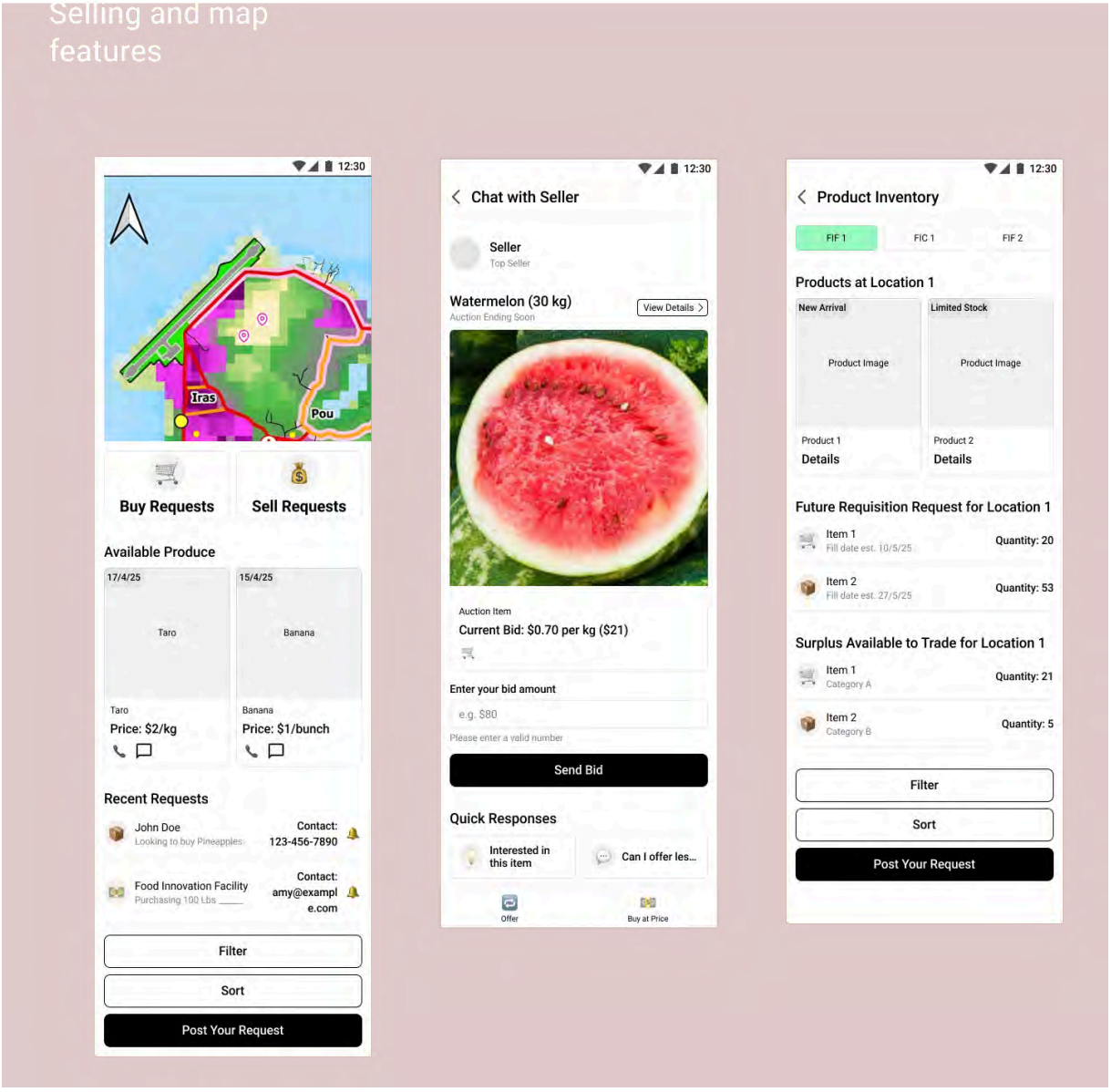
Source: *SourceTrace Systems, 2017. Pacific Pets Pathogens Weeds Phone App, 2023.*

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.

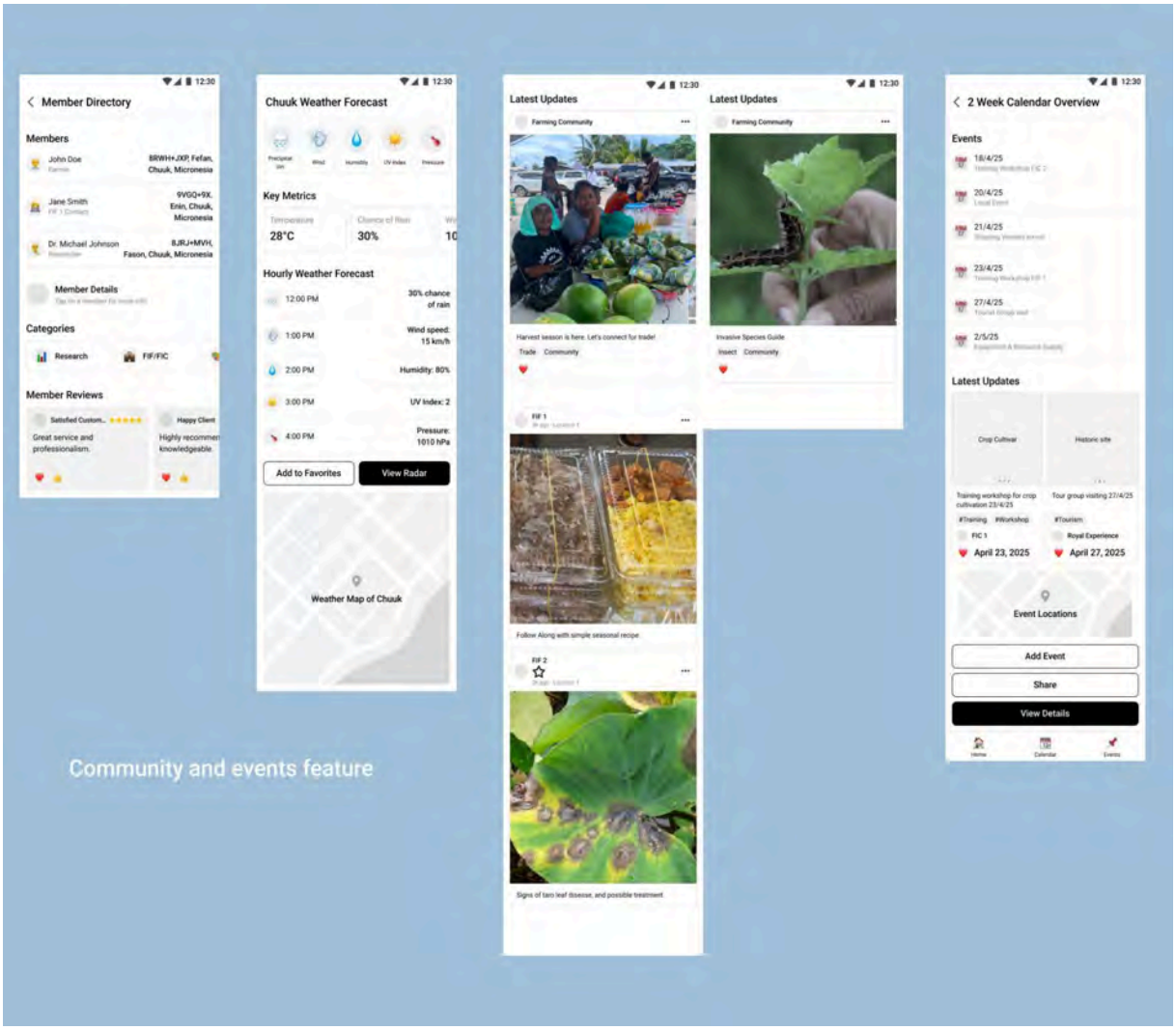
The centralized phone app is becoming popular within food processing hubs as a way to keep everyone connected. This proposed app is only one part of a larger information network, which includes websites that already exist.

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.

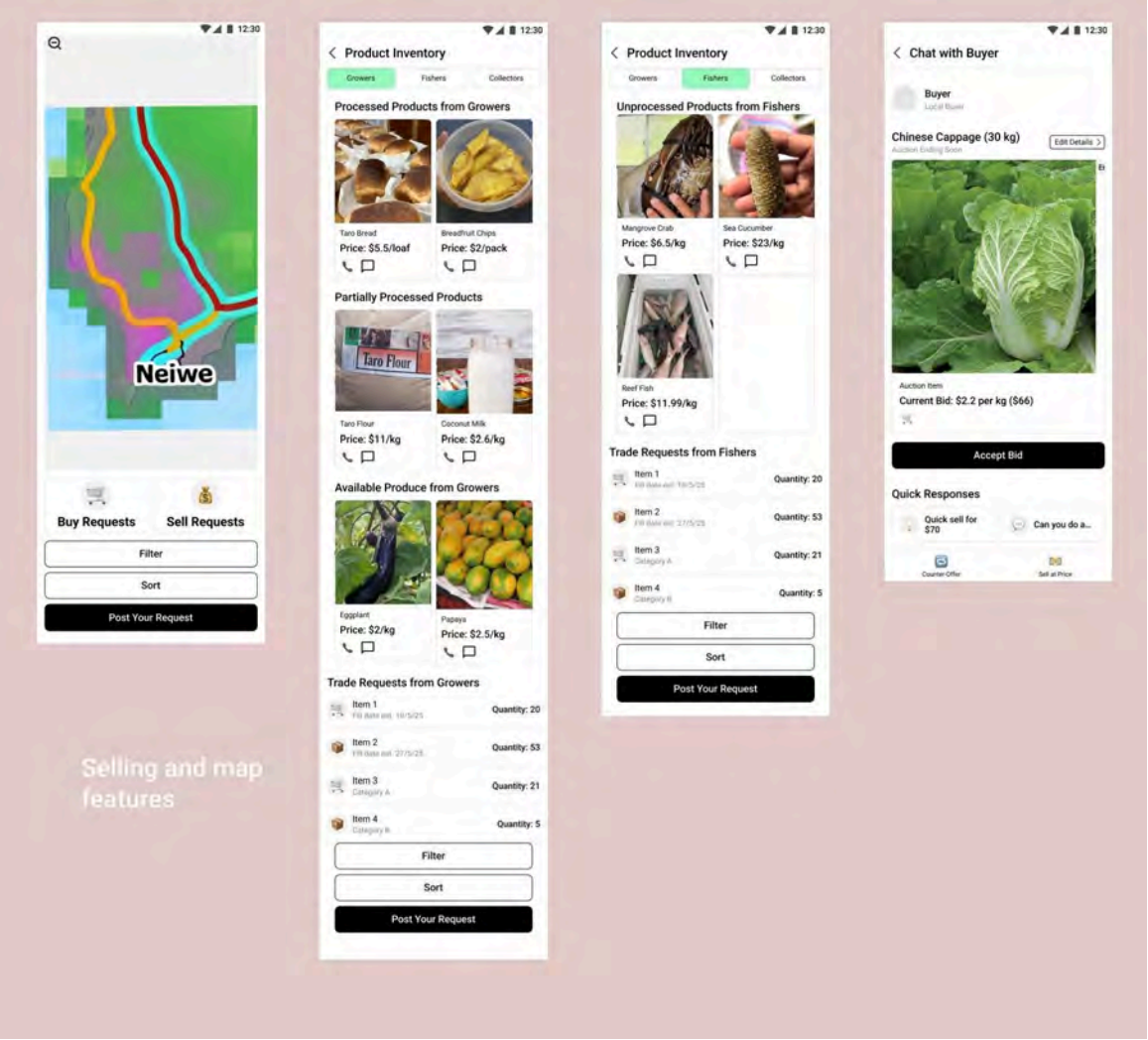


3. A comprehensive product inventory which highlights surplus produce available for trade and pre-order through future requisition requests.
4. A member directory of growers and processors, with business locations, contact information, and community member reviews.



5. Real-time weather forecasts and emergency preparedness information. This could also be achieved by linking to existing platforms Chuuk 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.

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 Chuuk 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 Chuuk 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 Chuuk'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 Chuuk 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 Chuuk State would be coordinated by Chuuk 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 Chuuk 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 Chuuk 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 Chuuk 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. Chuuk State is committed to including a coordinator to contribute toward building and ensuring access to such an information repository.

Part III.
Chuuk's Food Processing Implementation Framework

Here are the proposed steps to developing a tiered local food processing system for the State of Chuuk, 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

Commercial Food Drying

Food Grading

Food Preparation

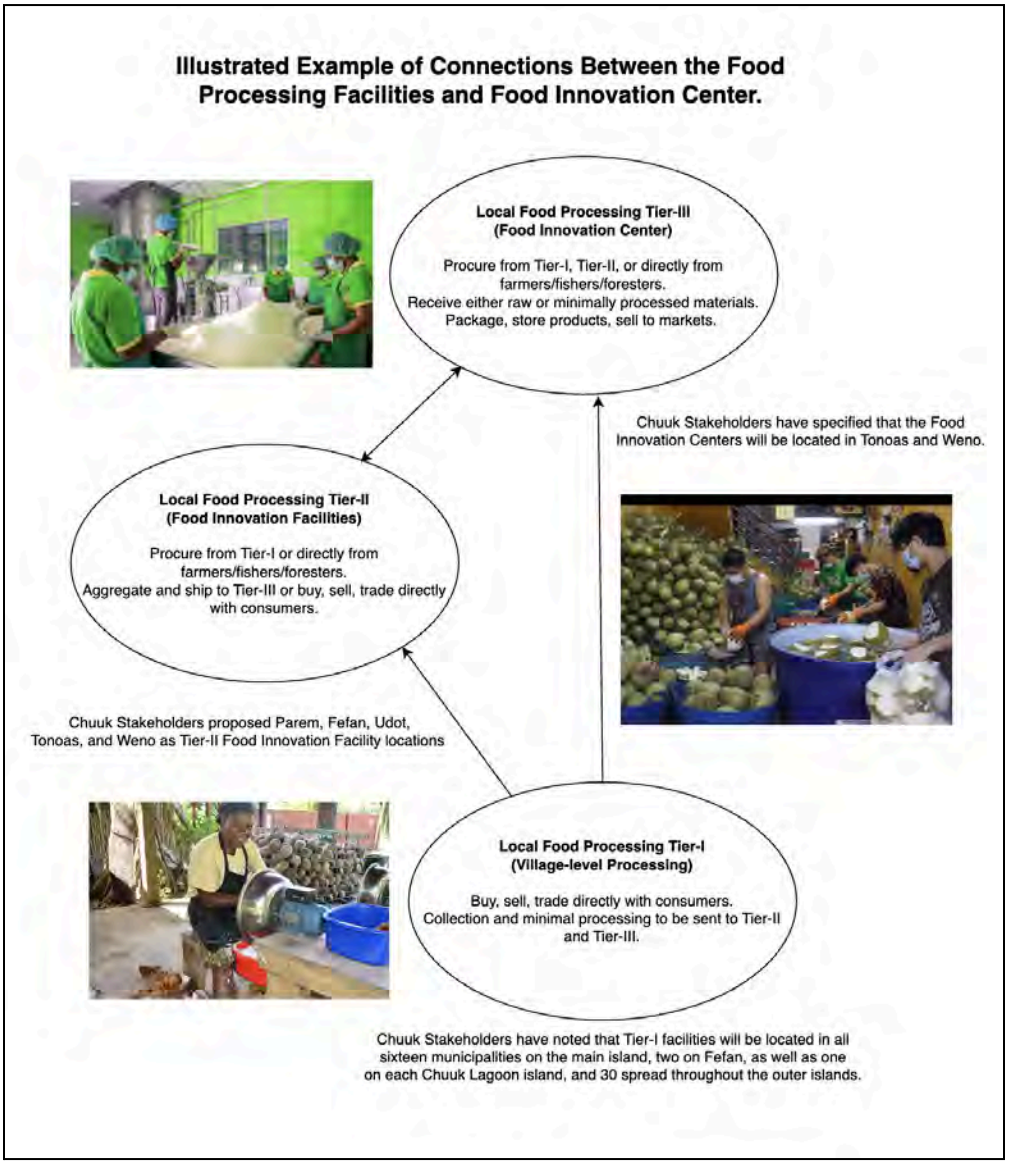
Packaging and Labeling

Commercial Bottling

Decentralized, Tiered Food Processing System for Chuuk State:

In Chuuk 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 Chuuk 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 Chuuk State. These facilities include teaching and training kitchens for

commercial food preparation, mid-scale processing equipment for priority products identified by Chuuk 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:

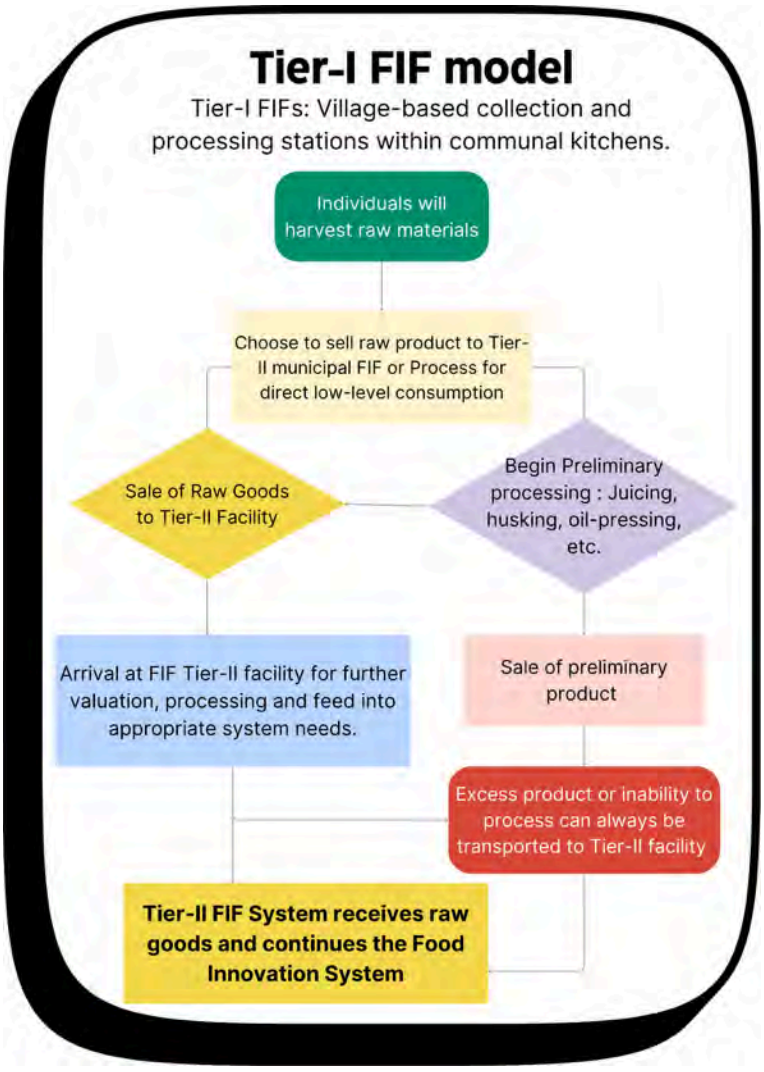
Tier-I facilities represent the foundational level of the food innovation processing system, consisting of 100-200 square foot spaces that can include communal kitchens. Chuuk stakeholders have suggested 63 total Tier I facilities with sixteen on Weno, one for each municipality. In addition, two Tier-I facilities will be located on Fefan, and one additional facility will be located on each inhabited island within the Chuuk Lagoon (Fonoton, Piis, Paneu, Tonoas, Uman, Siis, Parem, Udot, Eot, Romanum, Fanapanges, Toleisom, Oneisom, Paata, Polle). 30 more Tier I facilities will be developed throughout Chuuk's neighboring islands. 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.

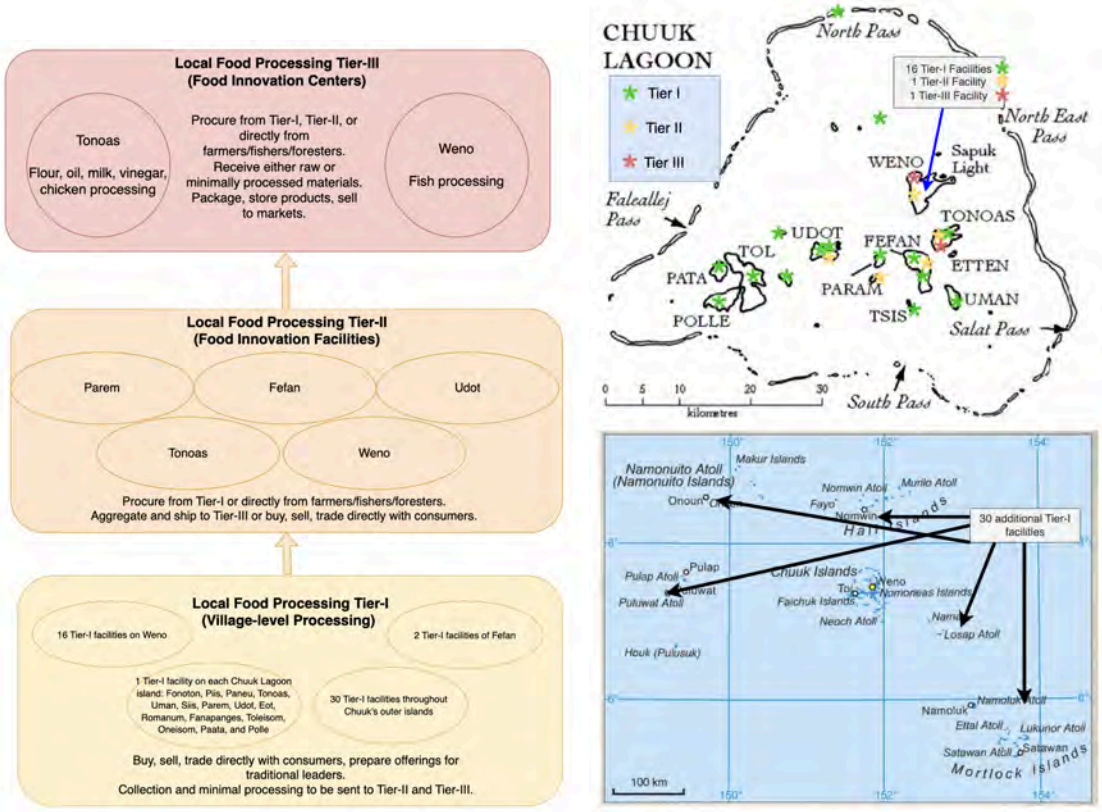


Documentation and coordination represent critical components of the Tier-I operation, with community partners maintaining comprehensive records through both physical and digital logging systems. These logs will capture detailed information about food harvesting activities, preparation and processing

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.

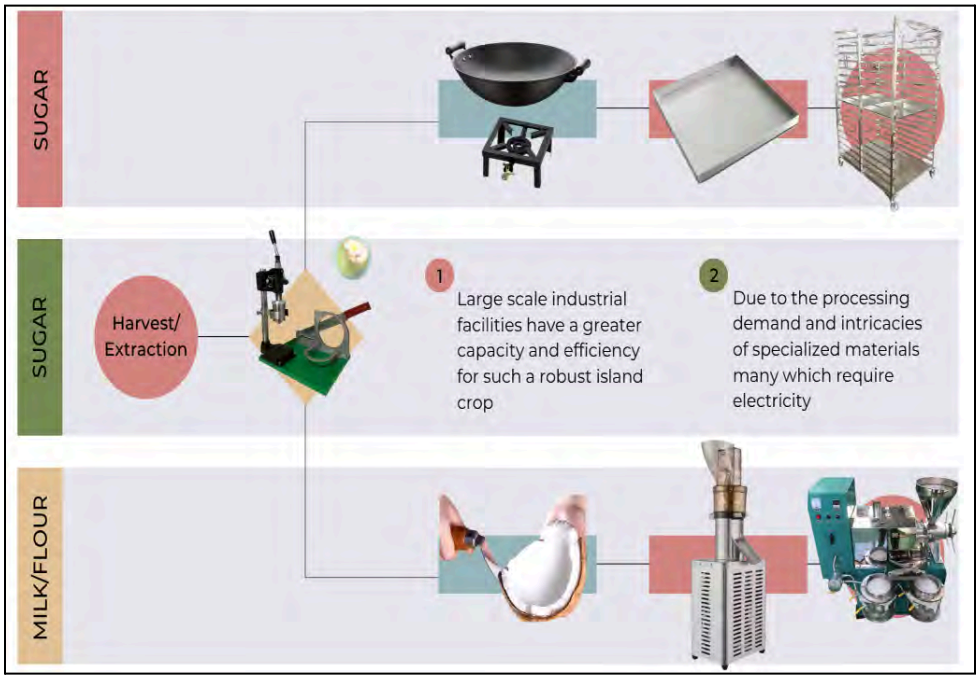


Tier-II Food Innovation Facility Layout (3,000–4,000 sq ft) – Located in Tonoas, Weno, Fefan, Parem, and Udot

Tier-II Facilities will receive raw and low-level processed materials from each of the ten Tier-I facilities. During the FSS convening, Chuuk policy makers identified **Tonoas, Weno, Fefan, Parem, and Udot** as the five 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 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 Tonoas

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
Room 1 Staple Crop Processing	Functions: Washing, chopping, drying (solar-assisted), grinding, and packaging. Crops: Breadfruit, taro, cassava, coconut. Technologies: Solar dryers, low-energy grinders, local packaging systems
Room 2 Vegetable & Fruit Processing	Functions: Cleaning, peeling, slicing, dehydration, vacuum sealing. Produce: Banana, papaya, mango, greens. Technologies: Blade processors, solar drying systems, hand wash stations.
Room 3 Community Kitchen	Functions: Cooking demos, nutrition education, recipe development. Tools: Solar-powered stoves, fermentation crocks, culturally rooted recipe books.
Room 4 Storage Areas	Features: Dry and cold storage, inventory tracking, adaptive cooling systems including eggs
Room 5 Administrative Office	Functions: Recordkeeping, training coordination, business management.
Room 6 Food Testing Lab	Functions: Nutritional testing, product development, food safety monitoring.

Room 7 Workforce Training Room	Functions: Video display, hands-on workshops, youth and women engagement.

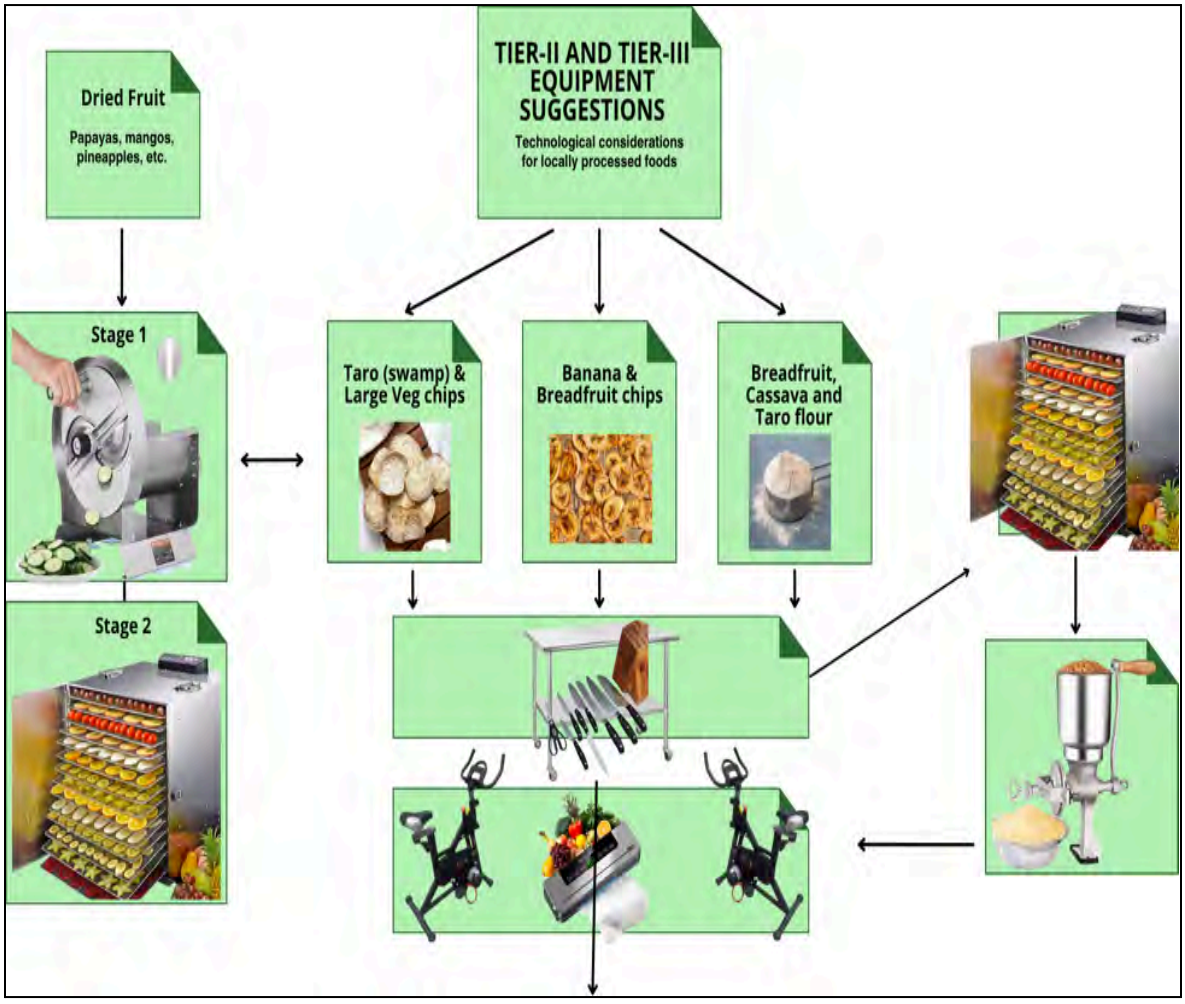
These full-scale regional Food Innovation Centers will be supporting research, policy integration, high-volume processing, storage, logistics, and training. The Chuuk State facilities will be located in Tonoas and Weno. Each of these facilities will be in an agreed-upon location on each of the four main 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.

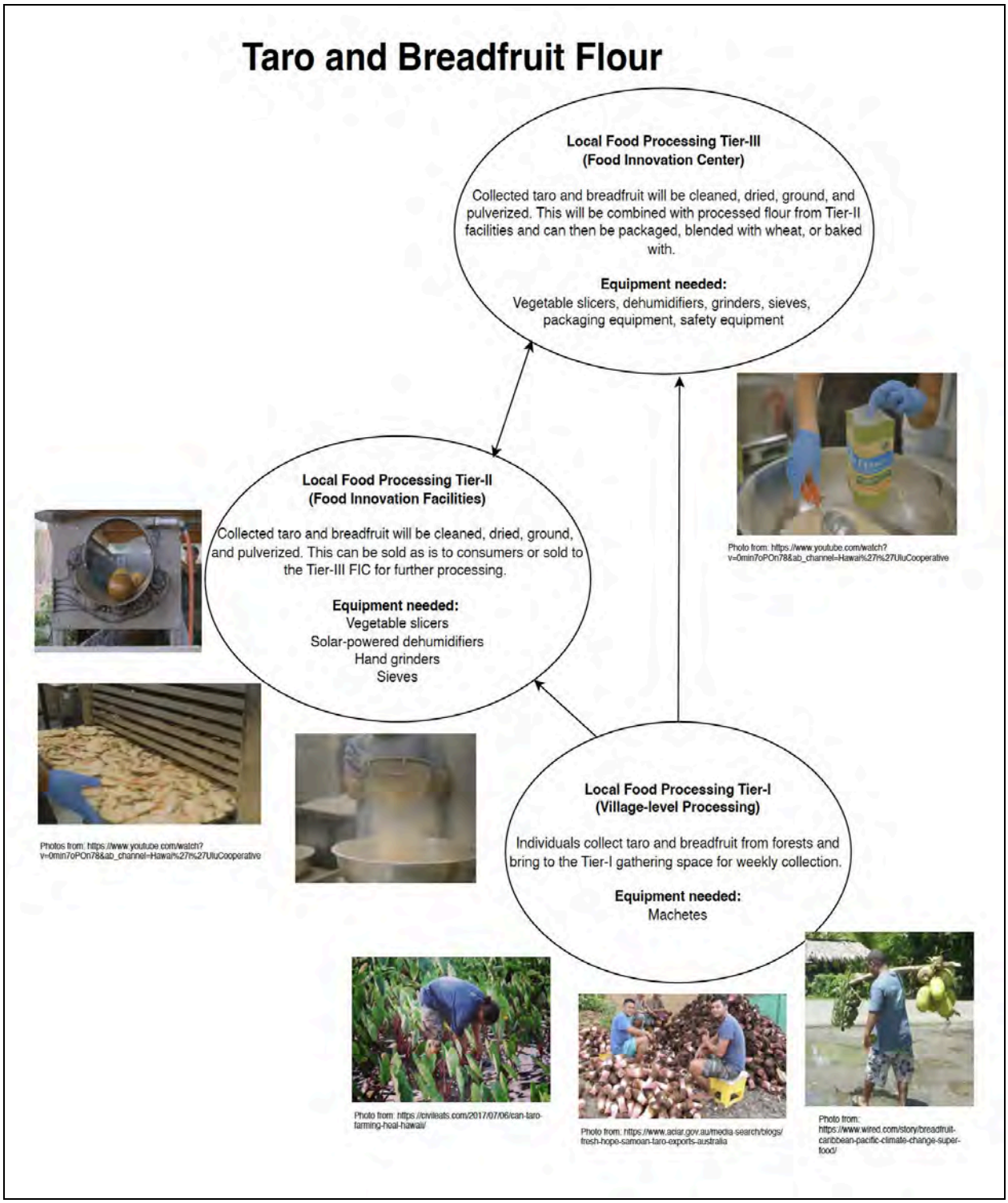
The establishment of a Food Innovation Center in Chuuk, particularly at Tiers 2 and 3, offers a strategic opportunity to achieve **economies of scale**, which occur when the cost per unit of production decreases as the volume of production increases. By consolidating the processing of multiple local food products in a shared facility, the center can reduce the per-unit costs of equipment, labor, storage, and quality control. This co-location allows for more efficient use of resources across various value chains, making value-added processing more affordable and accessible for producers. In turn, the center will help catalyze the development of local **supply chains** and support the creation of **jobs and livelihoods** in related sectors such as transportation, packaging, and distribution. Complementing the grassroots efforts of Tier 1 facilities (embedded

within each municipality and outer island) the Food Innovation Center ensures that both small-scale producers and regional enterprises benefit from improved infrastructure and market access, strengthening food security and economic resilience across Chuuk.

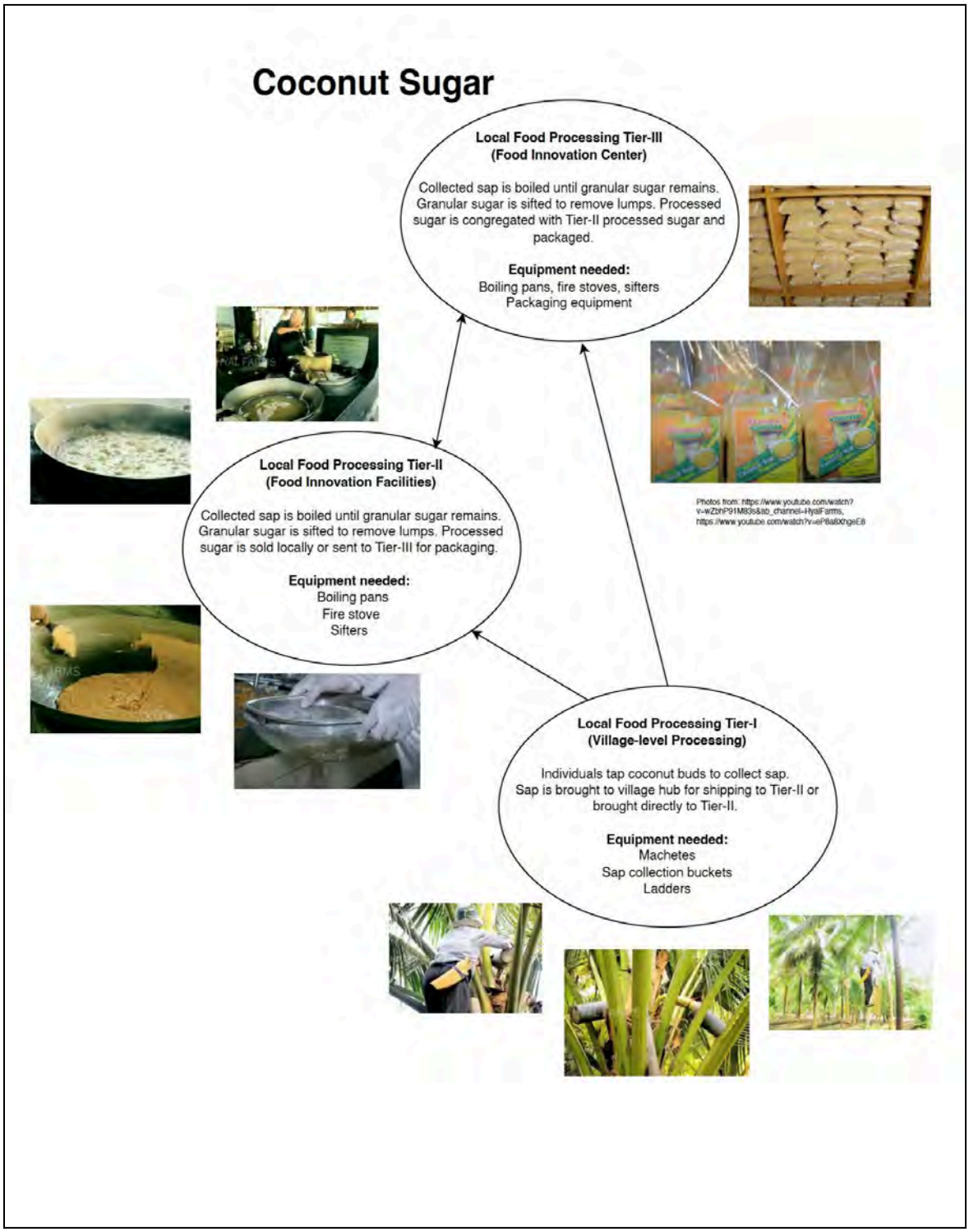
Example of Tier-II and Tier-III Processing System:



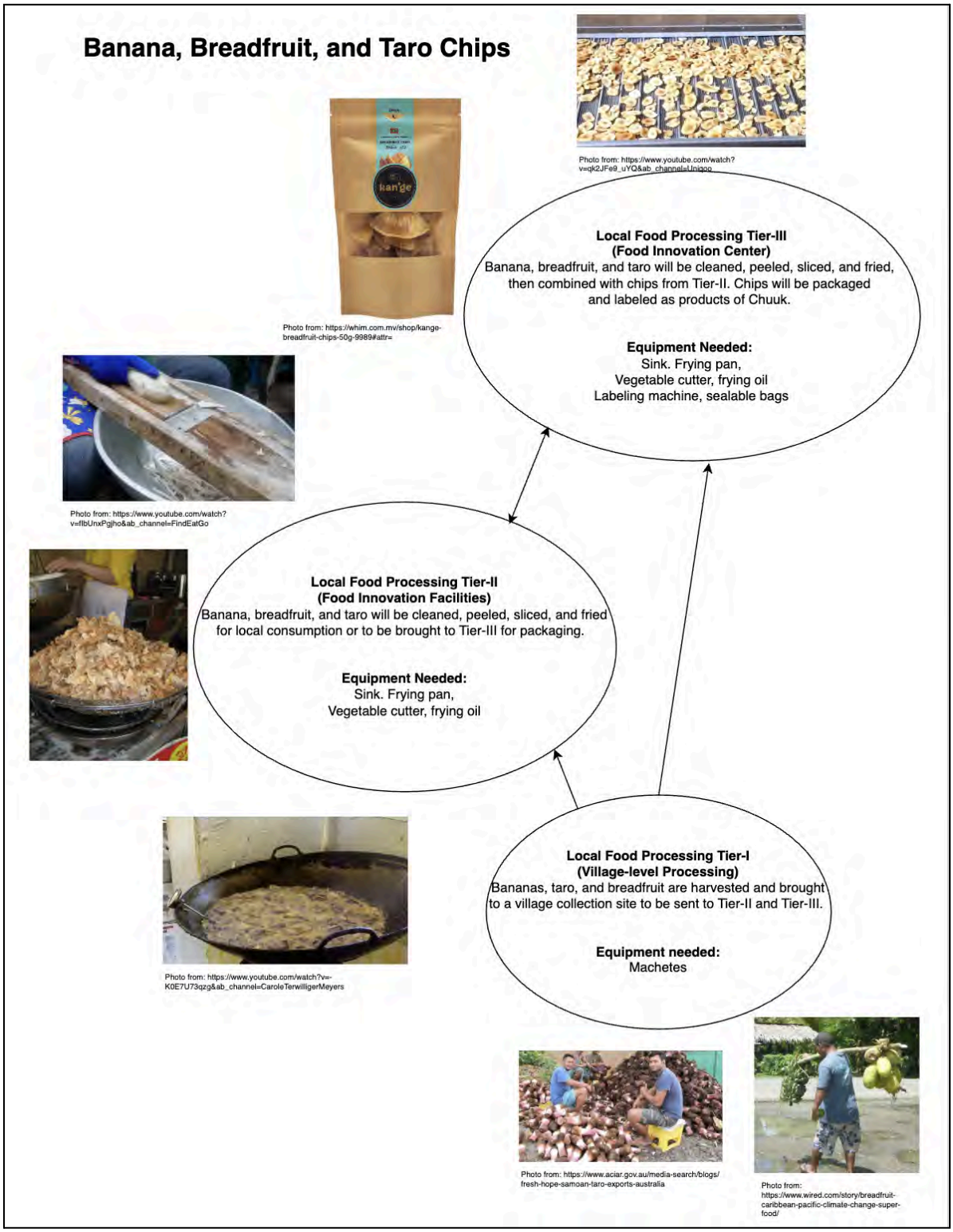
Example of Tiered System for Processing of Taro and Breadfruit Flour



Example of Tiered System for Processing of Coconut Sugar



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



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

Maritime Food Processing Tiered System (1,500 - 2,000 sq. ft.) - Located in Weno

Rather than a three-tiered system for fish, a modified tiered system will be put into place for maritime food processing in Chuuk State. Individual sub-contracted fishing boats will serve as Tier-I operations, collecting fish and transporting them to the main facility on Weno. These fishing boats will have ice boxes and insulated containers, and handheld solar-powered communication devices for coordination and inventory tracking, and the crew will have basic training in catch quality maintenance. These Tier-I boats will be sub-contracted as an alternative to each independent fisherman expanding fuel and time to deliver their catch individually. The Tier-I transportation workers will deploy dedicated cold-chain boats that visit key outer islands on a set schedule. These boats will collect fish from dockside drop points, and the fish will be stored in on-board cold storage until arrival at the central facility. This method will reduce fuel consumption and travel time for small fishers, ensure better fish quality upon arrival, standardize data collection and supply management, and encourage cooperative management and community participation, while creating jobs for fishermen who have been transporting their catches to markets for decades.

Chuuk small fishing boats entering harbor in Weno, drone photo by Charlie Tommy.

Local fisherman sells his fish by the pound in the Weno markets.

A Tier-III maritime processing facility will be developed on Weno Island due to its existing harbor infrastructure and airstrip, proximity to outer islands, availability of labor and utilities, and its potential as a central coordination point for Chuuk Lagoon and outer municipalities.

The estimated size of this facility is between 1,500 - 2,000 sq. meters, and it will include reliable power (solar hybrid), freshwater access or a desalination unit, and sanitation and waste management facilities. The facility will also be equipped with an ice maker (producing 10-20 tons/day), a blast freezer, cold storage, fish cleaning and filleting stations, smoking ovens or kilns, salting and drying racks, waste grinding and pelletizing machines (for feed production), packing and sealing machines, storage tanks for fishmeal byproducts, and a small truck and boat-based cold-chain logistics system.

Fish waste will be utilized for chicken feed, which will be processed in a Tier-II microenterprise facility. This facility will improve fish product quality and shelf life and reduce post-harvest loss, while leading to higher incomes for fishers via value-added products, reducing imports through the development of chicken feed, and the potential for export-ready products.

Local Fish and Marine Food Processing in Weno

Maritime Processing Tiered System

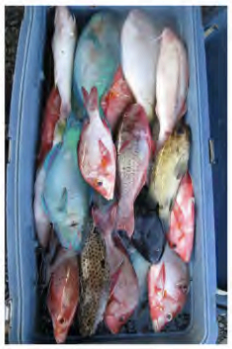


Photo: SCRFA.org

Local Food Processing Tier-III
(Weno)

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

Equipment needed:

Filet cutter	Blast freezer/cold storage
Cleaner/gutter/descaler	Salting/Drying racks
Fryer	Grinding machins
Ice maker	Packing and sealing machines
Smoking oven	

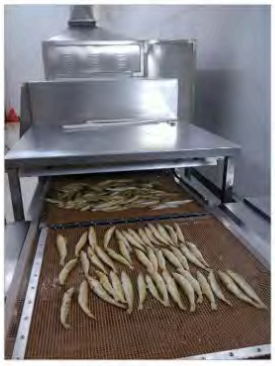


Photo from: https://food-drying-machine.com/food-drying-solution/fish-drying-in-bangladesh.html

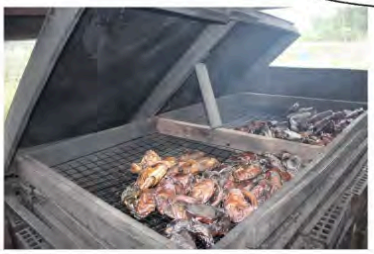


Photo from: https://thefishsite.com/articles/oven-ready-aquaculture

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

Local Food Processing Tier-I
(Individually Contracted Fishermen)

Fishermen collect and bring fresh-caught seafood to Weno for direct sale, storage, or processing.

Equipment needed:
Fishing lines
Nets
Spears
Ice boxes/Insulated containers
Communication devices

Photo: Chuuk Islands Fishing Club

Photo: SCRFA.org

Neighboring (Outer) Island Fish Preservation

Fish salting and drying will take place on islands outside of Chuuk Lagoon (Namonuito Islands, Hall Islands, Mortlock Islands, and Pattiw Islands). This will require their respective Tier-I facilities to have the ability to capture salt from the ocean to use for fish salting and a designated place for fish drying and processing off the ground.

Fish drying methods include sun drying and hang drying. Sun drying can take 3-7 days with optimal conditions, and requires frequent flipping of fish. Hang drying can take 1-4 weeks depending on weather and environmental conditions. Additional low cost solar chimney dyers will be built with local materials and rubberized screens. Such systems can significantly reduce drying time. These systems work best with small fish or large split fish.

Each method is dependent on hot, dry conditions to reduce the spoilage from molding and bacteria. Pest pressure from birds, insects and rodents are a concern and processing and handling technologies to reduce these issues will be introduced. These methods require constant attention to ensure that any spoiled fish are promptly removed. When done correctly, dried fish can last around 3 months.

Common methods of fish salting for preservation include dry and wet salting. Dry salting occurs when fish are coated with salt crystals. Wet salting (or brine curing) occurs when fish are

submerged in a 15% saltwater solution. Dry salting typically has a longer shelf life and does not require clean water. Yet, it can lead to overly hard, salty fish. Brine curing is gentler on the fish, but needs clean salt water. For reference, ocean water is typically only 3% salt so it must be boiled down significantly to be used as a brine. It does not have as long of a shelf life but has a reduced risk of overly salty fish. For both of these methods, sea salt can be harvested and used.

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 &	Moderate to High (Some vitamin loss in brining)

	B-Complex)	
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

Local fruits are generally sold fresh in Chuuk. Canning can provide a food-safe way to preserve nutritious fruits for long periods of time.

Workflow steps for Canning (Pressure Canning Emphasis)

Steps	Consideration
Step 1 (Selection)	Harvest selection of produce should occur at peak ripeness. *Bruised, moldy or overripe food items should be rejected*
Step 2 (Cleaning and Prep)	Food stuffs should be washed in potable water with 50ppm chlorine solution *Provisions for food items should be discerned whether to peel, core, slice as needed based on food item*
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 *(dependent on current altitude at time of processing)* Process 20-100 minutes *(depends on food density)*
Step 6 (Cooling and Sealing)	Allow jars to cool undisturbed for 12-24 hours *(Test seals, Label food item with date and other pertinent information)*
Step 7 (Storage)	Store in temperature controlled environment or low-humidity room *(Additionally can cover jars with cloth to reduce condensation-induced rusting due to environment)*

Workflow steps for Natural Fermentation and Vinegar Pickling

Steps	Consideration
Step 1 (Selection)	Harvest selection of produce should occur prior to peak ripeness. *Selecting for young vegetables without the presence of bruising. Moldy or overripe food items should be rejected.*
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 *Provisions for food items should be discerned whether to peel, core, slice as needed based on food item*

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 *(Please see USDA Canning Guidelines)*		Salinity adjustment *Aiming for 3.5-5% salt brine in hot/humid climates*	
Use of pressure rated glass jars and lids		pH testing *Using simple pH meters or test strips with a final pH target of <4.0*	

Monthly inspection *Stored goods for rust, leaks, or bulging lids*		Shortened fermentation times *Completing fermentation between 5-7 days in controlled environments/climates to avoid microbial ingression*	

Circular Village Egg Production:

Key stakeholder surveys and convenings have highlighted the increasing demand for locally sourced eggs. Chuuk 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. Chuuk 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 Chuuk 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 Chuuk 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 Chuuk 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:

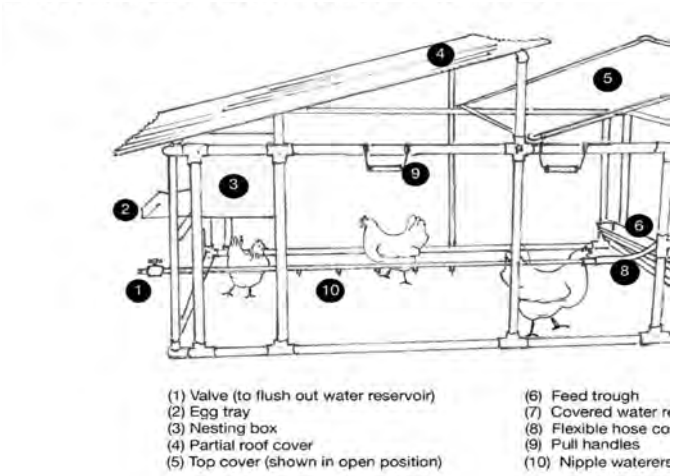
Foundational Trainings: Covering chicken care, sanitation, egg handling, cooperative models and systems of transport/articulation with other FIC Tiered Structures. Additionally, community leaders have highlighted the importance of incorporating traditional cultivation techniques and successes and failures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

Communication mechanisms through the Chuuk 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)



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 Chuuk's climate is a crucial consideration in poultry selection. Chuuk currently has feral chickens 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 Chuuk'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 Chuuk'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

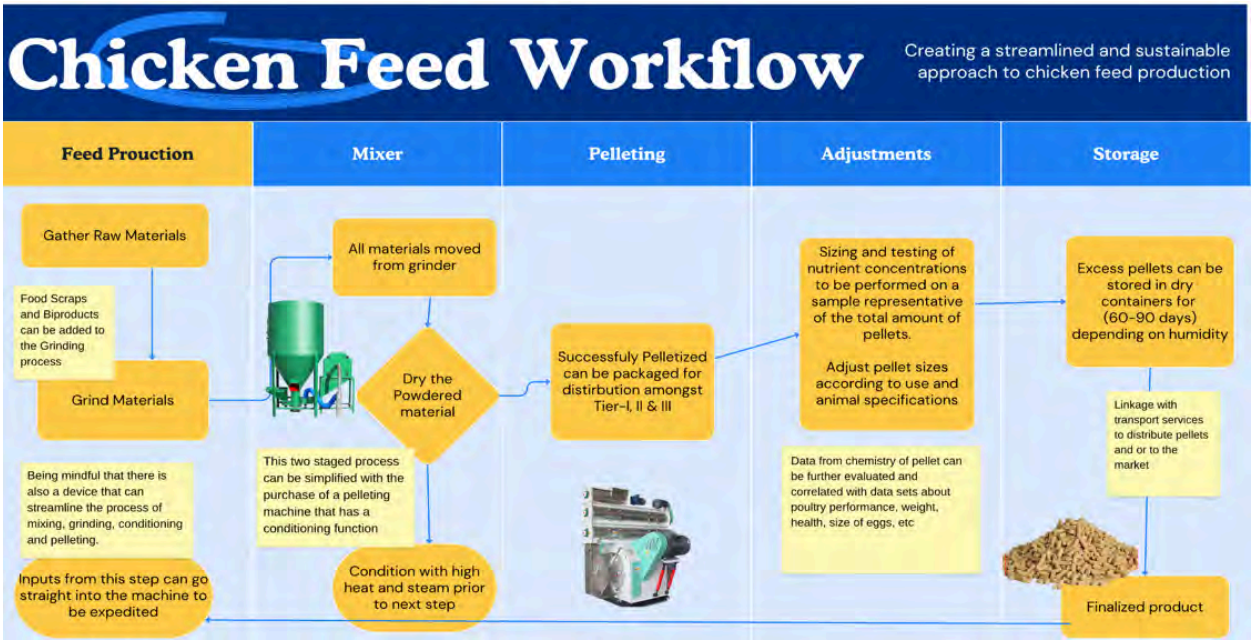
The GCFSAP020 Baseline Assessment and follow-up surveys and convenings identified sufficient access to feed as the number one barrier in egg production across FSM. This presents a unique opportunity for chicken feed production to serve as a microenterprise (Tier-II facility) on Chuuk's main island, to 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% mangos, 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, Chuuk 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 Chuuk 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 Chuuk 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 Chuuk 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 Chuuk 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 40º C (105º 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 can be sold to the Food Innovation Center (Tier-III) in Tonoras 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 Chuuk'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

The Rutgers food system science team is now designing the **instructions for mobile app functions** to meet stakeholder supply chain needs for local food system development:

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 Chuuk State

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

To strengthen food security and economic resilience, Chuuk State aims to develop a decentralized food innovation system rooted in local realities such as low population density, remote 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 Chuuk'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 Chuuk 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, employment, and are economically driven as an agribusiness. This model encourages entrepreneurial development without compromising environmental integrity or traditional knowledge systems.

The proposed organizational structure recognizes Chuuk's geographic spread and diverse community settings from Weno 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 mitigates risk, fosters local sales and trade, 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 Chuuk'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 Chuukese people. Internships and collaborations with local schools and integration of facilities at the start with communities for training and awareness will further support the new value-added facilities as it also serves as a community center.

Accordingly, Chuuk 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 Chuuk State.

The Partnership Framework can be built using a partnership model.

The partnership framework in Chuuk can be structured using a culturally responsive and locally anchored partnership model. This model reflects the essential collaboration between the Chuuk 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 Chuukese 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 Chuuk'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 Chuuk'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 Chuuk-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

• **Chuuk State Government and Local Municipalities**
Key agencies such as the Department of Resources and Development, Chuuk State Department of Agriculture and Forestry, and Chuuk 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**
Chuuk's Council of Mayors 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 various farmers' and fisher organizations, **Chuuk Women's Council**, and the Chuuk Conservation Society 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 Chuuk Small Business Development Center 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 Chuuk 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 could 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 Chuuk-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 Chuuk-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 Chuuk's key stakeholders, integrating customary authority, public institutions, and community-based organizations.

• Identification of mutual objectives and complementary capabilities among Chuuk State Government, municipal councils, the Council of Mayors, and organizations such as the Chuuk Women's Council and the COM-FSM Cooperative Research and Extension Program
• Feasibility studies and market analysis tailored to Chuuk'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.
• Risk assessment and mitigation planning focused on Chuuk'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 the Chuuk Women's Council

Phase I has been largely completed through the groundwork laid by the Chuuk Food Systems Solutions Project, which involved extensive fieldwork, community input, and technical assessments. That project built upon extensive surveys and studies on vulnerable households and farming households in Chuuk supported by the Green Climate Fund in concert with the State of Chuuk and National R&D of the FSM.

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 Chuuk 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

Chuuk 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 regions
• 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 Chuuk Department of Transportation and Communication (Division 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 **Chuuk Public Utility Corporation (CPUC)** 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 Chuuk'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 Chuuk, 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 Chuukese values of mutual support and transparency.

• Ownership is held by private members including farmers, fishers, women's groups, youth entrepreneurs, and small agribusinesses, and could be organized through entities such as various farmers associations, The Chuuk Conservation Society and the **Chuuk Women's Council**. Each member has equal voting rights regardless of financial contribution, aligning with Chuukese values of communal equity.
• An independent board of directors will be elected by cooperative members, with initial nominations guided by Chuuk State in consultation with the **Mayors' Council** municipal governments, and key producer organizations to ensure geographic and demographic representation. Importantly, an Advisory Board from public and private sectors would be formed to advise, guide, and provide oversight to ensure the operations are done properly, and with a focus on economic development and viability, and enhancing food security and local food production and processing.
• Management and staff hiring will be autonomous, with preference for local candidates trained through institutions such as the **College of Micronesia–FSM Chuuk Campus**, and with support from regional partners such as 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 Chuuk.

• The Chuuk 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. Policies could be as simple as preferential purchase of local foods, if/when available for all state functions.
• Financial assistance will be provided through grants or guarantees from sources such as the **FSM Development Bank**, **the Asian Development Bank, the World Bank, Chuuk State Capital Improvement System**, and/or with Corporation climate adaptation funds, such as 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 other regional and international partners and regional programs focusing on value chain development, business literacy, and climate-smart agriculture.
• The government will assist in facilitating market access by promoting Chuuk-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 **Chuuk Public Utility Corporation (CPUC)**.

Governance and Accountability

Dual Accountability System

The governance structure in Chuuk reflects the importance of traditional leadership, community consensus, and modern cooperative principles. It is designed to promote transparency, equity, and responsiveness while aligning with Chuukese 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 farmer's organizations, Chuuk Women's Council, and neighboring island community councils will support broad member engagement across Chuuk's diverse communities.
• The public-private partnership is accountable to traditional authorities, municipal leaders, and Chuuk State agencies through performance indicators that reflect Chuuk'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 Chuuk State Department of Planning and Statistics 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 Chuuk Campus and the Chuuk 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 Chuuk'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 **Chuuk 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 Chuuk's close-knit communities.

Financial Arrangements

Public Sector Contributions

The Chuuk 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 Chuuk's need for small-scale infrastructure, climate-resilient design, and capacity building for dispersed island communities. Partial financial ownership by the state will foster a stronger public-private partnership.

• Infrastructure support may include grants for construction, renovation, and equipment installation through the **Chuuk State Capital Improvement System** 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 Chuuk Campus** and its **Cooperative Research and Extension Program**, as well as by external partners like the **Pacific Community (SPC)** and the **USDA Natural Resources Conservation Service** and international institutions of higher learning and international NGOs that have been engaged in supporting the FSM and State of Chuuk.
• Risk mitigation will be facilitated through tools such as loan guarantees or micro-insurance programs offered by the **FSM Development Bank** and **Chuuk Small Business Development Center** to encourage smallholder and cooperative investments in processing and value addition.
• Market development support will include product branding initiatives by the **Chuuk 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 Chuuk'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 farmer's organizations, the **Chuuk Women's Council**, 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 FSM Development Bank, the Chuuk Small Business Development Center, 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 Chuuk's diverse communities, particularly those in rural and remote 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 Chuuk 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 Chuukese governance norms, environmental constraints, and cooperative principles.

Public Sector Risks

• Ensuring consistent performance monitoring by Chuuk State Government agencies without interfering in the internal operations of the cooperative. Oversight responsibilities will be coordinated through agencies such as the Chuuk State Department of Resources and Development and the Chuuk State's Department of Planning and Statistics.
• Maintaining political continuity and long term support for cooperative initiatives across different administrations. Engagement with traditional leadership bodies such as the Mayors' Council 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 Chuuk'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 Chuuk 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 Chuukese norms.
• Implementing regular performance reviews and learning-based evaluations that involve cooperative members, public sector stakeholders, and external technical partners is needed annually to ensure transparency and to review past work and plan for upcoming work.
• 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 Chuuk Small Business Development Center
• Reinforcing strong governance structures through training and support for cooperative boards, ensuring representation from each municipality and sector. Guidance from local, regional, and international institutions such as the COM FSM Chuuk 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 Chuuk's producers, fishers, and community members. The cooperative must operate independently while remaining aligned with public development goals and cultural values. Groups such as farmers' organizations, Chuuk Women's Council, and various island agricultural groups exemplify grassroots ownership and governance models that can inform cooperative design.
• Clearly defined roles, responsibilities, and boundaries between the cooperative, Chuuk State Government, municipal authorities, and Mayors' Council 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.

• Operating the facilities as a private business is fundamental to ensure long-term sustainability and generating business and new opportunities.
• 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 Chuuk'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 Chuuk Small Business Development Center.
• 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 Chuuk's municipalities and within the lagoon and the 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, the Pacific Community, and others.
• 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 Chuuk State Department of Planning and Statistics in collaboration with the Department of Resources and Development, the cooperative board, traditional leaders and the Mayor's Council .
• 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. Replication

will be guided by lessons from community based organizations like the **Chuuk Women's Council**.
• A culture of continuous learning and innovation will be cultivated. The cooperative will regularly test technologies including solar powered equipment, low waste packaging, Indigenous preservation methods, and other technologies developed elsewhere but which could be practical to introduce and use in Chuuk. 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 **Chuuk 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 **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 Chuukese 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 Chuuk-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 Chuuk'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 Chuukese 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 all island communities.. Priority groups include:

• Members of farmers' organizations
• Women entrepreneurs affiliated with the Chuuk Women's Council
• Fisher cooperatives from islands within the lagoon and neighboring islands
• 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 remote and neighboring islands and one for a women's group.
• Board terms will be staggered to ensure continuity, with initial appointments possibly guided by Chuuk 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 Chuukese 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 FSM Development Bank or outside auditing firms for accountability.
• **Marketing Manager**: Develops local and regional sales strategies, supports branding of Chuuk-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 Chuuk will reflect local production rhythms, community labor structures, and environmental constraints such as water availability and energy reliability.

• Production supervisors from within Chuuk 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 Chuuk 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 COM FSM Chuuk Campus will be recruited and trained to handle these roles, fostering local employment.

Member Services

Member services will be community-centered and reflect Chuuk'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 remote and neighboring islands.
• Technical assistance and market information will be provided through partnerships with Chuuk Women's Council, 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 Chuuk State Office of the Public Auditor (OCPA) .
• 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 Chuuk State Proposed Budget

Total estimated cost for building and equipping two US FDA Compliant Tier III Food Innovation Centers (FIC) plus two regional Food Innovation Facilities (FIF) and 63 village level Tier I FIFs is: $14.98 million (USD)

Total Budget: $14.98 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 that each needs to be flexible and adaptable while allowing for the core products to be processed efficiently and safely, packaged and commercially sold. The following description separates the most advanced FDA compliant two Tier III Food Innovation Centers (FIC) with their own respective estimated breakdown and costs; then provides a proposed budget for the lesser sophisticated regional Tier II Food Innovation Facilities (FIF) that focused on processing too also presented with their respective breakdown and costs; and finally, the village level Tier I FIFs that include the smallest investment of equipment and processing that can be done easiest locally and smaller-scale. This decentralized approach allows for each Tier to operate, manufacture and sell locally operating independently as well as in coordination and connection with the larger FIFs and FIC to procure adequate product supplies for increased production capacity and with increasing sophistication and quality from Tier I, Tier II and Tier III.

A. FIC- First Tier III. Total cost = $5,573,440.82
   A Tier III FIC is envisioned to be developed at a single site in Tonoas, with the specific location to be determined by Chuuk State. This facility will be focused on processing of staple crops, livestock and poultry. At this stage, we present the FIC as a unified entity with the objective of establishing FDA compliant food safe infrastructure, focusing on the processing and value addition of all terrestrial food products (plant based such as breadfruit, bananas, taro, yam, coconut) as well as chicken and swine. The Tier III FIC is designed also for community, private sector trainings and product development and with a food safety lab.

   FIC- Second Tier III. Total cost = $2,468,104
   The second Tier III Food Innovation Center (FIC) proposed in Chuuk is dedicated to farmed and wild caught fish and aquacultural products. Fishermen from within the Chuuk Lagoon and Chuuk's outer islands will be able to bring their caught fish to this Tier III facility, located on Weno, to be processed, stored, or dried, salted, and sold. Byproducts from the fish will be used for local animal feed. This standalone facility, proposed to be located also in or near Weno is designed to meet USDA/APHIS, Codex, and HACCP feed safety standards and will span 3,000 square feet. Built with climate-resilient materials and equipped with freezers, ice machines, salters, smokers, and animal feed processing equipment. The initiative complements Chuuk's broader food security strategy by creating an accessible space for seafood to be collected, processed, tested, and stored, reducing import dependency, and supporting smallholder

fishermen and provide space for trainings and product development. This facility is designed to meet the needs of Chuuk agriculture and over time for shipment to Yap, Pohnpei and Kosrae and for the substitution and replacement of imported animal feed into the FSM.

B. FIF- Tier II (5 total). Total cost= $6,402,462

- **Five regional Tier II Food Innovation Facilities are proposed to be located on Parem, Fefan, Tonoas, Weno, and Udot**, Each of these FIFs are designed at 2,500 square feet each, with construction costs estimated at $450 per square foot, totaling $5,625,000. When equipment, administrative setup, training infrastructure, and contingency allowances are included, the full cost for all facilities amounts to $6,376,587.49. These centers will support product aggregation (the receiving, holding and distribution of food products to Tier III facilities), trainings and food hubs, also are designed for partial to full processing, 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 (63 total) = $237,925.63
The total estimated investment for 63 Tier I village level Food Innovation Facilities (FIFs) within Chuuk lagoon and across the outer islands is $237,925.63, with 33 units within the lagoon, each costing $4,179.56 and 30 outer island units costing around $100,000 total. **These micro-scale FIF centers will be distributed across Chuuk State with 16 in Weno (one in each municipality), 2 in Fefan, and 1 in all other islands within the lagoon – Fonoton, Piis Paneu, Tonoas, Uman, Siis, Parem, Udot, Eot, Romanum, Fanapanges, Toleisom, Oneisom, Paata, Polle**. Designed to support pre-processing, aggregation (the receiving, holding and distribution of food products to Tier II or III facilities, and trainings, these community-level facilities are key to promoting inclusive participation, localized trade and sales and localized value addition within Chuuk's food system.

D. Contingency Funds = **$300,000**

Grand Total= $14.98 million

A. The Chuuk Tier III Food Innovation Center (FIC)

A. FIC- Tier III. Total cost = $5,573,440.82 (4,500,000 + 723,440.82 + 90,000 + 185,000 + 75,000)

Budget Narrative:

1. Construction and Infrastructure for the Terrestrial Tier III Center: $4,500,000

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

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 Chuuk State and its designated lead agency to determine whether to construct on a new site or integrate elements of existing food processing and agricultural infrastructure in Tonoas. Chuuk's frequent rainfall, high humidity, and vulnerability to coastal flooding and soil erosion require that the facility be situated in a safe physical space and engineered for durability and safe operations under tropical conditions and adverse weather. Site location needs to consider access and connection to functional road and marine access and infrastructure.

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

This component covers civil works and vertical construction activities required to develop a fully enclosed, climate-resilient, food-safe and storm resistant structure. It reflects the realities of building in Chuuk State, where persistent rainfall, coastal exposure, soil erosion, and limited road access pose logistical and engineering challenges. Nearly all critical inputs such as gravel, sand, cement, steel, and specialized labor must be imported and coordinated through port facilities in Weno or Tonoas.

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

- **Land clearing, grading, and compacting**: Using imported equipment or locally leased heavy machinery adapted for Chuuk's volcanic soil and sloped terrain.
- **Sub-base and reinforcement**: Placement of imported gravel, sand, and geotextiles to stabilize the ground and reduce saturation risks common in high-rainfall zones.
- **Reinforced concrete slab**: Six-inch industrial-grade poured slab with rebar mesh, engineered to withstand heavy processing equipment and reduce erosion and settlement under humid conditions.
- **Drainage design**: Sub-slab slope integrated with floor drains and connections to greywater or septic systems, designed for rapid runoff management.
- **Shipping surcharges**: Includes handling costs for over 600 tons of construction-grade materials through Chuuk's main port, including demurrage, offloading, and inter-island transport as needed.

2. Structural Framing and Envelope – $750,000

- **Main steel frame and columns**: Galvanized I-beams and trusses prefabricated abroad and shipped to Chuuk for on-site assembly with corrosion-resistant coatings.
- **Roof framing and support**: Trussed rafters engineered to withstand tropical storm winds and seismic shifts typical in FSM's geophysical setting.
- **Exterior and internal framing**: Combination of steel studs and treated tropical hardwoods for non-load-bearing partitions in food-safe zones.
- **Anchoring and wind resistance**: Hurricane ties and bolted foundations to comply with Chuuk's building codes and ensure structural stability during cyclonic events.

3. Roofing System – $250,000

- **Galvanized corrugated steel panels**: Rust-resistant panels with Class A fire rating, suitable for humid, salt-laden air.
- **Radiant insulation barrier and vapor shield**: Reduces indoor heat gain and condensation, critical for equipment longevity and food safety.
- **Rainwater management and water collection system**: Guttering and downspouts integrated with large cisterns for harvesting and non-potable usage during water shortages.
- **Roof overhangs and soffits**: Designed to deflect driving rain and provide shade, reducing interior heat buildup and external wall degradation.

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

- **Receiving and dispatch area**: Concrete apron with covered roof for safe loading/unloading of food products in a high-rain environment.
- **Driveway grading and compaction**: Engineered to ensure access by heavy-duty trucks year-round, including slope stabilization for hillside terrain.
- **Exterior wall finishes**: Insulated sandwich panel siding or rendered block, treated with mold-resistant, food-safe coatings.
- **Security features**: Includes motion-activated lighting, mesh window screens, and tamper-resistant steel doors at all access points.

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

- **Crane rental and offloading services**: Required for unloading containers and positioning prefabricated structural modules.
- **Storage containers and on-site warehousing**: Secure facilities to hold equipment and building supplies for a multi-phase construction timeline.
- **Inter-island transport and labor mobilization**: Barge or aircraft charter for tools, materials, and personnel moving between islands within Chuuk lagoon, the Hall Islands, Namonuito Islands, Pattie Islands, and Mortlock Islands, and regional vendors.
- **Customs brokerage and insurance**: Necessary for importing high-value materials and ensuring coverage through Chuuk's port and customs facilities.

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 Chuuk, plumbing and electrical systems must be both robust and adaptable to manage utility fluctuations, persistent rainfall, and sanitation-intensive operations and geared to renewable energy such as solar. The budget reflects full importation of components, skilled installation labor, and built-in allowances for logistics and contingency adjustments.

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

- **Facility-wide potable water lines**: Food-grade PEX or CPVC piping installed throughout processing zones, dry and cold storage, sanitation rooms, and administrative areas.
- **Dedicated hand-wash stations**: At least two per processing room, fitted with foot- or elbow-operated valves, splash guards, and hygienic hand-drying dispensers.
- **Triple-compartment sinks**: Installed in the community kitchen, R&D laboratory, and wash-down areas to meet safe food handling protocols.
- **Grease traps and floor drainage**: Stainless steel interceptors and epoxy-sealed drains with engineered slope, linked to the centralized graywater handling system.

- **Rainwater catchment and storage system**: Roof-integrated gutter systems feeding cisterns with first-flush filters, UV or chlorination units for non-potable use in cleaning and landscaping.
- **Septic system**: Onsite wastewater treatment designed for high-volume discharge from food-grade operations, aligned with Chuuk EPA regulations and flood-resilient engineering.

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

- **Dedicated circuits for critical equipment**: Independent power lines for cold rooms, heat sealers, and high-load processing machinery, stabilized for voltage variation.
- **Processing zone separation**: Individual electrical sub-panels per room to isolate failures and enable safe equipment maintenance.
- **Food-safe electrical finishes**: All conduits and outlets sealed against moisture intrusion, with splash protection in wet areas and compliance with international food-grade standards.
- **LED lighting**: Shatterproof, high-efficiency LED fixtures with increased lumen output in food prep areas to improve visibility and inspection quality.
- **Emergency lighting and signage**: Battery-backed lighting and illuminated exit signs strategically installed to meet Codex and IFS food facility requirements.

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

- **Backup generator system**: Diesel-powered 50–80 kW generator housed in a noise-dampened, cyclone-resistant enclosure.
- **Automatic transfer switch (ATS)**: Enables seamless transition during power outages to preserve cold chain and data systems.
- **Solar-ready conduits and interface controls**: Designed for future photovoltaic integration, with rooftop and inverter panel compatibility.
- **Battery/inverter compatibility**: Wired to support lithium-ion or lead-acid battery backup installation in later phases, with surge protection and grounding.

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

- **Commercial hood-integrated fire suppression**: Wet-chemical systems installed over stoves, ovens, and fryers in high-risk kitchen and meat/poultry processing areas.
- **Wall-mounted extinguishers and alarms**: Dry chemical and CO2 units installed at regulated intervals, along with training modules for staff response.
- **Electrical grounding and lightning arrestors**: Protection systems installed to minimize equipment damage and reduce outage frequency during heavy storms.
- **Safety signage and PPE storage**: Clearly designated areas for emergency response, including spill kits, eye wash stations, gloves, and evacuation maps.

This section ensures that water, energy, and sanitation systems in the Chuuk FIC are resilient to local climatic stressors and built to sustain uninterrupted operations under demanding processing conditions. All system specifications are aligned with HACCP principles and Codex Alimentarius standards for internationally compliant food safety.

C. Interior Finishing – $625,000

This component ensures the internal spaces of the Food Innovation Center (FIC) meet rigorous international food safety standards for hygiene, durability, cleanability, and pest exclusion. All construction materials are selected to endure heavy usage in Chuuk's humid, salt-rich climate while complying with HACCP, USDA, and Codex food processing protocols. The budget

includes full importation, skilled labor, and design modifications to accommodate moisture control and local environmental conditions.

1. Hygienic Wall Systems – $225,000

- **FRP (Fiberglass Reinforced Plastic) panels**: Installed across wet processing zones such as fish, poultry, kitchen, and sanitation areas. These are chemical-resistant, mold-repellent, and easily cleaned for continuous sanitary operations.
- **Food-safe epoxy wall coatings**: Used in dry zones including storage, admin, and training areas. Coatings include antimicrobial additives and high-gloss finishes for visual inspection and contamination control.
- **Corner guards and coving**: Seamless transitions between walls and floors help prevent buildup of residues and allow for more effective washdowns.

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

- **High-performance epoxy coatings**: Non-slip, abrasion- and chemical-resistant flooring installed throughout the facility. Designed to withstand rolling equipment, wet cleaning, and foot traffic under constant humidity.
- **Anti-microbial aggregates**: Embedded in epoxy for added pathogen resistance and grip, especially in slaughter and preparation areas.
- **Drainage design**: Integrated slope directing effluent to stainless steel trench drains located in processing zones.
- **Expansion joints and water barriers**: Incorporated to prevent structural cracking caused by tropical humidity and temperature cycling.

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

- **Waterproof, seamless ceiling panels**: Used in prep and storage areas, with minimized joints to discourage insect and mold infiltration.
- **Reinforced ceiling insulation**: Includes moisture barriers to prevent condensation that could affect stored food or processing equipment.
- **Rodent- and insect-proof seals**: Food-safe silicone and mesh gaskets applied to all ceiling penetrations, including HVAC and lighting fixtures.
- **Access hatches for maintenance**: Fully gasketed and secure to maintain pest exclusion integrity and enable service access.

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

- **Clean-to-dirty workflow zoning**: Physical partitions established to separate raw input zones from finished product areas, supporting safe food handling practices.
- **Airtight doors with gaskets**: Heavy-duty stainless steel or food-grade PVC doors ensure hygienic isolation and temperature containment.
- **Observation windows and light panels**: Allow for transparent training and supervision without compromising sanitary zones.
- **Magnetic hold-open systems**: Enable hands-free access in high-traffic areas, reducing cross-contamination risks.

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

- **Restroom fixtures**: Low-flow toilets, urinals, foot-operated sinks, and hygienic hand dryers installed in gender-separated sanitation facilities.
- **Stainless steel cabinetry**: Built for the kitchen, lab, and sanitation areas to store PPE, reagents, utensils, and sealed food components.
- **Lockable storage units**: Used for hazardous materials, sensitive documentation, and regulatory compliance archives.

- **Public area finishes**: Durable, non-toxic paints and hardware throughout offices and meeting rooms, along with insect-resistant screening and directional signage.

The interior finishing ensures that the Chuuk FIC can meet export-ready hygiene requirements while enduring tropical wear conditions. Every surface is selected for resilience, pest exclusion, and ease of sanitation—ensuring operational integrity and longevity of the facility under local environmental stressors.

D. Refrigeration and Ventilation – $940,000

This budget line ensures the Tier III Food Innovation Center (FIC) in Chuuk maintains robust cold-chain integrity and consistent air quality across all processing and storage areas. Given Chuuk's environment and the perishability of local crops, fish, and poultry, this investment supports the installation of energy-efficient systems that enhance food safety, climate control, and operational reliability.

1. Cold Storage Systems – $480,000

- **Walk-in Coolers and Freezers**:
  Two industrial walk-in units—one freezer and one cooler—constructed with polyurethane-insulated wall panels, heavy-duty sealing gaskets, and digital temperature regulation. Units include stainless steel shelving, hygienic floor surfaces, and internal drainage for safe and efficient product handling.
- **Hybrid CoolBot Cold Rooms**:
  Two temperature-controlled rooms using CoolBot technology paired with high-BTU window air conditioning units, ideal for supplemental or emergency cold storage of fruits, vegetables, or finished goods awaiting shipment.
- **IQF (Individual Quick Freezing) System**:
  A compact quick-freeze tunnel to support rapid chilling of taro, breadfruit, and other produce, helping preserve quality and extend shelf life for both domestic use and export markets.
- **Battery-Logged Temperature Monitoring**:
  All cold storage areas are equipped with sensor-based temperature loggers that record data to cloud dashboards, ensuring HACCP compliance and supporting traceability audits.

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

- **Commercial Exhaust Hoods**:
  Installed over cooking and cleaning stations in poultry, livestock, and kitchen areas. Units feature high-efficiency stainless steel grease filters and integrated fire suppression where needed.
- **Cross-Ventilation Design**:
  Ceiling-mounted and wall-mounted fans installed in dry storage and staple crop rooms to ensure airflow, reduce stagnant humidity, and prevent spoilage and condensation buildup.
- **Dehumidifiers and Air Scrubbers**:
  Specialized dehumidification systems placed in livestock and poultry zones to control microbial growth and maintain safety. Air scrubbers with activated carbon and UV filters eliminate strong odors and improve air quality.
- **Zonal Pressure Management**:
  Negative air pressure maintained in high-risk zones (e.g., poultry and livestock processing) to isolate contaminants, while packaging, administrative, and R&D areas retain positive pressure to ensure clean air integrity.

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

- **Solar Integration Readiness**:
  All major refrigeration and ventilation units are pre-wired for rooftop solar photovoltaic (PV) connections and/or hybrid solar-diesel integration for future sustainability upgrades.
- **Insulation Upgrades**:
  Walls and ceilings in cold storage rooms and processing areas are fitted with high-R insulation and reflective foil barriers. Thermal seals are installed around all entry points to minimize cooling loss and reduce power consumption.
- **Backup Generators and Switchgear**:
  Includes one fixed 25–30 kVA diesel generator with an automatic transfer switch for the full cold storage load, along with a portable generator for limited backup of critical equipment during extended outages.
- **Thermal Curtains and Air Locks**:
  Installed at all entryways to walk-in freezers and coolers to limit exposure to warm ambient air during frequent door openings, preserving temperature stability and reducing operational strain on cooling systems.

Together, these refrigeration and ventilation systems allow the Chuuk FIC to meet international food safety requirements, maintain cold chain standards, and operate efficiently under high ambient moisture and temperature conditions. The design emphasizes modularity, redundancy, and adaptability to support uninterrupted service delivery year-round.

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

This component ensures that the Food Innovation Center (FIC) in Chuuk is constructed and commissioned according to internationally recognized food facility standards, particularly those aligned with U.S. FDA requirements. It also addresses the specific implementation challenges in Chuuk, including unpredictable shipping timelines, extended wet seasons, and limited local access to specialized trades. Strong oversight will ensure the facility is completed on time, on budget, and to specification.

1. Full-Time Construction Manager and staff assistant– $200,000

A dedicated, Chuuk-based construction manager and staff assistant will lead all phases of the build, from site mobilization through commissioning and handover.

Key responsibilities include:

- Day-to-day oversight of general contractors, subcontractors, and local labor teams
- Verifying compliance with engineering drawings, food facility safety codes, and schedule milestones
- Coordinating the arrival, offloading, and on-site storage of imported materials and equipment
- Addressing unforeseen delays related to site conditions, weather impacts, or logistics bottlenecks
- Managing sequencing of plumbing, electrical, HVAC, and finishing teams to avoid conflicts
- Delivering weekly progress reports and risk alerts to the project coordination unit

Cost includes:

- Monthly professional fees over a 12-month period
- Travel costs from a regional base or U.S. origin
- Temporary furnished housing and utilities in Chuuk
- Local per diem and ground transport for daily site access

2. FDA-Aligned Food Facility Technical Advisor – $125,000
A specialized technical advisor will ensure the FIC meets hygienic design criteria including food-safe zoning, equipment layout, drainage planning, and materials compliance. The advisor will be engaged during design finalization, construction supervision, and facility commissioning.
Key deliverables include:

- Reviews of architectural and utility drawings for HACCP and Codex compliance
- Expert guidance on facility layout, critical control points, and workflow optimization
- In-person supervision of equipment installation and sanitary finish applications
- Technical support for regulatory certifications (e.g., US FDA registration, HACCP protocols)
- Development and documentation of SOPs, sanitation plans, and staff training guidance
- Lead workshops in HACCP and food safety and engineering for all Tier III staff, as well as bringing in for trainings staff from all other FIC and FIF in Chuuk.

Cost includes:

- Monthly advisory retainer over 9–12 months
- Three field visits including airfare, lodging, and meals in Chuuk
- Virtual coordination for plan review, document feedback, and remote training modules

3. Quality Assurance and Construction Audits – $50,000
To uphold construction quality and reduce long-term rework costs, independent QA/QC audits will be conducted throughout the project lifecycle by a licensed civil engineer or architect, ideally sourced from the region.
This includes:

- Bi-weekly site inspections with written evaluations and issue tracking
- Material verification against technical specifications and bills of quantity
- Photographic and physical validation of critical systems such as drainage, electrical layout, and flooring
- Certification checklists for milestone-based contractor payments and performance incentives

Together, this oversight package guarantees that the Chuuk FIC is constructed to specification, with high standards of safety, quality, and compliance. The combination of local management and technical expertise provides funders and stakeholders with assurance that the investment will yield a durable, fully functional, and regulation-ready food-grade facility.
Total Construction and Infrastructure: $4,500,000

Component	**Amount (USD)**
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
Total	**$4,500,000**

2. Equipment and Supplies for FIC: $723,440.82

This equipment budget covers the procurement, shipping, and installation of specialized machinery tailored to the operational needs of a Tier III Food Innovation Center (FIC) in Chuuk. The facility will be outfitted to support a wide range of food processing functions including staple crops, poultry, fish, and community kitchen activities, as well as packaging, cold storage, and internal logistics.

The equipment is organized by functional zones to ensure smooth, hygienic workflows and support safe, efficient value-added processing of local foods such as breadfruit, taro, banana, coconut, cassava, and reef fish. Each processing room will be equipped with machinery that enables both traditional and modern food production methods in compliance with global food safety protocols.

All equipment purchases will include installation guidance, critical spare parts, and operational support features such as HACCP traceability systems. Selected tools are modular and scalable to allow future expansion or upgrades. The investment ensures that the FIC will be fully operational with sufficient capacity to support training, local entrepreneurship, product development, and potential export-readiness.

A. Staple Crop & Vegetable/Fruit Processing
This zone supports the transformation of Chuuk's local staples—including breadfruit, taro, banana, coconut, and cassava—into shelf-stable, value-added products such as flour, chips, leathers, and dried fruit. Equipment in this area enables pre-treatment, slicing, dehydration, frying, and vacuum sealing under food-safe conditions. And, this FIC is designed so that the equipment can be used for other products and processing needs. That is, its sufficiently flexible relative to space and equipment to allow for flexibility and response to opportunities that arise.
Key Equipment:

- Produce washer and precision vegetable cutters (Nilma or Sammic models)
- Solar or hybrid electric dryers designed for fruits and starchy roots
- Flour grinder for taro and cassava meal production
- Commercial deep fryer and chamber vacuum sealer for snack lines
- HACCP traceability software and spare parts kits for continuous uptime

B. Poultry Processing
This dedicated space enables hygienic, small-scale poultry processing aligned with humane slaughter protocols and a linear "dirty-to-clean" workflow. The layout is optimized for chilled flow-through operations and compliance with HACCP poultry handling guidelines.
Key Equipment:

- Slaughter cone station, hot water scalding tank, and defeathering machine
- Chill tanks, evisceration benches, cutting tables, and poultry saws
- Vacuum sealing unit and barcode labeling system
- Overhead rail system for processing line flow and stainless sanitation toolkits
- Cold storage for whole birds, cuts, and fresh eggs

C. Fish Processing
Designed for the preparation of both fresh and preserved fish products, this zone supports cleaning, filleting, drying, and quick freezing. The equipment is suited for reef fish, tuna, and other local species, incorporating both modern and traditional preservation methods.
Key Equipment:
- Stainless steel filleting and gutting tables with integrated spray-down jets
- Traditional fish smokers and open drying racks
- Entry-level Baader deboning machine and IQF (Individual Quick Freezing) tunnel
- Salt curing tanks and hygiene kits for microbial safety control

D. Community Kitchen
This shared-use kitchen provides infrastructure for culinary innovation, food safety training, and small-batch entrepreneurship. It is designed to support recipe testing, cooking demonstrations, and pilot-scale production runs for new product development and use as rental for food production for catering and sale.
Key Equipment:
- Commercial-grade oven, countertop deep fryer, and gas cooktop with exhaust hood
- Planetary mixer, blast chiller, and either a steam kettle or tilt skillet
- Heavy-duty dishwashing station and electric warming cabinet

E. Storage and Logistics
This zone underpins the entire facility's cold chain and inventory system, supporting raw material intake, intermediate storage, and finished product staging. Designed for modular efficiency, it allows flexible handling of both perishable and dry goods.
Key Equipment:
- Walk-in cold room, upright commercial freezers, and dry storage shelving
- Food-grade ingredient bins, pallet jacks, and insulated delivery coolers
- Temperature and humidity monitoring systems with digital alerts
- Modular racking systems for vertical storage optimization and FIFO management

Total Equipment Investment (with Logistics Buffer):
This total includes:
- Equipment purchase based on validated vendor pricing and technical specifications
- Estimated international shipping, port clearance, and customs handling
- Installation, setup, and calibration support as required by specific equipment
- Contingency buffer to accommodate unexpected freight surcharges or delays

This comprehensive equipment suite enables the Chuuk FIC to operate efficiently across a range of product categories—including poultry, fish, root crops, and tropical fruits—while meeting international hygiene and traceability standards. Each investment is selected to support local food processing capacity, entrepreneurial activity, and workforce training, strengthening food system resilience and economic development in Chuuk.

Equipment & Supplies for a Tier III FDA-compliant Food Innovation Center in Chuuk:

Equipment	Price per Unit	Number of Units	Total without Cost Conversion	Total with 1.5x Cost Conversion
Staple Crop Processing Items				
Staple Crop Slicer	1,825.25	1	1,825.25	2,737.88
Flour Mill	1,250.00	3	3,750.00	5,625.00
Coconut Processing Items				
Coconut Water Extractor	2,200.00	1	2,200.00	3,300.00
Coconut Milk Extractor	10,300.00	1	10,300.00	15,450.00
Coconut Sugar Processor	3,500.00	1	3,500.00	5,250.00
General Tier-III				
Tabletop Impulse Sealer - 20"	200.00	2	400.00	600.00
Vertical Band Sealer	890.00	2	1,780.00	2,670.00
Double Chamber Vacuum Packaging Machine	4,000.00	1	4,000.00	6,000.00
Dehydrator Dryer	22,600.00	1	22,600.00	33,900.00
Solar powered Cold Room	10,000.00	2	20,000.00	30,000.00
Ventilated Stack and Nest Container	24.00	50	1,200.00	1,800.00
Flour and Sugar Sieve	305.43	3	916.29	1,374.44
Stainless Steel Worktables	575.00	5	2,875.00	4,312.50
Poultry Processing Items				
Mainstreet Stainless Steel Floor Fryer	749.00	1	749.00	1,123.50
Stainless Steel Triple Basins	306.15	1	306.15	459.23
Avantco A-49R-HC 54" Reach in Refrigerator	1,949.00	1	1,949.00	2,923.50
Mannlake Scalder with Temp Control	525.00	1	525.00	787.50
Food Safety Testing Checklist				
Food Safety Testing				300,000.00
Culture Plates				0.00
Thermapen Thermometer	299.00	1	299.00	448.50

Water Activity meter (Aquameter)				0.00
Hygiene monitor and Management system	1,000.00	1		1,500.00
High sensitivity Allergen Tester	284.65	1	284.65	426.98
Handheld temp adjusted Refractometer	260.00	4	1,040.00	1,560.00
Thermometer Calibrator (4 point hot/cold)	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)	300.00	2	600.00	900.00
Water Activity Meter and Moisture Meter	3,000.00	2	6,000.00	9,000.00
Check-Set IV Cold/Hot Calibrator	1,592.12	1	1,592.12	2,388.18
AP550 Flat-Surface Label Applicator	2,395.00	1	2,395.00	3,592.50
AP380 Label Applicator	1,595.00	1	1,595.00	2,392.50
PL400 Pouch Labeler	1,595.00	1	1,595.00	2,392.50
Barcode Thermal Ribbons	56.00	1	56.00	84.00
Barcode Scanner L13687	1,025.00	1	1,025.00	1,537.50
Barcode software	790.00	1	790.00	1,185.00
Zebra ZQ511 Mobile Receipt Printer	840.00	1	840.00	1,260.00
Zebra ZT620 industrial Barcode Printer	6,200.00	1	6,200.00	9,300.00
Safety Equipment				
Porta Stream II Eyewash station	460.00	3	1,380.00	2,070.00
Saline Concentrate Refill	100.00	10	1,000.00	1,500.00
Dust Cover	52.00	3	156.00	234.00
S Carton Uline Industrial Latex Gloves	26.00	10	260.00	390.00

M Carton Uline Industrial Latex Gloves	14.00	10	140.00	210.00
L Carton Uline Industrial Latex Gloves	19.00	10	190.00	285.00
Class A First Aid Kits	67.00	5	335.00	502.50
Class B First Aid Kits	155.00	5	775.00	1,162.50
Class B+ First Aid Kits	395.00	5	1,975.00	2,962.50
Uline Ice Wraparound Fog Armor Dispenser box	94.00	2	188.00	282.00
3M Construction Harness	185.00	2	370.00	555.00
Carton Polyethylene Apron	22.00	6	132.00	198.00
Multi compartment Stainless Steel Dispensers	250.00	3	750.00	1,125.00
Canning and Pickling Equipment				
Canner Aluminum Bath water Canner	269.99	2	539.98	809.97
30 Gallon Large Round Canner	1,451.25	1	1,451.25	2,176.88
Case Wide Mouth Ball Glass Mason Jars 32 oz	16.44	100	1,644.00	2,466.00
10 Gallon Fermentation Crock	199.99	2	399.98	599.97
Fermentation Weights	43.97	20	879.40	1,319.10
Fermentation lid cloth covers	13.93	25	348.25	522.38
Potable Aqua Water Purification Tabs with PA plus	12.99	50	649.50	974.25
Stainless Steel Funnel	10.49	10	104.90	157.35
11.5 Qt Canning Rack	8.49	10	84.90	127.35
Additional Equipment				
Nilma Veg Wash	4,000.00	1	4,000.00	6,000.00
Floor Frier Rig	1,600.00	1	1,600.00	2,400.00
Semi Automatic Bucket Conveyor Pouch filling and sealing machine	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
Slaughtering Table	425.00	2	850.00	1,275.00
Vertical Electric Liquid and Paste Water bottle filling machine	1,750.00	1	1,750.00	2,625.00
Butchers Table	1,000.00	3	3,000.00	4,500.00
Poultry cutting saw	2,631.00	1	2,631.00	3,946.50
Oven and range 72"	15,293.00	1	15,293.00	22,939.50
176lb Floor Electric Mixer	7,123.00	1	7,123.00	10,684.50
Heavy Duty Steel shelving 96 x 24 x 72"	1,445.00	5	7,225.00	10,837.50
Solar Dryer or Dehumidifier Dried Fruit	210.00	10	2,100.00	3,150.00
Information Hub				
Mobile Platform app				0.00
Samsung 4TB SSD Hard drives	439.99	3	1,319.97	1,979.96
Website				0.00
Dell Inspiron 27' All in one cpu	1,189.98	1	1,189.98	1,784.97
4 Person L Desk Workstation	3,210.00	1	3,210.00	4,815.00
LG smart TV	299.00	1	299.00	448.50
Norton Anti virus software	19.99	1	19.99	29.99
Mesh Task Chairs	165.00	6	990.00	1,485.00
Downtown conference tables (Powered) 192 x 48"	1,560.00	1	1,560.00	2,340.00
Portable Projector Screen 107"	525.00	1	525.00	787.50
Wall monitor Mount	95.00	1	95.00	142.50
Kitchen Supplies				
Mobile ingredient bins	343.00	3	1,029.00	1,543.50
Self ingredient Bin 200 cups	243.00	3	729.00	1,093.50

Baking Pan	216.00	3	648.00	972.00
Wire Grate	168.00	3	504.00	756.00
Cambro Dish Racks	42.00	3	126.00	189.00
Cambro Glass Racks	80.00	3	240.00	360.00
Pan Dolly	305.00	3	915.00	1,372.50
Uline Trash Cans	74.00	3	222.00	333.00
Uline Trash can lids	29.00	3	87.00	130.50
Biohazard Step On Waste Can	131.00	3	393.00	589.50
Uline Thin trash can 23G	45.00	3	135.00	202.50
Rubbermaid Slim Jim Lid Can/bottle	52.00	3	156.00	234.00
Rubbermaid Slim Jim Lid paper	52.00	3	156.00	234.00
Rubbermaid Slim Jim Swing top	51.00	3	153.00	229.50
Stainless Dollie	135.00	3	405.00	607.50
Handsfree Trash Can 55G	255.00	3	765.00	1,147.50
Outdoor Landmark Series Trash Can Dome top 50G	970.00	3	2,910.00	4,365.00
Fork liftable Transport tilt truck	2,505.00	3	7,515.00	11,272.50
Hydraulic Platform Stacker	2,695.00	3	8,085.00	12,127.50
130km low speed new energy double cab mini pick up truck	9,999.00	3	29,997.00	44,995.50
Commercial Cutting Board	152.00	5	760.00	1,140.00
Commercial Mixing 3qt	62.00	3	186.00	279.00
Commercial Mixing 5qt	89.00	3	267.00	400.50
Commercial Mixing 8qt	125.00	3	375.00	562.50
Commercial Mixing 13qt	94.00	3	282.00	423.00
Commercial Mixing 20qt	150.00	3	450.00	675.00
Stainless Steel Steam Table Pans 3qt	150.00	3	450.00	675.00
Stainless Steel Steam Table Pans 6qt	250.00	3	750.00	1,125.00

Stainless Steel Steam Table Pans 10qt	150.00	3	450.00	675.00
Stainless Steel Steam Table Pans 14qt	175.00	3	525.00	787.50
Stainless Steam Table Pan Lids 1/6	55.00	3	165.00	247.50
Stainless Steam Table Pan Lids 1/3	85.00	3	255.00	382.50
Stainless Steam Table Pan Lids 1/2	110.00	3	330.00	495.00
Stainless Steam Table Pan Lids Full	205.00	3	615.00	922.50
Stainless Steel Scoops 8oz	69.00	3	207.00	310.50
Stainless Steel Scoops 16oz	75.00	3	225.00	337.50
Stainless Steel Scoops 32oz	80.00	3	240.00	360.00
Stainless Steel Scoops 64oz	86.00	3	258.00	387.00
Stainless Steel Scoops 96oz	114.00	3	342.00	513.00
Stainless Steel Scoops 128oz	122.00	3	366.00	549.00
Stainless Steel Scoops 160oz	134.00	3	402.00	603.00
Stainless Steel Mixing Paddles 48"	35.00	3	105.00	157.50
Mixing Polypropylene Paddles 40"	65.00	3	195.00	292.50
Mixing Polypropylene Paddles 52"	72.00	3	216.00	324.00
Hand Scraper 3 x 8"	7.00	5	35.00	52.50
Hand Scraper 4 x 9"	8.00	5	40.00	60.00
Stainless steel paper cutter 36"	163.00	2	326.00	489.00
Unbleached Paper rolls 36"	81.00	3	243.00	364.50
Handheld Induction Sealer and Caps	340.00	5	1,700.00	2,550.00

Clear Straight-sided Glass jars with metal cap 8oz	40.80	5	204.00	306.00
Clear Straight-sided Glass jars with metal cap 16oz	54.60	5	273.00	409.50
Clear Straight-sided Glass jars with metal cap 32oz	64.80	5	324.00	486.00
Amber Straight-Sided Glass Jars with Metal Cap 8oz	40.80	5	204.00	306.00
Case Standard Glass Canning Jars 8oz	14.40	5	72.00	108.00
Case Standard Glass Canning Jars 16oz	18.00	5	90.00	135.00
Case Standard Glass Canning Jars 24oz	20.40	5	102.00	153.00
Case Standard Glass Canning Jars 32oz	22.80	5	114.00	171.00
Case Replacement Standard Canning Jar Lids	81.00	5	405.00	607.50
Case Glass Spice Jars 2oz	48.00	5	240.00	360.00
Case Glass Spice Jars 4oz	27.60	5	138.00	207.00
Case Glass Spice Jars 8oz	15.60	5	78.00	117.00
Case Glass Spice Jars 16oz	18.60	5	93.00	139.50
Case Cubitainers	60.00	5	300.00	450.00
Case of Square Utility Jugs	34.20	3	102.60	153.90
Jug Pump	10.50	3	31.50	47.25
Chemical Resistant Spray Bottles	25.50	3	76.50	114.75
Case Replacement nozzles	17.25	3	51.75	77.63
Bundle Egg Cartons	90.00	10	900.00	1,350.00
Egg Filler Flat Case	42.00	10	420.00	630.00
Williams Sonoma Prep Tools 15 Piece Gadget and Utensils Set	279.95	3	839.85	1,259.78
Berry Basket	75.00	5	375.00	562.50
Lab Ware				

Case Graduated Glass Dropper Bottles 1/2 oz	48.00	5	240.00	360.00
Case Graduated Glass Dropper Bottles 1oz	50.40	5	252.00	378.00
Case Graduated Glass Dropper Bottles 2 oz	28.80	5	144.00	216.00
Case Graduated Glass Dropper Bottles 4oz	33.60	5	168.00	252.00
Case Glass Beakers 100ml	31.00	5	155.00	232.50
Case Glass Beakers 250ml	40.00	5	200.00	300.00
Case Glass Beakers 400ml	27.00	5	135.00	202.50
Case Glass Beakers 1,000 ml	58.00	5	290.00	435.00
Case Test Tubes 8ml	40.00	5	200.00	300.00
Case Test Tubes 16ml	62.00	5	310.00	465.00
Case Test Tubes 25ml	67.00	5	335.00	502.50
Case Test Tubes 50ml	94.00	5	470.00	705.00
Test tube racks 13mm	22.00	5	110.00	165.00
Test tube racks 16mm	22.00	5	110.00	165.00
Test tube racks 20mm	22.00	5	110.00	165.00
Test tube racks 25mm	22.00	5	110.00	165.00
Glass Graduated Cylinders 10ml	24.00	10	240.00	360.00
Glass Graduated Cylinders 25ml	30.00	10	300.00	450.00
Glass Graduated Cylinders 50ml	23.00	10	230.00	345.00
Glass Graduated Cylinders 100ml	38.00	10	380.00	570.00
2" x 250' Parafilm M Lab Film	44.00	5	220.00	330.00
4" x 125' Parafilm M Lab Film	44.00	5	220.00	330.00
Case Whirl-Pak bags 2oz	98.00	10	980.00	1,470.00

Case Whirl-Pak bags 4oz	100.00	10	1,000.00	1,500.00
Case Whirl-Pak bags 18oz	139.00	10	1,390.00	2,085.00
Case Whirl-Pak bags 24oz	184.00	10	1,840.00	2,760.00
Case Whirl-Pak bags 69oz	318.00	10	3,180.00	4,770.00
Pack Weighing Dishes (Aluminum) 20ml	15.00	10	150.00	225.00
Pack Weighing Dishes (Aluminum) 40ml	17.00	10	170.00	255.00
Pack Weighing Dishes (Aluminum) 80ml	21.00	10	210.00	315.00
Safety wash bottles 500ml	54.00	6	324.00	486.00
Safety Wash bottles 1,000ml	64.00	6	384.00	576.00
Case Transfer Pipettes 3ml	32.00	10	320.00	480.00
Case Transfer Pipettes 5ml	32.00	10	320.00	480.00
Case Transfer Pipettes 7ml	32.00	10	320.00	480.00
Total Cost				**723,440.82**

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

This component ensures that the Food Innovation Center (FIC) in Chuuk serves not only as a production facility, but also as a fully functional administrative, scientific, and educational hub. Its presence will serve as a community center. It supports reliable operations, digital traceability, quality control, and human capacity development. The budget includes costs for importing IT infrastructure, lab instruments, and training resources, which are critical but expensive to source, ship, and maintain in a remote island setting.

A. Administrative Office – $22,000

A 300 square foot space will serve as the operations and coordination center for the FIC.

Key Components:

- Office furniture crafted locally where feasible (e.g., coconut timber desks and shelves), paired with imported ergonomic seating and storage cabinets
- One laptop and one desktop computer with extended warranties, surge protection, and wireless multifunction printer/scanner
- Dry-erase boards, secure inventory and filing cabinets, and wall-mounted visual planning aids
- Split-unit air conditioning and ceiling fans for humidity control, delivered and professionally installed

Additional cost reflects air freight of electronics, durability enhancements for the tropical climate, and backup systems to minimize disruptions.

B. Research and Development Laboratory – $30,000
This 150–200 square foot lab will focus on food quality assurance, safety testing, and new product development.
Key Equipment:
- Stainless steel wash benches, corrosion-resistant sinks, and drainboards
- Microscopes, incubators, scales, moisture analyzers, and handheld pH testing tools
- Seal integrity testers and microbiological media for product stability analysis
- Lockable refrigeration for reagent and sample storage
- PPE sets, fire extinguisher, and eyewash station

All laboratory tools will be imported from certified suppliers and include calibration kits and startup training for local technical staff.
C. Training Room – $13,000
This 12-seat training space will support food safety instruction, small business workshops, and hands-on entrepreneurship sessions.
Includes:
- Digital projector with retractable screen and multiple media inputs (HDMI, USB)
- Mixed modular seating (imported and local), with provisions for cultural layouts such as pandanus mats
- HACCP training posters, whiteboards, and mobile flip charts
- Lockable cabinet for training materials and instructor supplies
- Ceiling fans and screened windows, with an optional outdoor annex for community-based sessions

Shipping costs for audiovisual and educational materials, as well as packaging for kits, are included. The adjacent outdoor area with cement flooring and a traditional roof structure will function as an extension space for training and product drop-off; its costs are accounted for under the main facility construction budget. Additionally, open outside space is planned with a roof for trainings, demonstrations and meetings.
D. Office Supplies & IT Infrastructure – $25,000
This component supports digital administration, traceability, remote collaboration, and reporting.
Inclusions:
- Two computers (desktop and rugged laptop), color printer, and dual high-speed routers
- Satellite uplink or high-capacity mobile hotspot to ensure connectivity in remote parts of the island
- Cloud subscriptions for inventory control and HACCP compliance platforms (e.g., Google Workspace, FoodReady)
- UPS backups, power stabilizers, office supplies, document binders, laminator, and IT setup support

Cost reflects the need for enhanced networking, security features, and redundancy to operate reliably in areas where technical support is limited or unavailable.

Total for Section 3: $90,000

Component	**Cost**
A. Administrative Office	$22,000
B. R&D Laboratory	$30,000

Component	Cost
C. Training Room	$13,000
D. Office Supplies & IT Systems	$25,000
Total	**$90,000**

4. Operational Readiness and Sustainability: $185,000
This budget line ensures that the Tier III Food Innovation Center (FIC) in Chuuk is fully functional at launch—not only constructed and equipped, but also staffed, supplied, and prepared to deliver services from day one. Costs reflect the logistical and financial realities of initiating operations in an island context, including freight-intensive procurement of materials, limited availability of local suppliers, early-stage staffing needs, and temporary utility burdens before revenue begins to stabilize.

A. Initial Inventory (Raw Materials) – $50,000
Start-up inventory will support test runs, staff training, community outreach, and product demonstrations. These inputs provide the foundation for practical learning and enable the FIC to begin limited processing operations immediately after commissioning.

Includes:

- Bulk purchase of locally sourced fruits and staples such as breadfruit, taro, banana, yam, coconut, and cassava
- Poultry inputs for training in slaughter, evisceration, packaging, and chilling
- Reef fish and nearshore pelagic species (e.g., skipjack, tuna) for processing trials
- Food-grade packaging materials: vacuum pouches, PET containers, glass jars, labels, cartons (primarily imported)
- Oil, spices, vinegar, and salt for food preparation during pilot runs and public events
- Inventory buffer to support outreach to Chuuk's outlying municipalities or schools

Costs reflect the need to import shelf-stable materials and packaging supplies not available on-island, as well as delivery logistics for reaching remote communities.

B. Training and Staffing – $95,000
This component addresses the initial staffing and knowledge transfer necessary to build local capacity in food-safe operations. Given the limited pool of trained food processors in Chuuk, funds are included to recruit and retain key personnel and to engage experienced trainers for the launch phase.

Includes:

- Salaries for a core team over the first 6 to 8 months: facility manager, food safety officer, sanitation worker, maintenance technician, and administrative/training support
- HACCP onboarding and certification training led by regional or remote instructors
- Technical training from equipment vendors or partner institutions on safe operation of machinery
- Bilingual (English and Chuukese) training resources in both digital and print formats
- "Train-the-trainer" programs to build long-term local instruction capacity

Budget includes travel stipends or honoraria for expert trainers from Hawaii, Guam, the Philippines, or other regional partners, along with virtual training modules supplemented by in-person demonstrations.

C. Utilities and Operating Costs (Year 1) – $40,000
The FIC will face elevated utility costs during its first year, due to the need for continuous cleaning, refrigeration, and basic digital infrastructure. While passive ventilation and future solar capacity may reduce some expenses, others remain high due to import dependency and service limitations.
Includes:

- Power generation (diesel fuel and backup generator maintenance), grid connection where feasible, and solar interface upkeep
- Potable water supply and wastewater management for sanitation and processing
- Weekly facility cleaning, daily replenishment of PPE, detergents, and sanitizers
- Pest management services, basic building maintenance, and consumable replacement parts
- Internet service, telephone access, and hosting for a basic outreach website

This budget ensures smooth operations and client-readiness during the critical first year of service delivery, while allowing time for the development of sustainable revenue streams through product sales, training services, or rental of shared facilities.

Total for Section 4: $185,000

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

5. Contingency Fund: $75,000
To support the successful completion and uninterrupted launch of the Tier III Food Innovation Center (FIC) in Chuuk, a contingency reserve of $75,000—approximately 6 to 7 percent of the overall project budget—has been set aside. This fund provides critical financial flexibility to manage unanticipated costs, delays, or technical challenges common to infrastructure development in remote island environments.

Rationale and Use:
Contingency funding is essential in Pacific Island contexts where import reliance, shipping delays, labor shortages, and extreme weather are routine variables. This reserve ensures that unforeseen circumstances do not compromise project delivery or necessitate cuts in core functionality.

Examples of Use Cases:

- **Construction material volatility:** Price surges in rebar, cement, or insulation due to international shipping fluctuations or port rerouting via Guam, Hawaii, or Asia
- **Logistical setbacks:** Additional charges for delayed offloading, barge rebooking, or long-term storage fees at Chuuk port caused by schedule disruptions or equipment backlogs
- **Installation mismatches or broken parts:** Modifications needed to integrate imported machinery with local layouts or power systems, requiring specialized labor or custom parts
- **Weather-induced delays:** Storms or flooding that interrupt building schedules or damage pre-positioned equipment and supplies
- **Operational bridging costs:** Short-term staffing extensions, fuel procurement, emergency repairs, or delays in cost-share contributions from partners or donors

Governance and Oversight:
Use of contingency funds will be carefully monitored by the financial oversight team and require documented justification by the facility manager, followed by review and approval from the designated project steering committee or oversight body. Should any funds remain unused after the construction and initial operating phase, they may be redirected to capacity building, food safety certifications, system upgrades, or strategic investments that strengthen long-term facility performance. Key is for fiscal transparency to ensure proper allocation and use of all funds.

B. Tier III Maritime Food Processing Facility in Chuuk, FSM

Overall Budget: $2,468,104

Overview

This proposal envisions a 3,000 square foot Tier III Food Innovation Center (FIC) in Weno focused on manufacturing maritime seafood products as well as animal feed using protein-rich bycatch fish waste, coconut cake, and legume biomass. The facility supports circular economic practices and enhances food and feed security in Chuuk and across the Federated States of Micronesia (FSM), reducing reliance on imported feed and creating value from underutilized local resources. The facility will also serve as a training hub for agro-entrepreneurs and support the marine industry as well as the local pig, poultry, and aquaculture sectors because of the focus on producing local feed. .

Design Assumptions

- Construction cost: $500 per sq ft, based on food-grade, cyclone-resilient, ventilated design with hygienic zoning.
- Operating year-round with up to two daily shifts (six-day workweek).
- Estimated 80 percent operational uptime to account for maintenance, holidays, and training.
- All raw materials (bycatch, coconut cake, legume crops) are seasonally available in sufficient quantities through partnerships with local fishers, oil processors, and farmers.

Production Capacity

- Target: ~1 metric ton (1,000 kg) of feed per day.
- Annual production (under optimal input availability): ≈260 metric tons.
- Feed types: floating and sinking pellets for aquaculture; mash or pelletized feeds for poultry and pigs.

Core Ingredients

- **Bycatch Fish Waste**: Collected at Weno's port and processed onsite through grinding, drying, and deodorizers.
- **Coconut Cake**: Obtained from Vital coconut processing center, used as a high-fiber, protein-rich base.
- **Legume Biomass**: Derived from local pigeon pea, velvet bean, and other nitrogen-fixing crops cultivated in agroforestry systems.
- **Plant Biomass** from area and from fruit and vegetable **waste following processing on Tonoas**.
- Supplemented with dried root vegetables, seaweed powder, and mineral premixes where needed.

Facility Design

- Includes raw material receiving bays, preprocessing zone (grinders, dryers), feed mixing and pelleting room, drying tunnels, quality control lab, packaging area, training room, cold storage, and administrative office.
- Integrated solar-ready electrical system and water catchment.
- Waste management through composting and wastewater filtration systems.

Strategic Objectives

- Support local poultry and livestock feed production through value-added processing.
- Enable import substitution for feed inputs currently imported.
- Promote agro-enterprise models for fishers, processors, and youth groups.
- Ensure compliance with Codex and HACCP standards for feed production.
- Strengthen food system resilience by creating internal feed supply chains.

Facility Specifications

- **Location**: Chuuk State, Federated States of Micronesia
- **Facility Type**: Tier III Food Innovation Center (Maritime and Animal Feed Manufacturing)
- **Size**: 3,000 square feet
- **Construction Cost**: $500 per square foot × 3,000 sq ft = **$1,500,000**
- **Design Standards**: The facility will be constructed in accordance with internationally recognized food and feed safety standards, including Codex Alimentarius, HACCP principles, and USDA/APHIS guidelines for hygienic design, sanitation, and biosecurity. This ensures compliance for both domestic use and export-readiness where applicable.
- **Target Production Output**: Under ideal operating conditions (two shifts/day, six days/week, with seasonal input availability), the facility aims to produce approximately 1 metric ton of feed per day, resulting in an estimated **260 metric tons per year**.
- **Core Processing Zones**:
    - Raw material receiving and preprocessing (fish waste handling, drying, and deodorization)
    - Feed milling, blending, pelleting, and drying

    - Cold and dry storage for raw materials and finished product
    - Quality assurance lab for feed composition and safety testing
    - Administrative and training spaces for operators and agri-entrepreneurs
- **Power and Utility Design**: Hybrid energy setup with diesel backup and solar-ready wiring; rainwater harvesting and greywater reuse systems will support sustainability.
- **Staffing and Operation**: The facility will employ a team including a plant manager, feed technician, machine operator, sanitation worker, and admin assistant, with specialized training supported by technical partners and regional experts.

Estimated Budget Summary

1. **Construction and Infrastructure**
    - Size: 3,000 sq ft
    - Rate: $500/sq ft (based on tropicalized, food-grade facility design)
    - **Total: $1,500,000**
2. **Equipment and Installation**
    - Feed dryers, grinders, hammer mills, pelletizers, mixers, cooling conveyors, and packaging tools
    - Cold storage and odor control for fish waste intake
    - Generators and ventilation systems
    - **Estimated Total: $1,100,000**
3. **Administration, R&D, and Training Facilities**
    - Includes an administrative office, training room, and micro-lab
    - Computers, IT equipment, and audiovisual tools
    - **Estimated Total: $95,000**
4. **Operational Readiness and Start-Up Inventory**
    - Raw material buffer (legumes, coconut cake, fish waste)
    - Packaging, labeling, PPE, safety materials, feed supplement inputs
    - Training personnel and initial salaries
    - **Estimated Total: $185,000**
5. **Utilities and Safety Systems**
    - Water and electrical systems
    - Generator and solar integration readiness
    - Fire suppression, pest control, sanitation systems
    - **Estimated Total: $110,000**
6. **Project Management and Technical Oversight**
    - On-site construction management and technical audits
    - Compliance with FDA feed safety standards and Codex regulations
    - **Estimated Total: $105,000**
7. **Contingency Fund (7%)**
    - To address freight delays, price escalations, labor shortages
    - **Estimated Total: $230,000**

Equipment & Supplies for a Tier III FDA-compliant Maritime Processing Center in Weno:

Equipment	Price per Unit	Number of Units	Total without Cost Conversion	Total with 1.5x Cost Conversion
Fish Processing Items				
Mannlake Scalder with Temp Control	525.00	1	525.00	787.50
Fish Fillet Cutter	2,000.00	2	4,000.00	6,000.00
Fish Cleaning, Scaling, Gutting	1,600.00	2	3,200.00	4,800.00
Mainstreet Stainless Steel Floor Fryer	749.00	1	749.00	1,123.50
Stainless Steel Triple Basins	306.15	1	306.15	459.23
Avantco A-49R-HC 54" Reach in Refrigerator	1,949.00	1	1,949.00	2,923.50
Stainless Steel Worktables	575.00	3	1,725.00	2,587.50
Animal Feed and Fertilizer Processing Items				
Fish and Produce Processing Grinder	5,000.00	2	10,000.00	15,000.00
Chicken Feed (Streamline)	2,500.00	1	2,500.00	3,750.00
Chicken Feed Production Line	5,500.00	1	5,500.00	8,250.00
Feed Pellet Packager	2,000.00	1	2,000.00	3,000.00
Robot Coupe R702VV 2 Continuous Feed Food Processor	6,011.00	1	6,011.00	9,016.50
Bags	0.07	50,000	3,500.00	5,250.00
Fertilizer mixer	3,500.00	2	7,000.00	10,500.00
Bulk Storage Containers	688.00	15	10,320.00	15,480.00
Shovels	51.00	15	765.00	1,147.50
Pitchforks	59.55	15	893.25	1,339.88
Food Safety Testing Checklist				
Check-Set IV Cold/Hot Calibrator	1,592.12	1	1,592.12	2,388.18
AP550 Flat-Surface Label Applicator	2,395.00	1	2,395.00	3,592.50
AP380 Label Applicator	1,595.00	1	1,595.00	2,392.50
PL400 Pouch Labeler	1,595.00	1	1,595.00	2,392.50
Barcode Thermal Ribbons	56.00	1	56.00	84.00

Barcode Scanner L13687	1,025.00	1	1,025.00	1,537.50
Barcode software	790.00	1	790.00	1,185.00
Zebra ZQ511 Mobile Receipt Printer	840.00	1	840.00	1,260.00
Thermapen Thermometer	299.00	1	299.00	448.50
Safety Equipment				
Porta Stream II Eyewash station	460.00	3	1,380.00	2,070.00
Saline Concentrate Refill	100.00	10	1,000.00	1,500.00
Dust Cover	52.00	3	156.00	234.00
S Carton Uline Industrial Latex Gloves	26.00	10	260.00	390.00
M Carton Uline Industrial Latex Gloves	14.00	10	140.00	210.00
L Carton Uline Industrial Latex Gloves	19.00	10	190.00	285.00
Class A First Aid Kits	67.00	5	335.00	502.50
Class B First Aid Kits	155.00	5	775.00	1,162.50
Class B+ First Aid Kits	395.00	5	1,975.00	2,962.50
Uline Ice Wraparound Fog Armor Dispenser box	94.00	2	188.00	282.00
3M Construction Harness	185.00	2	370.00	555.00
Carton Polyethylene Apron	22.00	6	132.00	198.00
Multi compartment Stainless Steel Dispensers	250.00	3	750.00	1,125.00
Additional Equipment				
Slaughtering Table	425.00	2	850.00	1,275.00
Butchers Table	1,000.00	3	3,000.00	4,500.00
Cookshack SM360 Smoker Oven	13,490.00	1	13,490.00	20,235.00
Heavy Duty Steel shelving 96 x 24 x 72"	1,445.00	5	7,225.00	10,837.50
Hose	50.00	1	50.00	75.00
Solar Dryer or Dehumidifier	210.00	10	2,100.00	3,150.00
Information Hub				
Samsung 4TB SSD Hard drives	439.99	2	879.98	1,319.97
Dell Inspiron 27' All in one cpu	1,189.98	1	1,189.98	1,784.97
4 Person L Desk Workstation	3,210.00	1	3,210.00	4,815.00

LG smart TV	299.00	1	299.00	448.50
Norton Anti virus software	19.99	1	19.99	29.99
Mesh Task Chairs	165.00	6	990.00	1,485.00
Downtown conference tables (Powered) 192 x 48"	1,560.00	1	1,560.00	2,340.00
Portable Projector Screen 107"	525.00	1	525.00	787.50
Wall monitor Mount	95.00	1	95.00	142.50
Kitchen Supplies				
Mobile ingredient bins	343.00	2	686.00	1,029.00
Self ingredient Bin 200 cups	243.00	2	486.00	729.00
Baking Pan	216.00	2	432.00	648.00
Wire Grate	168.00	2	336.00	504.00
Cambro Dish Racks	42.00	2	84.00	126.00
Cambro Glass Racks	80.00	2	160.00	240.00
Pan Dolly	305.00	2	610.00	915.00
Uline Trash Cans	74.00	2	148.00	222.00
Uline Trash can lids	29.00	2	58.00	87.00
Biohazard Step On Waste Can	131.00	3	393.00	589.50
Uline Thin trash can 23G	45.00	3	135.00	202.50
Rubbermaid Slim Jim Lid Can/bottle	52.00	2	104.00	156.00
Rubbermaid Slim Jim Lid paper	52.00	2	104.00	156.00
Rubbermaid Slim Jim Swing top	51.00	2	102.00	153.00
Stainless Dollie	135.00	2	270.00	405.00
Handsfree Trash Can 55G	255.00	3	765.00	1,147.50
Outdoor Landmark Series Trash Can Dome top 50G	970.00	3	2,910.00	4,365.00
Fork liftable Transport tilt truck	2,505.00	2	5,010.00	7,515.00
Hydraulic Platform Stacker	2,695.00	2	5,390.00	8,085.00
130km low speed new energy double cab mini pick up truck	9,999.00	2	19,998.00	29,997.00
Commercial Cutting Board	152.00	5	760.00	1,140.00

Commercial Mixing 3qt	62.00	3	186.00	279.00
Commercial Mixing 5qt	89.00	3	267.00	400.50
Commercial Mixing 8qt	125.00	3	375.00	562.50
Commercial Mixing 13qt	94.00	3	282.00	423.00
Commercial Mixing 20qt	150.00	3	450.00	675.00
Stainless Steel Steam Table Pans 3qt	150.00	3	450.00	675.00
Stainless Steel Steam Table Pans 6qt	250.00	3	750.00	1,125.00
Stainless Steel Steam Table Pans 10qt	150.00	3	450.00	675.00
Stainless Steel Steam Table Pans 14qt	175.00	3	525.00	787.50
Stainless Steam Table Pan Lids 1/6	55.00	3	165.00	247.50
Stainless Steam Table Pan Lids 1/3	85.00	3	255.00	382.50
Stainless Steam Table Pan Lids 1/2	110.00	3	330.00	495.00
Stainless Steam Table Pan Lids Full	205.00	3	615.00	922.50
Stainless Steel Scoops 8oz	69.00	3	207.00	310.50
Stainless Steel Scoops 16oz	75.00	3	225.00	337.50
Stainless Steel Scoops 32oz	80.00	3	240.00	360.00
Stainless Steel Scoops 64oz	86.00	3	258.00	387.00
Stainless Steel Scoops 96oz	114.00	3	342.00	513.00
Stainless Steel Scoops 128oz	122.00	3	366.00	549.00
Stainless Steel Scoops 160oz	134.00	3	402.00	603.00
Stainless Steel Mixing Paddles 48"	35.00	2	70.00	105.00
Mixing Polypropylene Paddles 40"	65.00	2	130.00	195.00
Mixing Polypropylene Paddles 52"	72.00	2	144.00	216.00
Hand Scraper 3 x 8"	7.00	5	35.00	52.50
Hand Scraper 4 x 9"	8.00	5	40.00	60.00

Stainless steel paper cutter 36"	163.00	2	326.00	489.00
Unbleached Paper rolls 36"	81.00	3	243.00	364.50
Case of Square Utility Jugs	34.20	2	68.40	102.60
Jug Pump	10.50	2	21.00	31.50
Chemical Resistant Spray Bottles	25.50	2	51.00	76.50
Case Replacement nozzles	17.25	2	34.50	51.75
Williams Sonoma Prep Tools 15 Piece Gadget and Utensils Set	279.95	2	559.90	839.85
Total Cost				**243,103.91**

Grand Total (All-Inclusive)

Category	Amount (USD)
Construction and Infrastructure	$1,500,000
Equipment and Installation	$243,103.91
Admin, Training, and R&D	$95,000
Operational Readiness & Start-Up Inputs	$185,000
Utilities and Safety Systems	$110,000
Project Management and Oversight	$105,000
Contingency Fund	$230,000
Total Estimated Budget	**$2,468,104**

Key Outputs and Outcomes

- Daily feed production capacity of approx. 1 metric ton
- Utilization of underused marine and agricultural waste
- Training hub for youth and agro-entrepreneurs
- Reduction of animal feed imports to FSM
- Resilient food and livestock systems through circular resource flows

C. Chuuk State Tier II Food Innovation Facilities (FIF)

FIFs Five Tier II: $6,402,462 *(5,625,000 + 471,212.49 + 75,000 + 231,250)*
Chuuk State proposes the establishment of five regional Tier II Food Innovation Facilities (FIFs), each designed at approximately 2,500 square feet, based on an estimated cost of $450 per square

foot. The total cost for each facility is projected at **$1,125,000**, yielding a combined construction cost of $5,625,000 for all FIFs.

The five proposed Tier II FIFs (with proposed locations in Tonoas, Weno, Fefan, Parem, and Udot) will serve distinct agricultural value chains critical to Chuuk's economy and food security strategy. These facilities are needed and because of the geographical distances between the communities across the islands within the lagoon and outer islands, **Tier II will be dedicated to solar-powered, low level processing of staple crops such as coconut, breadfruit, taro, yams and coconuts, along with other fruits and green vegetables, with the intent to develop dried, pureed, fermented, or packaged forms for local consumption and small-scale trade**.
Each FIF will serve as a semi-centralized hub supporting aggregation, processing, training, and storage in alignment with HACCP standards and Codex Alimentarius food safety protocols. The facilities are envisioned as modular and replicable, designed to provide geographic and thematic coverage across Chuuk's major agro-ecological zones while enhancing community-level value addition and market access. And, each will serve as training and community food production and processing centers for education on nutrition, cooking, product development, food preservation and more to support food security and access to healthy and nutritious local foods.

Budget Narrative:

1. Construction and Infrastructure: $1,125,000 per Tier II FIF

This estimate reflects the cost of constructing a 2,500 square foot Tier II Food Innovation Facility (FIF) in Chuuk, based on a benchmark rate of $450 per square foot. The design is aligned with FDA-compliant food-grade facility standards and adapted for island-specific environmental and logistical realities. The estimate includes imported building materials, skilled labor, refrigeration and sanitation systems, climate-resilient features, and project management oversight.

A. Foundation and Structural Works – $461,250

This component encompasses all civil works and vertical construction required to deliver a fully enclosed, durable, food-safe structure. As with many Pacific Island environments, nearly all construction inputs in Chuuk—such as cement, rebar, roofing, and steel—must be imported, and transportation logistics remain complex and high-cost.

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

- Land clearing, grading, and compacting: Executed with leased local machinery or imported equipment as available
- Sub-base and reinforcement: Stabilized with imported gravel, sand, and geotextiles to prevent erosion and water intrusion
- Reinforced concrete slab: Six-inch thick, industrial-grade poured slab with embedded rebar mesh, designed to endure heavy machinery and high humidity
- Drainage integration: Slope-engineered flooring linked to subsurface graywater or septic handling
- Shipping surcharges: Includes freight charges for bulk aggregate and cement delivery to Chuuk port, plus demurrage and local stevedoring

2. Structural Framing and Envelope – $187,500

- Galvanized steel beams and structural columns: Fabricated off-island and assembled on site

- Roof and rafter framing: Designed to meet Pacific cyclone codes, with trussed systems for weather resilience
- Partition framing: Interior non-load bearing walls built using treated local timber or steel studs where available
- Anchoring system: Engineered foundations with hurricane straps and wind-load compliance

3. Roofing System – $62,500

- Galvanized corrugated panels: Rust-resistant and Class A fire-rated for tropical climates
- Thermal barrier and vapor seal: Prevents heat ingress and condensation around processing equipment
- Rainwater harvesting: Includes gutters, downspouts, and cistern-compatible outflows
- Overhangs and soffits: Designed for passive cooling and protection from driving rain

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

- Covered receiving and dispatch platform: Concrete apron to accommodate supply vehicles and packaged product flow
- Graded access paths: Driveways with slope-stabilized surfaces for delivery truck use
- Exterior wall treatments: Mold-resistant finishes with food-safe paint or sandwich panel facades
- Security enhancements: Includes motion-sensitive exterior lighting, reinforced entry doors, and screened windows

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

- Crane and hoisting support: Required for steel frame placement, refrigeration units, and HVAC equipment
- Storage and warehousing: On-site containers for safeguarding imported materials over an extended build period
- Mobilization: Includes inter-island transport, barge shipments, and contractor deployment
- Customs clearance and risk management: Covers insurance, broker fees, and handling of sensitive or high-value imports

This construction package provides the structural foundation needed to implement high-functioning, food-grade processing facilities tailored to Chuuk's conditions. Each FIF will adhere to international food safety design standards while maintaining the resilience and adaptability needed in 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 Chuuk's tropical, infrastructure-limited setting, plumbing and electrical systems must be durable, adaptable, and optimized for water-intensive processing and intermittent power access. The budget reflects the need for full importation of components, skilled installation labor, and contingency allowances for climate and supply chain variability.

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

- Facility-wide potable water lines: Food-grade PEX or CPVC piping throughout processing, sanitation, and admin areas
- Hand-wash stations: Two per processing zone, with foot- or elbow-activated faucets and hands-free towel dispensers
- Triple-compartment sinks: Installed in community kitchen, sanitation stations, and oil/coconut processing zones

- Grease traps and drainage: Integrated system using stainless steel interceptors and epoxy-coated floor drains
- Rainwater catchment and storage: Cisterns fed by roof guttering, with sediment filtration and UV/chlorine treatment for non-potable reuse
- Septic system: On-site wastewater disposal capacity tailored to peak food processing volumes

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

- Dedicated circuits for essential processing equipment: Separate feeds for coolers, fryers, dryers, and vacuum units, with surge protection
- Room-based sub-panels: Each production zone on independent load circuits to manage maintenance and safety
- Food-grade electrical finish: Moisture-sealed conduits and outlets, splash zones protected by guards and elevated cable runs
- Shatterproof LED lighting: High-lumen, food-safe LED fixtures throughout, with enhanced visibility in production and inspection rooms
- Emergency lighting and signage: Battery backup lights and compliant exit signs to meet international food facility protocols

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

- Backup generator: One 50–80 kW diesel unit housed in a ventilated, weatherproof enclosure
- Automatic Transfer Switch (ATS): Enables continuous power supply for refrigeration, IT, and sanitation systems during outages
- Solar-ready wiring: Pre-installed conduits and switchgear for Phase II PV integration or donor-funded solar expansion
- Battery/inverter readiness: Compatible electrical layout for lithium-ion or lead-acid battery storage systems in the future

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

- Kitchen hood fire suppression: Commercial-grade automatic discharge systems in processing and cooking areas
- Extinguishers and alarm placement: CO2 and dry chemical units positioned every 75 feet, with fire alert systems
- Grounding and lightning protection: Island-appropriate surge suppression and grounding rods to reduce outage risk
- PPE storage and signage: Clearly marked storage for safety gear, chemical spill kits, and emergency response tools

This package ensures that all water, sanitation, and energy systems meet global food safety norms and can function reliably despite utility instability, frequent rainfall, or operational peaks. It aligns with Codex Alimentarius and HACCP guidelines and anticipates future upgrades to improve sustainability and resiliency in the Chuuk context.

C. Interior Finishing – $156,250

This component ensures that the interior spaces of the Tier II Food Innovation Facilities (FIFs) in Chuuk meet rigorous global food safety standards for hygiene, durability, cleanability, and pest exclusion. All surfaces and materials are designed to withstand high humidity, salt exposure, and intensive use in food processing environments. The budget includes imported finish materials, tropical-grade sealing, and specialized labor consistent with HACCP, USDA, and Codex guidelines.

1. Hygienic Wall Systems – $56,250

- FRP (Fiberglass Reinforced Plastic) panels: Installed in wet processing zones such as coconut, root crop, and sanitation rooms. Panels are mold- and corrosion-resistant, smooth-surfaced, and easily sanitized.
- Epoxy wall coatings: Applied in dry zones, offices, and storage rooms. Coatings include antimicrobial additives and are high-gloss for better visibility of contaminants.
- Wall-floor coving and corner guards: Rounded, seamless joints to eliminate harborage points for bacteria or pests and simplify cleaning in corners and transitions.

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

- Epoxy flooring system: Slip-resistant, food-grade coatings across all rooms, reinforced for heavy equipment and daily wet cleaning.
- Antimicrobial finishes: Granular additives for microbial resistance and staff safety in high-traffic zones.
- Integrated trench drainage: Strategically sloped floors with stainless steel trench drains in processing and sanitation zones to minimize pooling.
- Moisture protection: Waterstop expansion joints and thermal sealing barriers to prevent subfloor degradation.

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

- Seamless, washable ceiling panels: Water-resistant and joint-minimized surfaces in all food prep and storage rooms.
- Moisture-barrier insulation: Installed above ceilings to prevent condensation from forming and dripping onto work surfaces.
- Pest-proofing: Insect- and rodent-sealed light fixtures, vent penetrations, and cabling channels using silicone and mesh.
- Secure maintenance hatches: Locked and gasketed access panels prevent ceiling void contamination.

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

- Hygienic zoning: Internal partitions designed to maintain clean-to-dirty product flow and staff movement.
- Airtight food-grade doors: Insulated, gasketed doors for processing rooms, fitted with antimicrobial handles.
- Visual monitoring windows: Tempered glass observation panels installed in training and demonstration areas.
- Hands-free door systems: Magnetic door holders and kick plates installed at high-traffic transitions for hygienic access.

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

- Restroom infrastructure: Eco-flush toilets, foot-operated sinks, hand dryers, and changing space for sanitation workers.
- Stainless steel storage: Corrosion-proof cabinets for tools, PPE, and ingredients in R&D and kitchen zones.
- Chemical and compliance storage: Lockable units for detergents, SOP binders, and safety documentation.
- Finishes for shared areas: Mold-resistant paints, window insect screens, and durable signage in administrative spaces.

This interior finishing investment ensures that both Tier II FIFs in Chuuk are food-safe, resilient, and compliant with export-quality standards. Each surface and fixture is selected for maximum longevity and sanitation performance in Micronesia's humid, high-wear environment.

D. Refrigeration and Ventilation – $235,000

This budget line ensures that the Tier II Food Innovation Facilities (FIFs) in Chuuk maintain consistent cold-chain reliability and effective air circulation throughout the facilities. Given the island's tropical climate and the perishability of products like coconut derivatives, taro, banana, and leafy greens, this investment supports climate-resilient, energy-efficient systems designed to uphold food safety, reduce spoilage, and ensure continuous operations.

1. Cold Storage Systems – $120,000

- **Walk-in Coolers and Freezers:** Two commercial-grade insulated cold rooms (one cooler and one freezer), constructed with polyurethane paneling, sealed gaskets, and food-grade flooring. Systems are equipped with temperature controls and humidity-resistant shelving for safe storage of processed coconut, root crops, and fresh produce.
- **CoolBot Hybrid Cold Rooms:** Two rooms integrated with CoolBot controllers and high-capacity air conditioners for flexible, energy-conscious cooling, ideal for overflow inventory, community co-packing, or R&D trials.
- **Entry-Level IQF System:** Compact Individual Quick Freezing unit for rapid chilling of products like coconut cubes, banana slices, or taro, extending product shelf life for both local and export markets.
- **Remote Temperature Monitoring:** Battery-logged, cloud-connected temperature tracking systems for all refrigerated zones, ensuring full HACCP-aligned traceability.

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

- **Exhaust Hoods and Filters:** Heavy-duty stainless steel hoods installed over frying and boiling stations in coconut and root processing rooms, equipped with grease filters and integrated fire suppression.
- **Airflow Systems:** Wall-mounted and overhead fans ensure continuous ventilation across processing and storage zones, minimizing moisture buildup and reducing microbial risks.
- **Humidity and Odor Management:** Dehumidifiers, UV air purifiers, and activated carbon scrubbers control environmental conditions in food prep and storage zones, especially important in high-moisture coconut and fermented food applications.
- **Zonal Pressure Control:** Negative pressure zones in high-risk areas (e.g., grating and fermentation rooms), with positive pressure maintained in packaging and admin areas to prevent air contamination.

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

- **Solar Compatibility:** All cold chain and ventilation infrastructure pre-configured for solar system installation. Roof structures are engineered to support future photovoltaic modules.
- **Enhanced Insulation:** All storage and processing areas include reflective thermal barriers, high-R value insulation, and vapor-resistant sealing to reduce heat gain and cut operating costs.
- **Backup Generator and Transfer Switches:** Dedicated 25–30 kVA diesel generator with automatic transfer switch to protect refrigeration operations during grid outages. A portable generator provides redundancy for critical zones.
- **Thermal Barriers and Air Locks:** PVC curtains and door airlocks installed at cold room entry points to minimize temperature fluctuation during product transfer.

Together, these refrigeration and ventilation investments ensure that the Chuuk Tier II FIFs maintain the cold-chain integrity required for safe food storage, preparation, and packaging. Designed with redundancy and energy awareness, these systems allow uninterrupted operation and compliance with export and domestic food safety standards, even in Chuuk's challenging tropical setting.

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

This component ensures that the Tier II Food Innovation Facilities (FIFs) in Chuuk are constructed and commissioned to meet internationally recognized food facility standards—particularly those aligned with U.S. FDA, HACCP, and Codex Alimentarius requirements—while addressing logistical and infrastructural challenges specific to the Federated States of Micronesia (FSM).

1. Full-Time Construction Manager – $50,000

A dedicated on-site construction manager will oversee the full implementation of each facility, from groundbreaking through final commissioning.

Responsibilities include:

- Daily supervision of construction teams and subcontractors
- Ensuring adherence to architectural plans, engineering designs, and safety regulations
- Overseeing scheduling, procurement, and on-site logistics for imported building materials and systems
- Troubleshooting delays due to weather, shipping, or infrastructure constraints
- Coordinating plumbing, electrical, finishing, and refrigeration subcontractors to streamline workflows
- Delivering weekly updates and compliance documentation to project leads and funders

Cost includes:

- Monthly fee for 9 to 12 months of site engagement
- Travel and relocation from a regional hub (e.g., Guam, Hawaii, or mainland U.S.)
- Housing stipend, per diem, and in-country transport support

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

A specialized food facility consultant will provide ongoing guidance to ensure hygienic layout, food-safe material use, drainage logic, and processing zone standards meet international benchmarks.

Key deliverables include:

- Pre-construction review of design and utility schematics for compliance with HACCP, GMP, and zoning best practices
- Real-time feedback during construction and pre-commissioning walkthroughs
- Guidance on equipment placement, sanitation zones, and raw-to-finished product segregation
- Drafting SOP templates and cleaning protocols for operations readiness
- Support for food safety training, audit preparation, and possible certification pursuits

Cost includes:

- Consulting retainer over 9–12 months
- Three site visits (including airfare, housing, and meals)
- Remote working sessions, document reviews, and training sessions

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

To reduce costly rework and maintain accountability during construction, the project will engage an independent civil engineer or architect to conduct ongoing inspections and reporting.

Scope includes:

- Bi-weekly site visits and progress verification reports
- Cross-checking of actual materials and quantities against procurement records
- In-field testing of electrical, plumbing, and finish work (e.g., epoxy floors, drainage)
- Structured milestone validation to authorize staged contractor payments

This oversight and technical support package will ensure that both Chuuk Tier II FIFs are delivered with high construction integrity, in compliance with global food processing standards, and with clear documentation for funders and local stakeholders. It builds in institutional knowledge, minimizes construction risk, and positions the facilities for long-term success.

Total Construction and Infrastructure or Remodeling for Tier II:

Component	Amount (USD) for each Tier II FIF	Amount (USD) for five Tier II FIFs
A. Foundation & Structure	**$461,250**	**$2,306,250**
B. Plumbing & Electrical	**$178,750**	**$893,750**
C. Interior Finishing	**$156,250**	**$781,250**
D. Refrigeration & Ventilation	**$235,000**	**$1,175,000**
E. Project Management & Oversight	**$93,750**	**$468,750**
Total	**$1,125,000**	**$5,625,000**

2. Equipment & Supplies for the Tier II FIFs: $471,212.49

Equipment	Price per Unit	Number of Units	Total without Cost Conversion	Total with 1.5x Cost Conversion
Staple Crop Processing Items				
Machine Coconut Opener	300.00	15	4,500.00	6,750.00
Oven/range	1,000.00	5	5,000.00	7,500.00
Wok	17.00	15	255.00	382.50
Burner	4.30	15	64.50	96.75
Steel Tray	10.00	150	1,500.00	2,250.00
Tray Rack	90.00	25	2,250.00	3,375.00

Flesh tool	3.00	25	75.00	112.50
Industrial Juicer	600.00	6	3,600.00	5,400.00
Oil Extractor	800.00	5	4,000.00	6,000.00
Machete	28.00	50	1,400.00	2,100.00
Flour Mill	800.00	5	4,000.00	6,000.00
Liberty Stainless Steel Taps	84.00	50	4,200.00	6,300.00
Sugaring Bucket	51.94	100	5,194.00	7,791.00
28' Fiberglass Extension Ladder	460.00	5	2,300.00	3,450.00
Winco 12 in Sieve Baking Sheet	24.01	50	1,200.50	1,800.75
Lakshmi Coconut Milk Extractor	210.80	5	1,054.00	1,581.00
Coconut Packager	1,650.00	5	8,250.00	12,375.00
Coconut Oil press	168.75	5	843.75	1,265.63
Manual Coconut MIlk press	90.00	5	450.00	675.00
Dehydrator	239.00	3	717.00	1,075.50
Manual Veg Slicer	90.00	5	450.00	675.00
Stainless Steel Worktables	575.00	30	17,250.00	25,875.00
General Processing Items				
Mainstreet Stainless Steel Floor Fryer	749.00	2	1,498.00	2,247.00
Stainless Steel Triple Basins	306.15	5	1,530.75	2,296.13
Avantco A-49R-HC 54" Reach in Refrigerator	1,949.00	5	9,745.00	14,617.50
Hose	50.00	5	250.00	375.00
Food Safety Testing Checklist				
Benchtop Ph Meter	1,035.00	2	2,070.00	3,105.00
Thermapen Thermometer	299.00	5	1,495.00	2,242.50
Hand held temp adjusted Refractometer	260.00	5	1,300.00	1,950.00
Thermometer Calibrator (4 point hot/cold)	1,592.12	5	7,960.60	11,940.90
Thermometers (digital + infrared)	300.00	5	1,500.00	2,250.00
Safety Equipment				
Half Face respirator	43.00	10	430.00	645.00

Porta Stream II Eyewash station	460.00	5	2,300.00	3,450.00
Goggles	22.00	30	660.00	990.00
S Carton Uline Industrial Latex Gloves	26.00	10	260.00	390.00
M Carton Uline Industrial Latex Gloves	14.00	10	140.00	210.00
L Carton Uline Industrial Latex Gloves	19.00	10	190.00	285.00
Class A First Aid Kits	67.00	5	335.00	502.50
Class B First Aid Kits	155.00	5	775.00	1,162.50
Class B+ First Aid Kits	395.00	5	1,975.00	2,962.50
Goggles	94.00	25	2,350.00	3,525.00
Carton Polyethylene Apron	22.00	5	110.00	165.00
Canning and Pickling Equipment				
Canner Aluminum Bath water Canner	269.99	2	539.98	809.97
https://www.allamericancanner.com/41-Quart-Pressure-Canning-Kit.htm	677.99	2	1,355.98	2,033.97
Wide Mouth Ball Glass Mason Jars 32 oz	1.37	100	137.00	205.50
Fermentation Crock	85.49	5	427.45	641.18
Fermentation Weights	43.97	5	219.85	329.78
Fermentation lid cloth covers	13.93	5	69.65	104.48
Potable Aqua Water Purification Tabs with PA plus	12.99	5	64.95	97.43
Stainless Steel Funnel	10.49	5	52.45	78.68
11.5 Qt Canning Rack	8.49	5	42.45	63.68
Canning Labels	6.49	5	32.45	48.68
1000 sheets of 4 rectangular labels	109.99	5	549.95	824.93
Hatchery Equipment				
2560 Egg Incubator Kit	6,119.99	2	12,239.98	18,359.97
Chick Brooder 3 Layer H: 15"	799.99	2	1,599.98	2,399.97
Grow out Pen 5 Layer H: 9.5"	699.99	2	1,399.98	2,099.97
Walk in 15ft Chicken run	1,999.99	2	3,999.98	5,999.97
Over Ez Tarp for walk in 8 foot chicken run	199.99	2	399.98	599.97
Over Ez Chicken Coop Jumbo	3,999.00	2	7,998.00	11,997.00

Nesting Pads	39.99	2	79.98	119.97
Eaton Natural Hemp Bedding 8lb	24.99	2	49.98	74.97
Silo Feeder (40LB) 3 pack	699.99	2	1,399.98	2,099.97
High Country Plastics 270lbs feed bin with stand	312.99	2	625.98	938.97
3 section breeding pen	239.99	2	479.98	719.97
Heater & Thermostat for Box Brooder 110V	114.99	2	229.98	344.97
Chick Brooder heating Plate Temperature Controller	19.99	2	39.98	59.97
Thermo-Chicken 12.5 in. x 18.5 in 40-Watt Heated Pad	71.98	2	143.96	215.94
Solar Powered Automatic Chicken Coop Door with remote	89.99	2	179.98	269.97
Wise mountable feeder 22lbs poultry & Game feeder	59.99	2	119.98	179.97
Wise mountable drinker 3 Gallon poultry and game waterer	69.99	2	139.98	209.97
Pencron Expandable portable power station 1920WH	679.00	2	1,358.00	2,037.00
24000 Watt Dual Fuel Air cooled Standby Generator	6,398.10	2	12,796.20	19,194.30
Global Inidustrial Stainless Steel Veterinary Scale	515.00	2	1,030.00	1,545.00
Global industrial replacement AC adapter	19.75	2	39.50	59.25
Global Industrial Stainless steel cleaner & Polish	68.95	2	137.90	206.85
Rayovac AAA 24 Battery Contractor Pack	12.24	2	24.48	36.72
Electronic Weighing Poultry Scale, Chicken weighing Bag with sling	23.99	2	47.98	71.97
Poultry First Aid Kit	104.99	2	209.98	314.97
Chicken Ointments Best of show by Manna Pro	43.99	2	87.98	131.97
Coop Cleaning Supply Kit	59.99	2	119.98	179.97
OverEZ Chicken Waterer 12 Gallon	79.99	2	159.98	239.97
Case of 250 cartons for eggs	169.99	4	679.96	1,019.94

Tier-II Information Hub				
Samsung 4TB SSD Hard drives	439.99	5	2,199.95	3,299.93
Dell Inspiron 27' All in one cpu	1,189.98	5	5,949.90	8,924.85
LG smart TV	299.00	2	598.00	897.00
Norton Anti virus software	19.99	5	99.95	149.93
Mesh Task Chairs	165.00	5	825.00	1,237.50
Downtown conference tables (Powered) 192 x 48"	1,560.00	5	7,800.00	11,700.00
Wall monitor Mount	95.00	2	190.00	285.00
Kitchen Supplies				
Self ingredient Bin 200 cups	243.00	10	2,430.00	3,645.00
Baking Pan	216.00	10	2,160.00	3,240.00
Wire Grate	168.00	10	1,680.00	2,520.00
Cambro Dish Racks	42.00	10	420.00	630.00
Cambro Glass Racks	80.00	10	800.00	1,200.00
Pan Dolly	305.00	5	1,525.00	2,287.50
Uline Trash Cans	74.00	10	740.00	1,110.00
Uline Trash can lids	29.00	10	290.00	435.00
Biohazard Step On Waste Can	131.00	10	1,310.00	1,965.00
Uline Thin trash can 23G	45.00	10	450.00	675.00
Rubbermaid Slim Jim Lid Can/bottle	52.00	10	520.00	780.00
Rubbermaid Slim Jim Lid paper	52.00	10	520.00	780.00
Rubbermaid Slim Jim Swing top	51.00	10	510.00	765.00
Stainless Dollie	135.00	10	1,350.00	2,025.00
Handsfree Trash Can 55G	255.00	10	2,550.00	3,825.00
Outdoor Landmark Series Trash Can Dome top 50G	970.00	10	9,700.00	14,550.00
Fork liftable Transport tilt truck	2,505.00	5	12,525.00	18,787.50
Hydraulic Platform Stacker	2,695.00	5	13,475.00	20,212.50
130km low speed new energy double cab mini pick up truck	9,999.00	5	49,995.00	74,992.50

Commercial Cutting Board	152.00	10	1,520.00	2,280.00
Commercial Mixing 3qt	62.00	10	620.00	930.00
Commercial Mixing 5qt	89.00	10	890.00	1,335.00
Commercial Mixing 8qt	125.00	10	1,250.00	1,875.00
Commercial Mixing 13qt	94.00	10	940.00	1,410.00
Commercial Mixing 20qt	150.00	10	1,500.00	2,250.00
Stainless Steel Steam Table Pans 3qt	150.00	10	1,500.00	2,250.00
Stainless Steel Steam Table Pans 6qt	250.00	10	2,500.00	3,750.00
Stainless Steel Steam Table Pans 10qt	150.00	10	1,500.00	2,250.00
Stainless Steel Steam Table Pans 14qt	175.00	10	1,750.00	2,625.00
Stainless Steam Table Pan Lids 1/6	55.00	10	550.00	825.00
Stainless Steam Table Pan Lids 1/3	85.00	10	850.00	1,275.00
Stainless Steam Table Pan Lids 1/2	110.00	10	1,100.00	1,650.00
Stainless Steam Table Pan Lids Full	205.00	10	2,050.00	3,075.00
Stainless Steel Scoops 8oz	69.00	10	690.00	1,035.00
Stainless Steel Scoops 16oz	75.00	10	750.00	1,125.00
Stainless Steel Scoops 32oz	80.00	10	800.00	1,200.00
Stainless Steel Scoops 64oz	86.00	10	860.00	1,290.00
Stainless Steel Scoops 96oz	114.00	10	1,140.00	1,710.00
Stainless Steel Scoops 128oz	122.00	10	1,220.00	1,830.00
Stainless Steel Scoops 160oz	134.00	10	1,340.00	2,010.00
Stainless Steel Mixing Paddles 48"	35.00	5	175.00	262.50
Mixing Polypropylene Paddles 40"	65.00	5	325.00	487.50
Mixing Polypropylene Paddles 52"	72.00	5	360.00	540.00
Hand Scraper 3 x 8"	7.00	5	35.00	52.50
Hand Scraper 4 x 9"	8.00	5	40.00	60.00

Stainless steel paper cutter 36"	163.00	5	815.00	1,222.50
Unbleached Paper rolls 36"	81.00	10	810.00	1,215.00
Handheld Induction Sealer and Caps	340.00	10	3,400.00	5,100.00
Clear Straight-sided Glass jars with metal cap 8oz	40.80	5	204.00	306.00
Clear Straight-sided Glass jars with metal cap 16oz	54.60	5	273.00	409.50
Clear Straight-sided Glass jars with metal cap 32oz	64.80	5	324.00	486.00
Amber Straight-Sided Glass Jars with Metal Cap 8oz	40.80	5	204.00	306.00
Case Standard Glass Canning Jars 8oz	14.40	5	72.00	108.00
Case Standard Glass Canning Jars 16oz	18.00	5	90.00	135.00
Case Standard Glass Canning Jars 24oz	20.40	5	102.00	153.00
Case Standard Glass Canning Jars 32oz	22.80	5	114.00	171.00
Case Replacement Standard Canning Jar Lids	81.00	5	405.00	607.50
Case Glass Spice Jars 2oz	48.00	5	240.00	360.00
Case Glass Spice Jars 4oz	27.60	5	138.00	207.00
Case Glass Spice Jars 8oz	15.60	5	78.00	117.00
Case Glass Spice Jars 16oz	18.60	5	93.00	139.50
Case Cubitainers	60.00	5	300.00	450.00
Case of Square Utility Jugs	34.20	5	171.00	256.50
Jug Pump	10.50	5	52.50	78.75
Chemical Resistant Spray Bottles	25.50	5	127.50	191.25
Case Replacement nozzles	17.25	5	86.25	129.38
Bundle Egg Cartons	90.00	5	450.00	675.00
Egg Filler Flat Case	42.00	5	210.00	315.00

Williams Sonoma Prep Tools 15 Piece Gadget and Utensils Set	279.95	5	1,399.75	2,099.63
Berry Basket	75.00	5	375.00	562.50
Total Cost				**471,212.49**

3. Administration, Training, and R&D: $15,000 per Tier II FIF

This budget category ensures that each Tier II Food Innovation Facility (FIF) in Chuuk operates not only as a processing unit but also as an administrative and training hub. It supports critical back-office functions, technical coordination, food safety compliance, and staff development. The budget accounts for equipment shipping and installation in a remote island context where ICT and scientific tools are costly to import and maintain.

A. Administrative Office – $5,500

Each facility includes a 300 square foot office to support day-to-day management, documentation, and coordination activities.

Key Features:

- Desks, chairs, and cabinets sourced locally when possible (e.g., coconut timber), supplemented with imported ergonomic seating and secure filing systems
- One laptop and one desktop computer with surge protectors and extended warranties
- Wireless printer/scanner and router for document handling and communication
- Dry-erase boards, planning boards, storage shelves, and secured records cabinets
- One split-unit air conditioner and fans for cooling and humidity control

Cost drivers include the need for furniture and electronics that can withstand tropical humidity, backup components to reduce downtime, and air-freight of sensitive devices.

B. Research and Development Laboratory – $7,500

A 150–200 square foot R&D lab is included in each facility to support quality assurance and small-batch product development.

Key Equipment:

- Stainless steel benches and sealed sinks with corrosion-resistant fittings
- Basic lab equipment including microscope, pH meters, incubators, moisture analyzers
- Seal testers, microbial media, and refrigerated storage for samples and reagents
- Personal protective equipment (PPE), fire extinguishers, and eyewash station

These items are expected to be imported with necessary calibration and user training provided. Lab support is vital for innovation and hygiene compliance.

C. Training Room – $3,250

Each FIF includes a 12-person training space for workshops on food safety, entrepreneurship, and equipment use.

Features:

- Digital projector with screen and multimedia inputs
- Flexible seating arrangements: mix of modular chairs and traditional pandanus mats
- HACCP posters, flip charts, instructor workstation, and display boards
- Ceiling fans, screened windows, and provisions for an adjacent open-air annex for overflow training or staging

Shipping costs reflect specialized AV and educational tools. The outdoor annex area with cement flooring and thatched roof will be incorporated into the core building design.

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

Supports communication, documentation, and cloud-based management of food safety protocols.

Inclusions:

- Rugged laptop, desktop computer, color printer, wireless routers
- Connectivity infrastructure such as mobile hotspot or satellite uplink
- Subscriptions to secure cloud platforms for inventory, traceability, and reporting (e.g., Google Workspace, FoodReady)
- Office supplies including binders, laminators, UPS backup, and IT support

The budget includes redundancy measures to address connectivity gaps and reduce operational disruptions in Chuuk's more isolated areas.

Total for Section 3: $75,000

Component	**Amount (USD) for each Tier II FIF**	**Amount (USD) for all five Tier II FIFs**
A. Administrative Office	$5,500	$27,500
B. Training Room	$3,250	$16,250
C. Office Supplies and IT Infrastructure	$6,250	$31,250
Total	$15,000	$75,000

4. Operational Readiness and Sustainability: $46,250 per Tier II FIF

This budget line ensures that each Chuuk Tier II Food Innovation Facility (FIF) is not only constructed and outfitted with equipment, but also fully functional, staffed, and ready to begin operations from day one. It addresses the costs of procuring initial inventory, training personnel, covering startup utilities, and maintaining basic operations in the early phase, especially while the facility transitions to self-sustaining revenue generation.

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

Each FIF requires sufficient start-up inventory to conduct processing trials, staff training, product demonstrations, and early-stage market testing.

Included Inputs:

- Bulk local crops such as taro, banana, breadfruit, coconut, and sweet potato for processing into flour, chips, milk, oil, and other products
- Purchased poultry and eggs for the facility focused on coconut and animal-based processing
- Imported or locally sourced packaging materials including vacuum bags, PET bottles, laminated pouches, labels, and shipping cartons
- Supplemental ingredients like oil, salt, spices, and sugar for recipe trials and training modules

The budget reflects freight costs for packaging and food-grade supplies not available locally and allows flexibility to source perishables from nearby islands if needed.

B. Training and Staffing – $23,750

Initial operating success depends on building a team trained in hygienic processing, traceability, and equipment operation. These funds support hiring and upskilling staff and engaging qualified trainers.

Covered Costs:

- Staff salaries for 6 to 8 months for roles such as operations lead, sanitation and quality staff, maintenance support, and training assistant
- HACCP and SOP training delivered via remote instruction or short-term regional visits
- Technical training from equipment vendors on proper operation of cold storage units, sealers, fryers, or coconut processing tools
- Custom training materials in English and adapted to Chuuk's languages and cultural context
- Travel support for regional or national trainers, and remote Zoom-based modules with hybrid in-person days

This budget ensures that once operational, each facility can maintain food safety standards, operate machinery correctly, and build local institutional capacity for future scaling.

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

While some energy savings are achieved via solar design and CoolBot refrigeration, significant utility and operating costs persist during the first year of launch.

Inclusions:

- Generator fuel, solar integration maintenance, and electrical usage
- Water for sanitation and cleaning, plus wastewater management and treatment
- Cleaning agents, PPE, sanitizers, gloves, and weekly deep cleaning
- Pest control, minor repairs, and routine upkeep for facility hygiene
- Connectivity costs including mobile hotspot plans, domain hosting, and phone service for outreach or coordination

These funds ensure the FIF can maintain safe, consistent operations while it builds clientele, contracts, or government-supported processing programs.

Component	**Amount (USD) for each Tier II FIF**	**Amount (USD) for all Tier II FIFs**
A. Initial Inventory (Raw Materials)	$12,500	$62,500
B. Training and Staffing	$23,750	$118,750
C. Utilities and Operating Costs	$10,000	$50,000
Total	$46,250	$231,250

D. Chuuk State Tier I Food Innovation Facilities (FIFs)

FIFs Tier I Total Cost: $237,925.33 (63 centers)
Chuuk State proposes the establishment of 63 **Tier I Food Innovation Facilities (FIFs),** distributed across the entire state. Each of all sixteen municipalities on Weno will have a Tier-I facility to ensure local accessibility and engagement at the community level.Two more facilities will be located on Fefan. One facility will also be located on all other Chuuk Lagoon islands (Fonoton, Piis, Paneu, Tonoas, Uman, Siis, Parem, Udot, Eot, Romanum, Fanapanges, Toleisom, Oneisom, Paata, and Polle). In addition, thirty Tier I facilities will be located across Chuuk's outer islands (Namonuito Islands, Hall Islands, Mortlock Islands, and Pattiw Islands). These micro-scale facilities are intended to serve as decentralized nodes for pre-processing, aggregation, farmer training, and basic value addition of local crops and marine resources.
Each Tier I center will serve multiple purposes including:

- Providing space for sorting, washing, and drying produce
- Supporting basic equipment for coconut grating, taro slicing, and fruit dehydration using solar dryers
- Hosting community trainings on food hygiene, nutrition, and agro-processing
- Serving as staging areas for municipal-level aggregation and cold chain integration with higher-tier facilities

The total estimated cost per Tier I facility is $6,172.88, which includes construction-ready kits, local materials, starter tools, water access solutions, and transport costs to each island or interior site. In more remote locations such as Nukuoro and Kapingamarangi, additional logistics costs have been averaged into the per-unit figure to reflect barge chartering, weather contingencies, and offloading needs. The facilities will be co-designed with municipal stakeholders to ensure cultural appropriateness, community ownership, and alignment with local land availability.

1. Construction and Infrastructure: $24,000

This cost covers the basic construction or renovation of spaces to establish Tier I collection and pre-processing facilities across Chuuk. A total of 63 facilities will be developed: one in each of the sixteen municipalities on Chuuk main island, 2 on Fefan, 1 on each Chuuk Lagoon island (Fonoton, Piis Paneu, Tonoas, Uman, Siis, Parem, Udot, Eot, Romanum, Fanapanges, Toleisom, Oneisom, Paata, and Polle), and thirty across Chuuk's outer islands.
Each Tier I facility will feature a simple, functional structure consisting of a raised cement floor, open-air walls for ventilation, and a durable, weather-resistant roof. Locally available materials such as hardwood posts, bamboo framing, woven palm panels, and corrugated tin or thatch roofing will be prioritized to reduce costs and foster community participation. The spaces are intended to support basic agricultural activities such as sorting, peeling, grating, sun-drying, and temporary storage.

At an average cost of $2,000 per facility within Chuuk Lagoon, the budget reflects minimal yet essential investments in infrastructure, including:

- Site preparation and slab foundation

- Roof construction using locally sourced or donated labor
- Basic water drainage and sanitation considerations
- Adaptations for island-specific site conditions (e.g., elevation in flood-prone areas)

The remaining 30 facilities outside of Chuuk Lagoon will be budgeted at a total cost of $100,000 (around $3,000 per facility) to account for the additional travel cost for these remote locations.

This decentralized infrastructure model is critical for supporting early-stage food processing, household engagement, and farm-to-market linkages across both the main island and outer island communities of Chuuk.

2. Equipment & Supplies for Tier I Village Food Innovation Facilities in Chuuk: $71,925.63.

Equipment	Price per Unit	Number of Units	Total without Cost Conversion	Total with 1.5x Cost Conversion
General Processing Item				
Stainless Steel Commercial Work Table	674.18	10	6,741.80	10,112.70
Hand Grinder	20.00	10	200.00	300.00
Knives	30.00	63	1,890.00	2,835.00
Pedal Generator Stationary	255.00	10	2,550.00	3,825.00
Knife Sharpening Stones	2.99	63	188.37	282.56
Coconut Mesh Bag	35.00	63	2,205.00	3,307.50
Portable Solar generator	200.00	10	2,000.00	3,000.00
Compostable Gallon Resealable Bag	16.00	10	160.00	240.00
Staple Crop Processing Items				
Flesh tool	3.00	15	45.00	67.50
Machete	27.00	63	1,701.00	2,551.50
Flour Mill	36.00	63	2,268.00	3,402.00
Liberty Stainless Steel Taps	84.00	10	840.00	1,260.00
Sugaring Bucket	51.94	63	3,272.22	4,908.33
Winco 12 in Sieve Baking Sheet	24.01	63	1,512.63	2,268.95
Manual Coconut Mllk press	90.00	10	900.00	1,350.00
Mandoline Chip Slicer	15.00	10	150.00	225.00
Fishing Equipment				

Powerpro Braided Fishing Line	16.99	30	509.70	764.55
Promar Hook Resist Fishing nets	21.99	30	659.70	989.55
Gamakatsu Baitholder Fishing Hook	11.49	100	1,149.00	1,723.50
2-Gallon Buckets	3.60	30	108.00	162.00
Misc Supplies for Village Tier I cross commodity	300.00	63	18,900.00	28,350.00
Total Cost				**71,925.63**

Grand Total: $14,981,932 USD

The total estimated investment for the first 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. The total estimated cost of this facility is $5,573,440.82.

The total estimated investment for the second Tier III Food Innovation Center (FIC) in Chuuk, focused on manufacturing animal feed from locally sourced byproducts, is $2,468,104. This cost reflects a fully developed, procurement-ready budget that incorporates design, construction, equipment procurement, staffing, start-up operations, utilities, and contingency provisions. The construction component is based on a $500 per square foot estimate for a 3,000 square foot feed-grade facility, aligned with Codex, HACCP, and USDA/APHIS animal feed safety standards. All estimates take into account the logistical, environmental, and infrastructural realities of the Federated States of Micronesia and are designed to ensure reliable, sustainable, and compliant production of locally formulated animal feed. This facility complements the broader food systems strategy by valorizing bycatch and agro-waste, reducing feed imports, and enhancing food and livestock security across the islands.

With five regional Tier II Food Innovation Facilities (FIFs) proposed for Chuuk—each designed at 2,500 square feet and estimated at a construction cost of $450 per square foot—the base construction cost per facility is $1,125,000. Together, these five regional FIFs represent a total construction cost of $5,625,000. However, the full investment extends beyond construction alone. Including equipment procurement, installation, facility administration, training infrastructure, utility systems, and a contingency allocation for freight, delays, and cost escalation, the **total estimated investment for all Tier II facilities is $6,402,462**. These mid-scale processing hubs will support product lines such as coconut milk, oil, sugar, and dried produce, as well as taro, banana, breadfruit, and other indigenous crops—creating new pathways for value addition, enterprise incubation, and farmer-market linkages across Chuuk.

The total estimated investment for the 63 Tier I Food Innovation Facilities (FIFs) across Chuuk State is $237,925.63. This figure reflects a decentralized strategy to establish low-cost, community-embedded processing units in all sixteen municipalities of Weno and all other inhabited Islands in the Chuuk Lagoon. Thirty Tier I facilities will be placed across the outer islands beyond the Chuuk Lagoon. The 33 micro-scale facilities within Chuuk Lagoon, budgeted at $4,179.56 each, and the 30 Outer Island Facilities budgeted at a total of $100,000 are designed to support pre-processing, aggregation, and basic value addition of local agricultural and marine products. They also serve as vital entry points for farmer training, food safety awareness, and rural economic empowerment, ensuring inclusive food system engagement from the village level up.

All equipment and supplies included above. Grand total for two Tier III FICs, five regional Tier II FIFs, and 63 Tier I FIFs is **$14,981,932**.

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 $14.98 million investment is not just a single facility—but a network of strategically designed food processing and innovation centers across Chuuk. These include Tier I, Tier II, and Tier III facilities that serve as aggregation hubs, processing centers, training sites, and manufacturing platforms to strengthen Chuuk State's food system. The initiative is central to advancing FSM's goals for food security, rural development, economic diversification, and import substitution through value addition and local enterprise development.

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.

Castro, F. L. S., Chai, L., Arango, J., Owens, C. M., Smith, P. A., Reichelt, S., ... & Menconi, A. (2023). Poultry industry paradigms: Connecting the dots. *Journal of Applied Poultry Research*, *32*(1), 100310.

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

Da Silva, E. P., & De Martinis, E. C. P. (2013). Current knowledge and perspectives on biofilm formation: The case of Listeria monocytogenes. *Applied Microbiology and Biotechnology*, *97*, 957-968.

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

Enthoven, L., & Van den Broeck, G. (2021). Local food systems: Reviewing two decades of research. *Agricultural Systems*, *193*, 103226.

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*.

GovTribe. (2025). Fresh fruits & vegetables (FFV) support for DOD & non-DOD customers, Kwajalein Atoll [Contract opportunity SPE30225SS0006]. https://govtribe.com/opportunity/federal-contract-opportunity/fresh-fruits-vegetables-ffv-support-for-dod-non-dod-customers-kwajalein-atoll-spe30225ss0006

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)

Janahar, J.J., Balasubramaniam, V. M., Jimenez-Flores, R., Campanella, O. H., García-Cano, I., & Chen, D. (2022). Pressure, shear, thermal, and interaction effects on quality attributes of pea–dairy protein colloidal dispersions. *Food Hydrocolloids*, *131*, 107811–107811. https://doi.org/10.1016/j.foodhyd.2022.107811

Jones, A. M. P., Ragone, D., Tavana, N. G., Bernotas, D. W., & Murch, S. J. (2011). Beyond the Bounty: Breadfruit (Artocarpus altilis) for food security and novel foods in the 21st Century. *Ethnobotany Research and Applications*, *9*, 129–149. Retrieved from https://ethnobotanyjournal.org/index.php/era/article/view/478

Jowers, K. (2016, June 28). Shortages at 'privatized commissary' may point to future headaches. *Military Times*. https://www.militarytimes.com/2016/06/28/shortages-at-privatized-commissary-may-point-to-future-headaches/

Liu Y, Ragone D, Murch SJ. Breadfruit (Artocarpus altilis): a source of high-quality protein for food security and novel food products. Amino Acids. 2015 Apr;47(4):847-56. doi: 10.1007/s00726-015-1914-4. Epub 2015 Jan 15. PMID: 25588988.

Logistics Cluster. (n.d.). Logistics infrastructure. *Digital Logistics Capacity Assessments*. https://www.lca.logcluster.org/2-logistics-infrastructure

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.

May, & Henry, C. J. (2020). Reducing the glycemic impact of carbohydrates on foods and meals: Strategies for the food industry and consumers with special focus on Asia. *Comprehensive Reviews in Food Science and Food Safety*, *19*(2), 670–702. https://doi.org/10.1111/1541-4337.12525

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

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

O.O. Olaitan, O.A. Obadina, A.M. Omemu, O.O. Atanda, & I.O. Olotu. (2014). Nutritional quality and physico-chemical changes during breadfruit (*Artocarpus altilis*) natural fermentation. *Quality Assurance and Safety of Crops & Foods*, *7*(4), 441–447. https://doi.org/10.3920/qas2013.0353

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.

Picuno, P. (2016). Use of traditional material in farm buildings for a sustainable rural environment. *International Journal of Sustainable Built Environment*, *5*(2), 451-460.

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

Ragone, D. 2002. Breadfruit storage and preparation in the Pacific Islands. In S. Yoshida and P.J.Matthews (eds), Vegeculture in Eastern Asia and Oceania. JCAS Symposium Series 19, pp. 217-232. The Japan Center forArea Studies, National Museum of Ethnology, Osaka.

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).

Tamang, J. P., Shin, D.-H., Jung, S.-J., & Chae, S.-W. (2016). Functional Properties of Microorganisms in Fermented Foods. *Frontiers in Microbiology*, *7*. https://doi.org/10.3389/fmicb.2016.00578

Troubat, N. and Sharp, M.K. 2021. *Food consumption in the Marshall Islands – Based on analysis of the 2019/20 Household Income and Expenditure Survey.* Majuro, FAO and SPC.

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

Wolff, L. A., Vuorenpää, S., & Sjöblom, P. (2018). Chicken raising in a diverse Finnish classroom: Multidimensional sustainability learning. *Sustainability*, *10*(11), 388.

Yap, F. M. (2018). *iNaturalist*. https://www.inaturalist.org/places/yap#taxon=1

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.