<table>
<tr><td colspan="2">Alternative Technology for small islands and urban communities</td></tr>
<tr><td>1.0 Sector</td><td>Agriculture</td></tr>
<tr><td>2.0 Technology Characteristics</td><td></td></tr>
<tr><td>2.1 Technology Name</td><td>Hydroponic, Aquaponic & Aeroponic systems</td></tr>
<tr><td>2.2 Introduction</td><td>

Background

- Food security has been a concern for small islands as effects of climatic conditions as droughts, cyclones, sea level rise intensifies
- Other posing threats comes from pests and diseases including invasive species as such African snails and Rhinoceros beetles that undermines food security
- Its repercussions agriculture industry is felt immensely which results to in high cost of vegetables at the market and low productions outputs
- Proposed technologies allowed for vertical farming and the cultivation of crops in controlled environments, making better use of limited space.
- It will help reduce the cost of vegetables at the market and increase food security

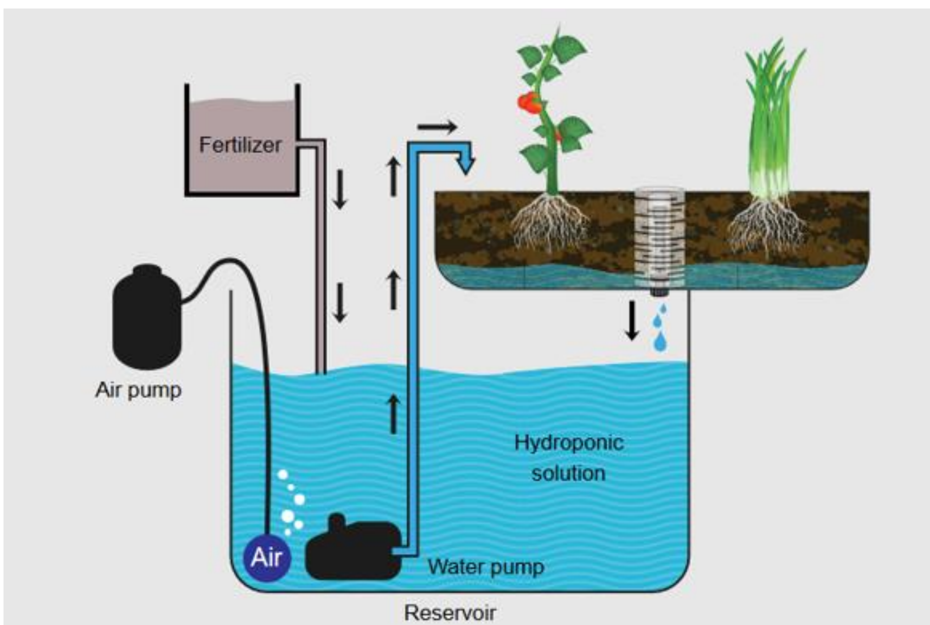

Figure 1: Simple hydroponic system
(FAO Fisheries and Aquaculture Technical Paper 589)

Rationale for these Technology

Hydroponic, Aquaponic, and Aeroponic systems are innovative agricultural techniques that do not rely on traditional soil-based cultivation. In these systems, plants are grown in nutrient-rich water solutions, with hydroponics focusing on water-only cultivation, aquaponics incorporating fish farming, and aeroponics using mist or air to provide nutrients.

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	Some of the most common crops grown in these systems are: lettuce, basil, coriander, spring onion, bok/pak choy, chiso, fruit vegetables such as tomato and cucumber, beets, okra, blueberries and more. Fruit vegetables typically have higher nutrient demand and therefore difficult to grow successfully in aquaponic system.
2.3 Technology Characteristics	**Benefits of Hydroponic Systems:** • Faster growth rates due to easier root access to nutrients and water. • Uses up to 90% less water compared to traditional soil-based farming. • Enables year-round cultivation in controlled environments. • Less susceptible to soil-borne pests and diseases. • Precise control over nutrient levels minimizes waste and deficiencies. **Benefits of Aquaponic Systems:** • Combines fish farming with plant cultivation in a closed-loop system. • Utilizes fish waste as a natural nutrient source for plants. • Creates a symbiotic environment promoting the health of both fish and plants. • Sustainable and intensive food production system • Efficient water usage as fish waste water nourishes plants, and plant filter the water for the fish. • Less reliance on chemical fertilizers and pesticides. • Can be used on non-arable land such as deserts, degraded soil or salty, low coral and sandy islands • Daily tasks, harvesting and planting are labor-saving and therefore can include all genders and ages • Economical production of either family food production or cash crops in many locations • Construction materials and information base are widely available **Benefits of Aeroponic Systems:** • Excellent oxygen availability to roots promotes rapid plant growth. • Utilizes a misting process to deliver water and nutrients directly to roots, minimizing waste. • Can be used for a wider variety of plants compared to hydroponics. • Enables vertical growth systems for maximizing production in limited areas. • Roots are less susceptible to diseases due to constant air exposure.

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Typical set-up for aquaponic

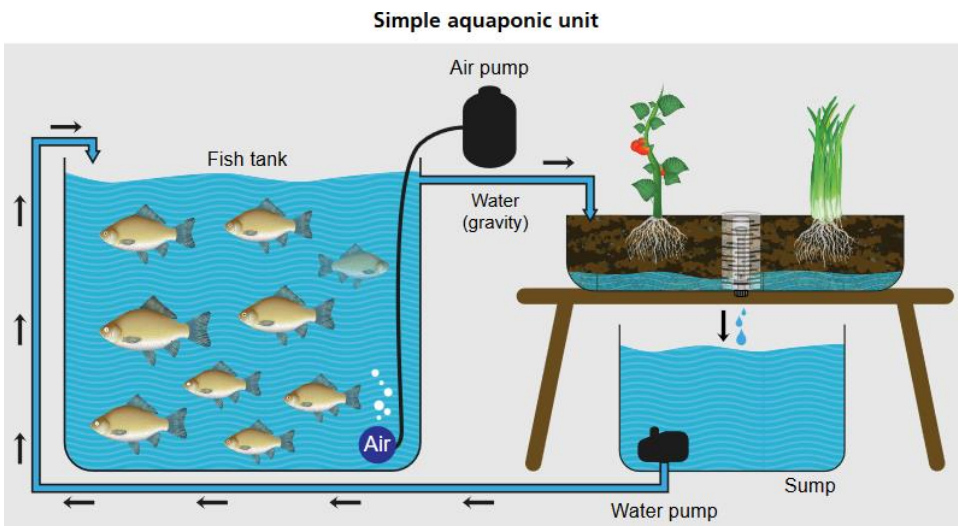

Figure 2: Aquaponic System
(FAO Fisheries and Aquaculture Technical Paper 589)

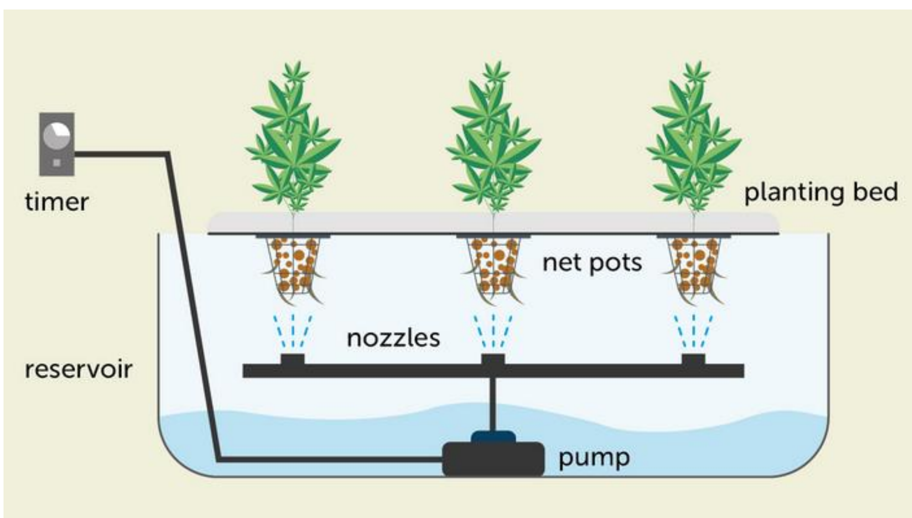

Figure 3: Aeroponic typical setup
https://greenverti.com/articles/3-types-of-growing-systems.html

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<td>2.4 Types of aquatic species for aquaponic</td>
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Types of aquatic species that has been used in aquaponic systems

a. Tilapia
- Blue tiplapia (*Oreochromis aureus*)
- Nile tilapia (*Oreochromis niloticus*)
- Mozambique tilapia (*Oreochromis massambicus*)
- Various hybrids of these three species

b. Carp
- Common carp (*Cyprinus carpio*)
- Silver carp (*Hypophthalmicbtbys molitrix*)

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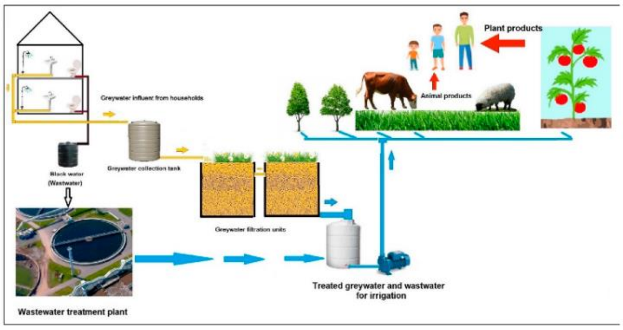
	• Grass carp (*Ctenopharyngodon Idella*) c. Catfish • Channel catfish (*Lctalurus punctatus*) • African catfish (*Clarias gariepinus*) d. Trout • Rainbow trout (*Oncorhychus mykiss)* e. Prawns • Giant river prawn (*Macrobrachium rosenbergii*)
2.5 Individual and farmers requirements	• Individuals and farmers who wants to acquire these technology systems should seeks experts from rural development ministry and other ministries like fisheries and environment for assistance • SINU can engage with interested candidates for research and identifying pests and diseases • Hard-wares to sell materials and pumps and other necessary items
3.0 Implementation Assumptions	
3.1 Endorsement by experts and how this technology can made available to other sectors	• Promote various designs that can be affordable for all parties • Utilize materials that are readily available in hardware shops and include hybrid system that uses local materials • Promote and demonstrate at SINU and other farms like Kastom garden and Don Bosco Agriculture Center • Recommended for small outer islands such as Ontong Java, Sikiana, Reef & Duff Islands, and Tikopia and Anuta islands due to their remoteness and limited land size. Also, these islands vulnerable to sea level rise and natural disasters such as cyclones and droughts
4.0 Costs	
4.1 Typical cost for a system	• A typical small hydroponic system should be around \$200-\$500 USD (growing medium \$20-\$100, nutrient solution \$20-\$50, water pump and aeration \$50-\$100, pH and EC meters \$20-\$100 each, plants and seeds varies, infrastructure varies) • Medium hydroponic system values around \$1000 USD (growing medium \$100-\$300, nutrient solution \$100-\$300, water pump and aeration \$100-\$300, pH and EC meters \$50-\$100 each, plants and seeds varies, infrastructure varies) • Cost of establishment can vary depending on the materials available and sourcing of local source materials
4.2 Additional Costs	• Cost of fertilizers might increase • Seeds and other supplementary materials
5.0 Other Benefits	• Water Conservation-Small Island countries frequently face water scarcity. Hydroponic, aquaponic, and aeroponic systems use recirculating water, with significantly reduced water consumption compared to conventional farming.

<table>
<tr><td></td><td>Nutrient control and minimized chemical usage - These systems offer precise control over the nutrient supply for plants, reducing the need for synthetic fertilizers or pesticides.
Climate resilience - small islands countries are susceptible to climate change impacts. These systems can mitigate climate risks by providing a protected environment, reducing vulnerability to extreme weather events and pests.
Sustainable food production - Small Island countries often rely on imported food, which increases their carbon footprint. Hydroponic, aquaponic, and aeroponic systems enable local food production and reduce dependence on imported goods, promoting food security and sustainability.
Diversification and value-added products - These systems allow for the cultivation of a wide range of crops, including high-value niche crops and medicinal plants. Farmers can also explore value-added processing opportunities, such as herb-infused oils or dried herbs, to diversify their products and increase income.</td></tr>
<tr><td>6.0 Key Considerations for implementation</td><td>a. Initial setup costs:
Setting up hydroponic, aquaponic, or aeroponic systems can be expensive. Small island countries may need financial support through government grants, loans, or partnerships to overcome the initial investment barrier.
b. Technical expertise and training:
Proper knowledge and skills are essential for successful implementation. Training programs, workshops, and partnerships with experts and research institutions can provide the necessary technical support.
c. Access to quality inputs:
Ensuring the availability of quality seeds, nutrient solutions, and suitable equipment is crucial for the efficient operation of these systems. Developing local supply chains and networks can help overcome logistical challenges.
d. Market demand and access:
Before starting hydroponic, aquaponic, or aeroponic farming, understanding the market demand for specific crops is important. Access to markets, such as hotels, restaurants, and farmers' markets, is also essential for selling produce.</td></tr>
<tr><td>7.0 Success Case in Fiji</td><td>Case Study:
a. The success stories of 150 community members from informal settlement of Koroipita in Fiji received of Smart Gro Box hydroponic kits
b. Helps communities on food security
c. Simple and easy system to manage</td></tr>
</table>

	 **Figure 4: Typical set-up of Smart Gro Box hydroponics kits** https://cdkn.org/story/small-scale-farmers-fiji-supplement-produce-using-home-hydroponic-kits

Water Treatment in Agriculture and Livestock	
1.0 Sector	Agriculture and Livestock
2.0 Technology Characteristics	
2.1 Technology Name:	Water Treatment Technology
2.2 Introduction:	**Background** Water is a critical resources for agriculture and livestock production in the Solomon Islands. The availability of clean and safe water is essential for the health and productivity of crops and livestock. One of the biggest problems facing many Pacific Island nations, including the Solomon Islands, is water scarcity. This is caused by things like fluctuating rainfall patterns, saline intrusion, and scarce freshwater supplies and climate change related. Access to potable water is essential for the Solomon Islands' two primary economic sectors, agriculture and livestock. This assessment aims to analyse the water treatment technologies available in the country and other alternative technologies that can be use with regards to its affordability in the Solomon Islands rural urban area.  *Figure 1 Water treatment Management System*[1]

[1] https://www.mdpi.com/2073-4441/13/23/3405

2.3 Technology Characteristics/ Applications/ Cost

<u>Present Water Treatment System in the Solomon Islands</u>

1. **Rainwater harvesting or Surface Catchment**

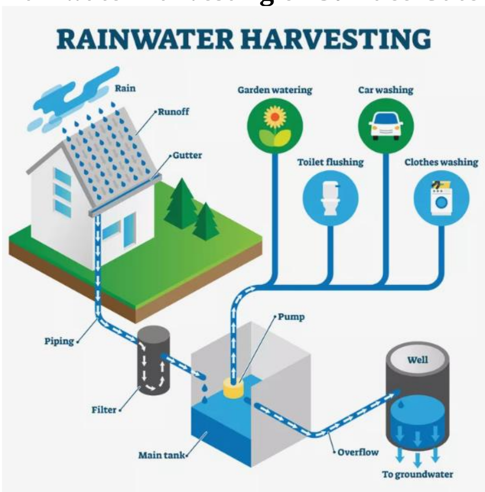


Figure 2: Rain water harvesting System[2]

This is the most basic rainwater harvesting use in most of the farmers to watering their garden and livestock in the Solomon Islands.

Site visited: Custom Garden

- Low cost system ($4,000 – 10,000 depending on the tank size)
- Afordable for farmers to use both in rural and urban areas.
- Challenging during drought
- Less maintanance involve
- Less expose to contaminants

2. **Chlorination**

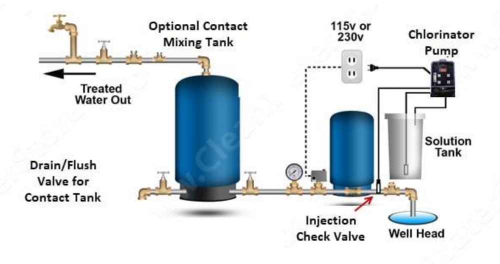


Figure 3: Water chlorination system[3]

[2] https://www.treehugger.com/beginners-guide-to-rainwater-harvesting-5089884

[3] https://www.cleanwaterstore.com/well-water-chlorination-systems.html

Chlorination system method basically for disinfection of water to kill bacteria, viruses, algae, Fungi and protozoa. Chlorine chemical and the type of chemical used for chlorination is calcium hypochlorite. Calcium hypochlorite comes in a form of granules and has 70 percent of concentration strength

Sites: Solomon Water (Honiara, Noro, Gizo, Auki, Tulagi)

- Very high cost system (commercial setup)
- Training and experts needed
- Farmers won't able to use for garden watering and livestock due to high cost of water bill.
- High cost of maintenance

3. Desalination (Solar Power)

Figure 4: Moerk Water solar powered water treatment system installed at a Maternity clinic in Western Province in 2017 for drinking water.[4]

Moerk's solar-powered systems use reverse osmosis to turn seawater or brackish water fresh. Membranes filter out salt, leaving clean water for agriculture, livestock and drinking, while minimizing environmental impact (chemical free).

Site: Munda, Western Province

- Expensive
- Cost: USD 12,000
- RO-System: 100 l/h drinking water
- Membranes last 7-10 years
- Useful for low lying islands in the Solomon Islands
- Training and experts needed
- Maintenance cost (USD $400 – 600)
- Intergraded Solar

[4] https://moerkwater.com.au/projects/honiara-desalination-training/

4. Surface water harvesting

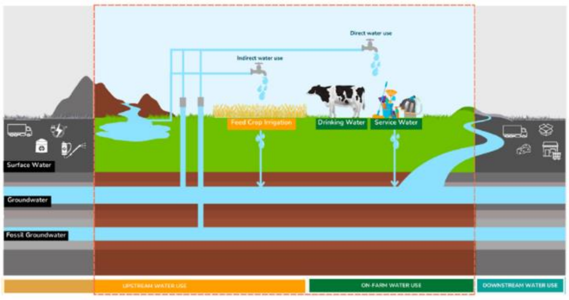


Figure 5: Surface water system concept[5]

The Solomon Islands, with its many islands and variable rainfall, relies heavily on surface water for agriculture and livestock. Most of the rural farmer for example uses gravity-fed channels to divert stream water to taro plots (Traditional taro irrigation)

Site: Many islands in the provinces use this system

- Low cost
- Challenges such as siltation
- Surface water can be contaminant with pollutants
- Community involvement to manage and main water system

Alternative Water Treatment System

Here are some of the water treatment system that are not commonly use in Solomon Islands but in low/ medium cost for agriculture and livestock application

5. Sand Filtration

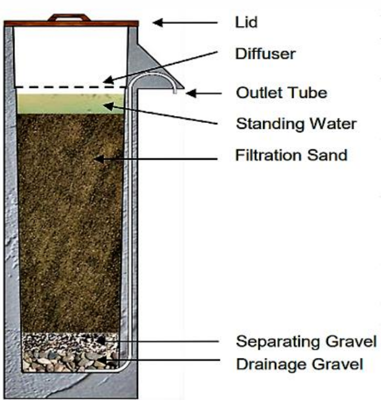


Figure 6. Biosand filtration[6]

Typically, sand and gravel layers are placed inside a concrete tank or blocks to create a sand filter. The

[5] https://moerkwater.com.au/projects/honiara-desalination-training/

[6] https://www.pseau.org/outils/ouvrages/cawst_household_water_treatment_safe_storage_factsheets_compilation_2011.pdf

contaminants are caught in the sand when the water passes through the filter. Surface water and groundwater can be treated for irrigation using sand filtering.

How biosand filter treatment work and its efficiency

- Low cost
- Contaminant sources: agriculture runoff, waste water, poor site of selection water source, wells and boreholes
- Remove bacteria up to 96.6%, viruses 70 to >99.9%, Turbidity 95%
- Processes: Mechanical rapping and sieving, Absorption and attachment, Predation, Natural death)
- Robustness: simple and easy to perform

6. Natural Coagulants use for water treatment

Figure 7: Moringa Seeds in a pod[7]

Natural coagulants such as Moringa seeds can quicken the sediments water treatment process. This natural and renewable vegetation has been widely use in Middle East and the Indian subcontinent and now to use in most of the countries in the world including Pacific.

How does it remove contamination

- Low cost
- Useful where there is no clean water
- Significant amounts of water-soluble proteins, which in solution have an overall positive charge, are present in coagulants. These proteins attach to the mostly negatively charged particles that generate turbidity, such as sand, silt, and clay. When negatively and

[7]https://www.pseau.org/outils/ouvrages/cawst_household_water_treatment_safe_storage_factsheets_compilation_2011.pdf

positively charged particles are chemically drawn to one another, coagulation occurs. Then, through flocculation, they might build up to become heavier and bigger particles, called flocs. Filtration can be used to remove or settle the flocs.

- Turbidity in water is caused by suspended particles that can attract bacteria and viruses. Thus, coagulation can lower turbidity levels while simultaneously enhancing the water's microbiological purity.

7. Solar submersible pump

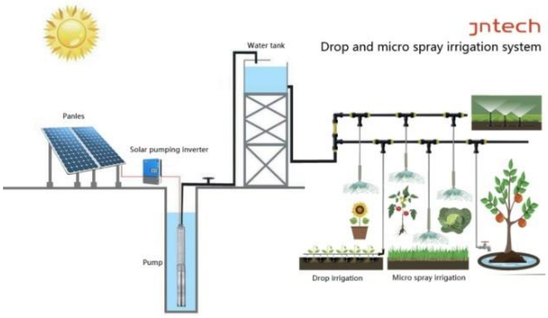


Figure 8: Solar Submersible System[8]

Systems of solar submersible pumps are revolutionary for livestock and agriculture in isolated locations or without connection to the electrical grid or high cost of water in urban areas.

- Cost: SBD 6,000 (Small), SBD 12,00 (Medium) and SBD 24,000

Site visited: YWAMS, Zai Na Tina, Super fly, Don Bosco

Figure 9: YWAMS, Solar submersible pump system, *Burnscreek, Honiara*

[8] https://www.jntechenergy.com/jntech-solar-powered-pump-system-solar-drop-and-micro-spray-irrigation-system-used-in-agricultural-and-forestry-irrigation_p703.html

	Figure 10: Super Fly - Solar submersible pump system supplier, Honiara  *Figure 11: Don Bosco Solar submersible pump system. GPPOL 2.*
2.4 Institutional and Organizational Requirement:	Regulatory Compliance o Ensure compliance with relevant local, state or provincial governing water quality standards and agriculture practices o Obtain necessary permit for operations such a water abstraction Technical Experts o Partner with professional experts in water treatment, agriculture water management o Implement suitable treatment technologies for agriculture and livestock through research (MAL & SINU and other stakeholders) Monitoring and record keeping o Regular monitor water quality (maintain detailed treatment process records Stakeholder engagement o Collaborate with farmers, authorities by promoting sustainable water use practices.
3.0 Implementation assumption	
3.1 Endorsement by Experts: How the technology will be implemented and diffused across sectors	o Technical experts (Super fly, Sun Power solar system supplier) will provide guidance on selecting and installation of appropriate water treatment systems based on the capacity needs and operation. o Local stakeholders, government agencies, communities and businesses to engage and supportive of the water treatment technology and implementation o Capacity building, knowledge sharing and technology transfer across sectors o Pilot project implemented across various sector o Community involvement o Partnership and collaboration
3.2 Adequacy for current climate: Explain the technology could have some improvements in country environment	o The sustainable water treatment reduce GHG emission by using renewable solar energy and local natural resources
3.3 Size of beneficiaries group:	o Farmers, o Farm produce and livestock consumers o Desalinization can benefit 500 – 600 people

Technology that provides small benefits to larger number of people will often be favored over those that provide larger benefits, but to fewer people.	
4.0 Costs	
4.1 Cost to implement mitigation options: Capital Cost	○ Depending on the types of water treatment system mentioned above.
4.2 Additional costs to implement mitigation option, compared to "business as usual"	Initial investment: ○ Investing by purchasing water treatment technology and implement sustainable agricultural practices, or upgrading livestock management facilities to meet mitigation goals. Training and capacity building ○ Involve training (workshops and education materials) staff on new practices, technologies and procedures to ensure effective implementation and compliance
4.3 Operational and Maintenance Cost	○ Most of the water treatment technologies above are at low cost except for desalination and chlorination water treatment system that will be very expensive
4.4 cost of GHG reduction	○ No GHG produce except for chlorination system (Solomon water)
4.5 lifetime	○ Solar system: 10 – 20 years ○ Biosand Filtration system: Sand and sediments can be replace after 1 month depend on volume of water filter every day ○ Rain water harvesting: 10-15 years
5.0 Benefits	
5.1 Development impact, indirect and benefits	○ Low-cost water purification systems help farmers by increasing crop productivity, livestock health, and revenue. Inadvertently, they improve community well-being, decrease waterborne illnesses, increase food security, and support sustainable agricultural methods, reduce produce of GHG all of which contribute to resilience and long-term economic growth.
5.2 Economic benefits:	○ Cost savings: Low-cost water treatment systems help farmers save money by reducing the need for expensive chemical treatments and medical expenses related to waterborne diseases. ○ Increased market opportunities: Improved crop yield and livestock health from clean water can open up new market opportunities for farmers, allowing them to sell their products at better prices. ○ Enhanced productivity: Clean water enhances agricultural and livestock productivity, leading to higher output levels and improved efficiency in farming practices, ultimately boosting economic returns. ○ Investment attraction: Communities with access to reliable water treatment systems may attract more

	investment in agriculture and related industries, creating job opportunities and stimulating economic growth in the region.
5.3 Social benefits:	○ Healthier livestock: Animal productivity and well-being are enhanced by clean water. ○ Disease prevention: Lowers farmworkers' and animals' exposure to waterborne infections. ○ A safer food supply: guarantees hygienic and safe methods of food preparation.
5.4 Environment benefits:	○ Less pollution: The environmental impact on water sources is reduced by solar-powered devices. ○ Sustainable practices: Eco-friendly livestock management and agriculture are encouraged by low-cost systems. ○ Conservation: Encourages farmers to practice environmental care and safeguards water resources.
6.0 Local context	
6.1 Opportunities and Barriers: Barriers to implementation and issues such as the need to adjust other policies.	Opportunities: ○ Enhance water quality for irrigation ○ Improve livestock health productivity ○ Increase crop yield and quality ○ Promote sustainable farming practices Barriers: ○ Cost of implementation ○ Limited access to technology ○ Lack of awareness ○ Maintenance challenges and cost
6.2 Status: Status of technology in the country	Technology Status ○ When comparing to other Pacific countries, SI lag behind in adopting advance water treatment technologies in Agriculture and livestock. Countries like Fiji, ZN, and Australia have made great investment advance irrigation system, desalination plant and waste water facilities.
6.3 Timeframe: Specify timeframe for implementation	○ Chlorination: 2-4 months depending on operation capacity ○ Natural resources materials (bio sand, Moringa seeds, desalination, submersible solar powered, rainwater harvesting, surface water: 2-5 days
6.4 Acceptability to local stakeholders: Where the technology will be attractive to stakeholders	Yes

Sustainable EWS to adapt to Climate Change Solomon Islands	
1.0 Sector	Climate Change & EWS
2.0 Technology Characteristics	
2.1 Technology Name:	Integrated EWS
2.2 Introduction:	**Background** ➢ The Solomon Islands, like any other Pacific Island country, faces significant challenges due to climate change. ➢ Comprised of over 900 islands, the nation is highly susceptible to the impacts of rising sea levels, increased frequency of extreme weather events, and changes in rainfall patterns. ➢ These climate-related risks pose serious threats to the livelihoods, infrastructure, and ecosystems of the Solomon Islands people. ➢ To mitigate the adverse effects of climate change, the Solomon Islands government through Ministry of Environment Climate Change Disaster & Meteorology (MECDM) has developed and implemented various Early Warning Systems (EWS). ➢ These systems are crucial for providing timely information that can help communities prepare for and respond to climate-related hazards. The current EWS in the Solomon Islands leverages a combination of satellite observation, weather stations, and manned observation to generate accurate weather forecasts. ➢ Additionally, communication of these forecasts and warnings to the public is facilitated through SMS, radio data services and social media platforms, ensuring that even remote communities receive critical information.

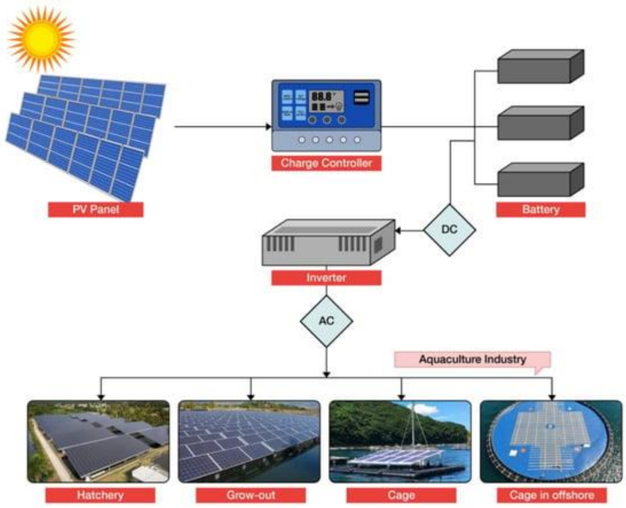
	<u>Climate Rationale for the technology</u> The integration of EWS technologies plays a vital role in enhancing the resilience of the Solomon Islands to climate change. Satellite observations provide comprehensive and real-time data on weather patterns, sea surface temperatures, and other climate indicators. Weather stations, strategically placed across the islands, offer localized and precise meteorological data, while manned observations add a human element, ensuring accuracy and contextual understanding. The dissemination of early warnings via SMS, radio data services and social media ensures that information reaches a broad audience quickly and efficiently. SMS alerts allow for direct communication to individuals' mobile phones, a particularly effective method given the widespread use of mobile devices. Social media added a more advance element to SMS directed at the growing number of online users. Radio data services complement this by broadcasting warnings to areas where mobile coverage might be limited, ensuring that even the most isolated communities are informed and can take necessary precautions.
2.3 Key Climate Change Impacts	• Rising Sea Levels • Increased Tropical Cyclones • Altered Rainfall Patterns • High temperatures

2.4 Technology Characteristics/ Highlights:	• High cost (High of initial cost and high maintenance)
	• Medium technology requirement for operation and management
	• Low & medium Technology
	
	<u>Technology brief descriptions</u>
	Current Early Warning System
	• **Observation and Forecasting**
	    o Satellite Observation
	    o Weather Stations
	    o Manned Observation
	• **Dissemination of Warnings**
	    o SMS (Short Message Service)

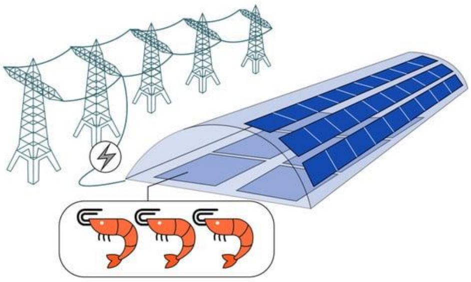
	○ Social Media ○ Radio Data Service
2.5 Institutional and Organizational Requirement:	• Enhance the infrastructure &Technological Capacity.
3.0 Implementation assumption	
3.1 Endorsement by Experts: How the technology will be implemented and diffused across sectors	• Renewable Energy-Powered Warning Systems that are financially suitable at the same time contribute to the country's climate change commitments. • Invest in more comprehensive EWS and integrating traditional warning systems. • Improve mobile network coverage and radio signal reach to ensure that all communities, especially in remote areas, receive timely warnings.
3.2 Adequacy for current climate: Explain the technology could have some improvements in country environment	• Proper forecasting and dissemination of warning enhances resilience. • Having informed public reduces the losses in all cross-cutting sectors.
3.3 Size of beneficiaries group: Technology that provides small benefits to larger number of people will often be favored over those that provide larger benefits, but to fewer people.	• Majority of the Solomon Islands population.
4.0 Costs	
4.1 Cost to implement mitigation options: Capital Cost	• The cost of equipment and maintenance is high although this needs proper assessment of capital cost.
4.2 Additional costs to implement mitigation option, compared to "business as usual"	• Cost of coordination of all related technologies available in Solomon Islands. (also needs further assessment)
4.3 Operational and Maintenance Cost	• Maintenance cost is high for weather station equipment.
4.4 cost of GHG reduction	• Using Renewable Energy-Powered Warning Systems reduces GHG emission.

5.0 Benefits	
5.1 Development impact, indirect /benefits	• Satellite Observation provides comprehensive coverage and early detection of climatic changes and potential hazards.
5.2 Economic benefits:	• Enhances the accuracy of predictions and allows for proactive measures that reduce losses.
5.3 Social benefits:	• Integrated EWS increases accessibility to early warning information and preparedness resources • SMS Increases accessibility to early warning information and preparedness resources. • Empowers communities to actively participate in disaster preparedness and response.
5.4 Environment benefits:	• Having renewable powered EWS ensures reliability and sustainability of early warning systems.
6.0 Local context	
6.1 Opportunities and Barriers: Barriers to implementation and issues such as the need to adjust other policies.	**Opportunities** ➢ Collaboration with other stakeholder to enhance the existing infrastructure. ➢ Invest in more advanced and automated weather stations and improve satellite data integration for better forecasting accuracy. ➢ engaging with university for research and development. ➢ Involve local communities in the design and implementation of EWS to ensure that they are culturally appropriate and meet the specific needs of different areas. ➢ Conduct regular public education campaigns to raise awareness about the importance of early warnings and how to respond effectively. ➢ Improve mobile network coverage and radio signal reach to ensure that all communities, especially in remote areas, receive timely warnings. ➢ Collaborate with neighboring countries and regional organizations to share resources, knowledge, and

	best practices for climate monitoring and disaster response. ➢ Multi-sectoral coordination needed to have coordinated EWS. **Barriers** ➢ Infrastructure Limitations, remote and rural areas lack adequate infrastructure for reliable communication and weather monitoring. ➢ Technological Gaps, limited access to advanced forecasting technologies and data analytics can hinder the accuracy and timeliness of weather predictions. ➢ Ensuring that the public understands and responds appropriately to early warnings is a continuous challenge.
6.2 Status: Status of technology in the country	**Technology Status** ➢ Weather forecasting and EWS currently operational. ➢ Tsunami ready is underway.
6.4 Acceptability to local stakeholders:	Yes

Technological Solutions for Fishery & Aquaculture: Shellfish, Sea grass	
1.0 Sector	Fisheries and Aquaculture Sector
2.0 Technology Characteristics	
2.1 Technology Name:	Renewable energy supply and technology to promote production efficiency for fisheries and aquaculture sector
2.2 Introduction:	**<u>Background</u>** ➢ Fisheries and aquaculture farming in the Solomon Islands presents a promising avenue for economic growth, food security, and environmental stewardship ➢ Key challenges include limited infrastructure, access to finance and market, social dynamics, and technical expertise. Environmental sustainability and climate resilience are also critical concerns ➢ The problem of unsupported power supply/outage and expense of electricity bills, farmers will want to venture into a much more renewable and sustainable mode of energy source.  **Figure 1 Sustainable solar power grid**[1] **<u>Concentrated Solar Power Technology</u>** • With the emerging development of hatcheries and other semi-enterprise aquaculture facilities, it is suitable to utilize solar energy to power the facility. • This promotes the use adaptation of solar grids to source energy to facilitate the physical operation of aquaculture ponds and farms. Moreover, it cut costs, considering Solomon Islands has one of the most expensive electricity costs in the world.
2.3 Technology Characteristics/ Highlights:	• Medium cost (High of initial cost but low in operational and maintenance)

[1] https://www.mdpi.com/1996-1073/14/21/6923

Few bullet points, i.e., low/high cost; advance technology; low technology.	**<u>Technology Options for different cultured fish species</u>**  ***Figure* 2. Solar power has been deployed with 8 PV panels and an energy storage system [2]**  ***Figure* 3. Solar-power-driven aeration and circular water current systems are used in shrimp farming [3]**
2.4 Institutional and Organizational Requirement:	• Ministry of Fisheries and Marine Resources (MFMR), SINU, WorldFish, MECDM, Provincial Government, Contractors and Engineers and other potential partners. • Engaging with the local university to do the research on these specific areas.
3.0 Implementation assumption	
3.1 Endorsement by Experts: How the technology will be implemented and diffused across sectors	• The coordination multi sectoral needed to give the clear responsibility designation for construction and maintenance
3.2 Adequacy for current climate: Explain the technology could have some improvements in country environment	• The option of choosing solar power promotes the use or renewable energy, will reduce GHG emission by reducing use of coal energy and reducing the fossil fuel burning.
3.3 Size of beneficiaries group: Technology that provides small benefits to larger number of people	➢ All fisheries based institutions and others with semi-structured ponds and tanks, hatchers and also network of communities with pond structures designed to use solar power grids.

[2] https://www.mdpi.com/1996-1073/14/21/6923
[3] https://www.mdpi.com/1996-1073/14/21/6923

will often be favored over those that provide larger benefits, but to fewer people.	
4.0 Costs ***(All cost are based on estimation independent from any solar powered aquaculture facility in S.I)***	
4.1 Cost to implement mitigation options: Capital Cost	➢ According to initial estimates it indicates that at least USD 1.2 million in farm construction and infrastructure, that is specifically for construction phase only.
4.2 Additional costs to implement mitigation option, compared to "business as usual"	➢ The additional costs which may be required to implement this technology includes cost for feasibility study and detail engineering and installation. ➢ For a large scale facility at 30KVa materials are estimated at SBD$400,00. ➢ And for smaller aquaculture facility would be around 10KVa costing around SBD$100,000 - $150,000. ➢ Installations can add up to SBD$100,000-$200,000
4.3 Operational and Maintenance Cost	➢ Installation and maintenance can range up to SBD$100,000-$200,000
4.5 lifetime	➢ 10 years
5.0 Benefits	
5.1 <u>Development impact, indirect /benefits</u>	• The sustainable road design will reduce GHG emission.
5.2 Economic benefits:	• Households gained incomes, which they are able to support their children tuition fee, basic needs like food and other assets are then able to be purchased as well. • Local buyers are also centred in provinces like Malaita which makes logistics and transport expenses favourable for the farmers as well (Konamalefo, 2024). • Contribute to providing fish protein continuity • Cost-cutting measure for aquaculture facility owners, as in the long run most of the aquaculture facility will be powered by solar energy
5.3 Social benefits:	• Surplus supply to meet the fish protein demand by the Solomon Islands population and also in the international market. • Builds connectivity and networking between different stakeholders who participates in the whole process
5.4 Environment benefits:	The sustainable use of energy will be environmentally friendly, as demand for fossil fuel burning is also reduced. Potential of fish restocking to the natural environment for certain fish species.
6.0 Local context	
6.1 Opportunities and Barriers: Barriers to implementation and issues such as the need to adjust other policies.	**<u>Opportunities</u>** ➢ the supports sustainable fisheries activity as part of environment preservation and providing restocking opportunity for fish population

	➢ availability of integrating local material and modern systems and technology in farm designing ➢ engaging with university for research and development and between stakeholders **Barriers** ➢ high cost of one off payment to fund technology ➢ lack of maintenance expertise ➢ social behaviour has potential to ruin project ➢ climatic and environmental factors rain ➢ limited accessibility – as some technological materials are not particularly sold at the local market
6.2 Status: Status of technology in the country	**Technology Status** Currently Solomon Islands have not applied a fully functional aquaculture system, powered by solar grid; Integrating some local materials with the modern technology, ✓ *Example is the use of plastic for aquaculture pond base (can be purchased in S.I)* ✓ *Local bush materials for parts of the structural design the farm*
6.3 Timeframe: Specify timeframe for implementation	36 months' implementation from initial scoping and consultations to the installation and physical operation of the selected facilities
6.4 Acceptability to local stakeholders: Where the technology will be attractive to stakeholders	Yes

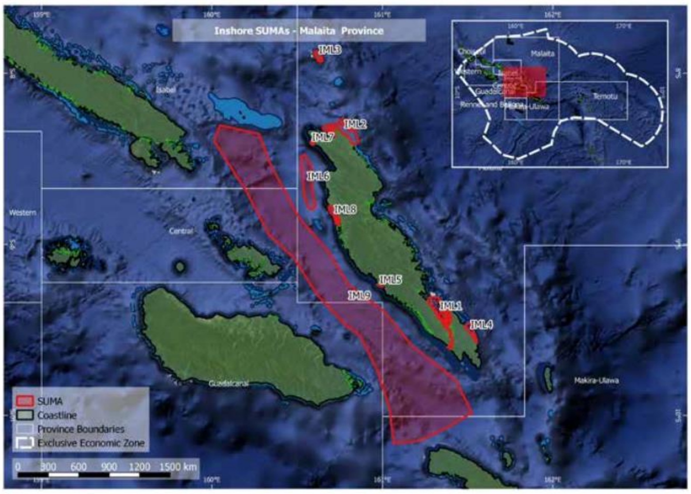
<table>
<tr><th colspan="2">Integrating spatial data and environment data to manage, restore and protect mangrove forests and coastal ecosystems using remote sensing and GIS</th></tr>
<tr><td>1.0 Sector</td><td>Environment and coastal</td></tr>
<tr><td colspan="2">2.0 Technology Characteristics</td></tr>
<tr><td>2.1 Technology Name:</td><td>Remote sensing and Geographic Information Systems (GIS)</td></tr>
<tr><td>2.2 Introduction:</td><td><u>Background</u>
➢ Estimated, around 50,000ha of mangrove areas, and around 33 mangrove species found in Solomon Islands[1]
➢ Villagers said that they knew that the mangroves were under threat, stating the firewood overharvesting as the main reason (Warren-Rhodes et, al,2011)
➢ There is very high dependency on mangrove forests and coastal resources for livelihoods, economically , socially and also subsistence needs daily due to unsustainable or overharvesting, resulting loss of mangrove cover and increase of carbon emissions
➢ Access and use of mangrove and coastal zones are critical for economic developments, such as infrastructures, roads, wharfs, logging and mining and expansion of urban centers and new settlements. Thus demands proper planning for decision making to ensure good governance and environmental monitoring
➢ Spatial mapping of mangrove forest and coastal areas or zones needs to be properly implemented in Solomon Islands as it provides critical informations such as biodiversity hotspots, monitor habitat changes and biodiversity, track land use changes, assessment of climate change impact, and human impacts on habitats.(see figure1 as concept model)


Figure 1 spatial mapping of Special Unique Marine Areas (SUMA) in Malaita Province in Solomon Islands concept[2]</td></tr>
</table>

[1] Pallai, G., and M. Q. Sirikolo. 2001. Mangroves of the Solomon Islands. USP Marine Studies Technical Report. Marine Studies Programme, The University of the South Pacific.

[2] https://macbio-pacific.info/wp-content/uploads/2018/09/SUMA-Solomon-Islands-Digital-Low-Resolution.pdf

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<u>Climate Rationale for the technology</u>

The integration of spatial data, GIS facilitates precise mapping and analysis of ecosystems and empowers individuals to map biodiversity hotspots, monitor habitat changes and biodiversity, track land use changes, assessment of climate change impact, and human impacts on habitats (see figure 2, for spatial mapping of specific sites).
This technology empowers decision-makers with actionable insights, facilitating the development of targeted conservation strategies and sustainable resource management practices.
It also enhances collaboration among stakeholders by providing a common platform for data sharing and visualization.

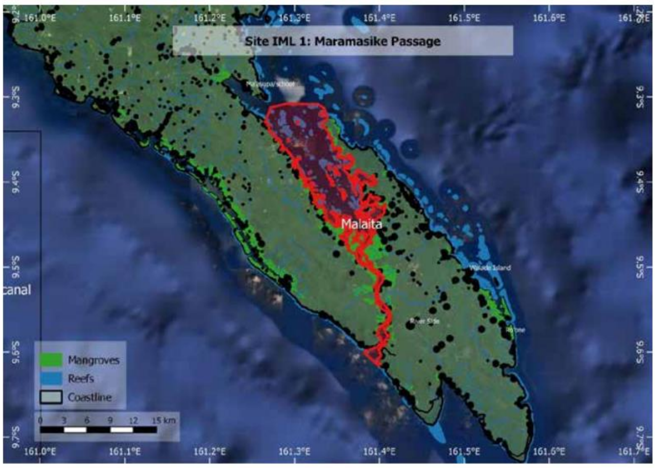

Figure 2. Spatial Mapping of mangrove forests and coastal zones important to communities (site-specific)[3]
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2.3 Technology Characteristics/ Highlights:

Few bullet points, i.e., low/high cost; advance technology; low technology.
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Medium cost (High of initial cost for initial spatial mapping activities, but low in operational since the environmental monitoring and governance will be done by sectors in terms of planning and developments
Medium technology requirement for GIS skills and trainings
Spatial Technology

<u>Technology brief descriptions</u>

Geographic Information Systems (GIS) play a pivotal role in modern environmental management and conservation efforts, offering a powerful framework for data management, analysis, and decision-making. By integrating spatial information with environmental data, GIS provides a comprehensive understanding of ecosystems, facilitating more effective conservation strategies and empowering environmentalists to make informed decisions.

The use of AI modelling will also support the validations and provide climate scenarios and projections.
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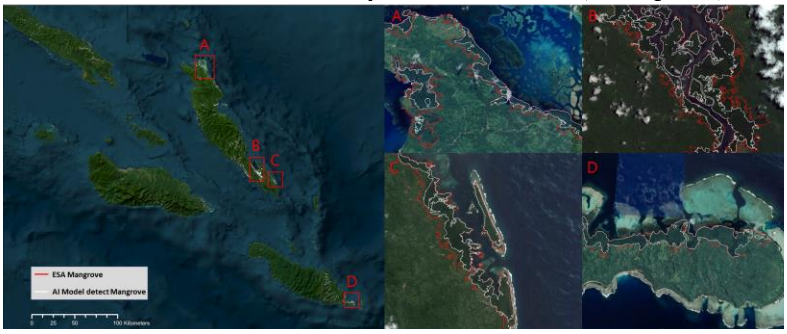
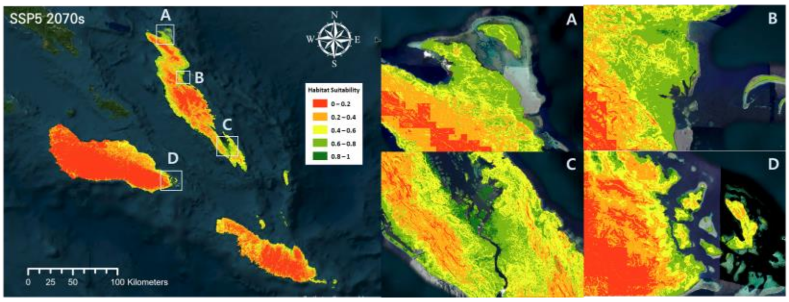
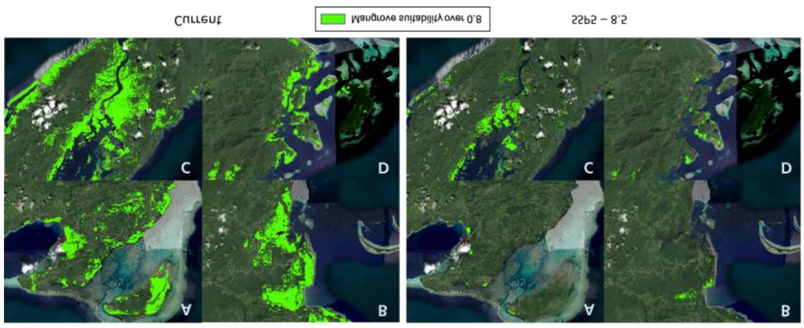
[3] https://macbio-pacific.info/wp-content/uploads/2018/09/SUMA-Solomon-Islands-Digital-Low-Resolution.pdf

	An example of AI modelling approach is the illustration models of Satellites maps of the mangroves of Solomon Islands & Climate scenarios modelled conducted by CTCN & KEI [4] (see figure3)  Figure 3: Satellite-based identifying mangroves of Solomon Islands (Focused on Malaita, Guadalcanal, Makira-Ulawa)  Figure 4: Habitat suitability of mangroves according to climate change scenario (SSP5-8.5, 2070s) Focused on Malaita, Guadalcanal, Makira-Ulawa  Figure 5: Current and future comparison of mangrove habitat suitability (Focused on Malaita, Guadalcanal, Makira-Ulawa) Figure 3, 4 and 5 demonstrates different scenarios and modelling that can be utilised.

[4] Figure3, 4 and 5 (all referred to Draft Policy Framework supported by CTCN & KEI. 2024. Policy Framework for ICZM Mangrove Plan in Solomon Islands.

2.4 Institutional and Organizational Requirement:	• Ministry of Environment Climate Change Disaster management and Meteorology (MECDM), Ministry of Fisheries and Marine Resources (MFMR), Ministry of Forestry and Research (MoFR) Ministry of Provincial Governments and Institutional Strengthening (including provincial government). • Engaging with the local university (example, Solomon Islands National University (SINU, etc), to conduct research and support documenting status of mangrove forests, vulnerabilities, and environmental monitoring
3.0 Implementation assumption	
3.1 Endorsement by Experts: How the technology will be implemented and diffused across sectors	• The GIS mapping and environmental data will not only be focusing on spatial mapping, but also facilitates formal protection of mangrove forests or coastal ecosystem or inshore CBRM areas(referred to locally Marine Managed Area, or Marine Protected Areas) • The coordination and management of sectoral should provide clear responsibilities and designation for management, rehabilitation or protection • The responsible ministry for GIS mapping and environmental monitoring should be MECDM, while MoFR and MFMR should be leading sectors in species identification and developing management planning, onsite assessments. MPGIS administers the provincial governments, as mangrove sites are located in particular provinces and customary areas.
3.2 Adequacy for current climate: Explain the technology could have some improvements in country environment	• The GIS mapping and integration of environmental data will be useful for current climate change adaption and mitigation measures for the country under the SI National Climate Change Policy 2023-32, SI-LED strategies, and including sectoral strategies that promotes formal protection and recognizes informal management initiatives and conservation identified as biodiversity significant Mangrove forest and coastal areas. It will also increase networks of ICZM community-based communities that contributes and align to national priorities under Protected Areas programmes or CBRM programmes. • It will also provide necessary ESIA safeguards under EIA processes for any development that may access or will potentially impact mangrove area or coastal zones
3.3 Size of beneficiaries group: Technology that provides small benefits to larger number of people will often be favored over those that provide larger benefits, but to fewer people.	➢ All the communities and stakeholders, both users and land owners of mangrove forests and coastal shorelines will receive environmental, economic, and social benefits of mangrove and coastal management, including other associated benefits through various collaborations(national, provincial and community level) ➢ Overall, it provides crucial insights and guidelines for sustainable coastal management, highlighting the necessity of proactive measures to address environmental impacts.
4.0 Costs	

4.1 Cost to implement mitigation options: Capital Cost	➢ Initial cost to introduction of the technology ($500,000.00USD) ➢ Additional cost towards its implementation (validations, and endorsements) by responsible sectors and authorities ($300,000.00USD) ➢ Total cost is $800,000.00USD
4.2 Additional costs to implement mitigation option, compared to "business as usual"	➢ The additional costs which may be required to implement this technology includes cost for feasibility and biological assessments or study undertaken prior to actual commencement of mapping; detail nation-wide consultation processes; establishing mangrove conservation areas and rehabilitation activities
4.3 cost of GHG reduction	➢ The Mangrove conservation, restoration and protection will reduce of GHG emission by absorbing carbon dioxide gas, reduce the local temperature, and also promotes conservation and protection of mangrove forest, and associated coastal shoreline forest areas that can contribute to biodiversity protection , habitat protection for flora and fauna, promotes blue carbon sequestration and conservation initiatives
4.4 lifetime	➢ Long-term, intended for ICZM mangrove and coastal management planning and environmental monitoring
5.0 Benefits	
5.1 Development impact, indirect /benefits	• The integration of spatial data and environmental data using GIS is offering a powerful framework for data management, analysis, and decision-making. It will reduce of GHG emission by absorbing carbon dioxide gas when rehabilitation reduce coastal erosion and inundations of shorelines. It will encourage local communities and responsible authorities to initiate conservation of mangrove forests and protection of key biological diversity hotspots such as coastal habitats, mudflats, reef systems, important for key stone species or local fauna. Generally, the spatial mapping will have minimal or no impacts on environment or biodiversity.
5.2 Economic benefits:	• Ensure sustainable economic development through the integration of GIS data and environmental informations (data) by limiting potential impacts and reduce mangrove depletion • Reduce costs associated with environmental or biodiversity loss, natural disasters risks, • Strengthen sectoral economic frameworks developments collaborations through infrastructures, tourism, agriculture, forestry and fisheries developments • Increasing research capacity needs through local institutions and international partners that identifies potential sustainable economic needs relating to mangrove and coastal resources, such as Blue Carbon Initiatives, Mangrove Protection Initiatives, Community based marine resource management (CBRMs), climate change resilience infrastructures developments (sea wall, wharfs, etc.)
5.3 Social benefits:	• Promotes and safeguarding traditional knowledge, values and use of mangrove flora, and associated belief systems,

	example traditional medicines, and subsistence livelihood needs • Cultural services and Aesthetic services important for ec-tourism activities relating towards mangrove and coastal environment • Increase collaborations or networks of key stakeholders for promoting mangrove management and protection for rehabilitation activities as in line with government policies and plans • Provide detail maps of biodiversity hotspots; mangrove forests, and inshore coastline maps
5.4 Environment benefits:	• Monitor habitat changes and biodiversity, track land use changes, assessment of climate change impact, and human impacts on habitats • Protection of key Nursery grounds, mud flats, reef systems, for marine life
6.0 Local context	
6.1 Opportunities and Barriers: Barriers to implementation and issues such as the need to adjust other policies.	**Opportunities** ➢ Mangrove management, restoration and protection will ensure a sustainable mangrove and coastal marine areas that retains climate resilience and adaptation. ➢ It will encourage local communities and responsible authorities to initiate conservation of mangrove forests and protection of key biological diversity hotspots such as coastal habitats, mudflats, reef systems, important for key stone species or local flora and fauna **Barriers** ➢ Medium-high cost (Mangrove and coastal Mapping for Solomon Islands) ➢ customary land tenure systems ➢ social behavior where people accepting the concept ➢ increasing developments (logging , mining, tourism ➢ engaging Experts –to validate
6.2 Status: Status of technology in the country	**Technology Status** Solomon Islands has been undertaking Conservation Programmes through CBOs or CBRM activities both for marine and forest areas, and is ongoing. There is Integrated Ocean Governance lead by Ocean 12, which has been undertaking Marine Spatial Planning nation-wide since 2018[5]. In spite of these efforts, there is still a gap to properly document mangrove forests or coastal areas in particular provinces and this technology will need a specific Mapping of Mangrove forests and key coastal areas in Solomon Islands towards climate adaptation and mitigations
6.3 Timeframe:	36 months

[5] https://macbio-pacific.info/solomon-islands/

Specify timeframe for implementation	
6.4 Acceptability to local stakeholders: Where the technology will be attractive to stakeholders	Yes

PV Solar Farming Technology to Harness Renewable Energy and Enhance Energy Security	
1.0 Sector	Energy Sector
2.0 Technology Characteristics	
2.1 Technology Name:	PV Solar Farming Technology
2.2 Introduction:	**<u>Background</u>** ➢ In the Solomon Islands the energy landscape is characterised by a reliance on traditional biomass and imported fossil fuels with limited but growing renewable energy sources. ➢ 80% of the Solomon Islands residing in coastal areas in the rural areas sustains a subsistence economy where agriculture plays a crucial role providing supplementary income to many households. ➢ The challenge is that most rural communities have limited access to or cannot afford basic energy services such as electricity, lighting, heating and transportation. Also, with increasing population demand for food and limited space is becoming a challenge. ➢ In addition, it is a challenge to ensure reliable and sustainable energy across remote islands. ➢ PV solar panel best energy option for rural areas that have unstable electric power supply. ➢ The growing need for public awareness about environmental problems caused by global warming and climate change highlights the importance of deploying photovoltaic solar farming systems. These systems harness renewable energy and enhance energy security ➢ The PV solar farming systems needs to be implemented in Solomon Islands especially rural communities not just to improve energy access and food but reduce dependence on imported fuels as well as reducing impacts on mangrove ecosystems.

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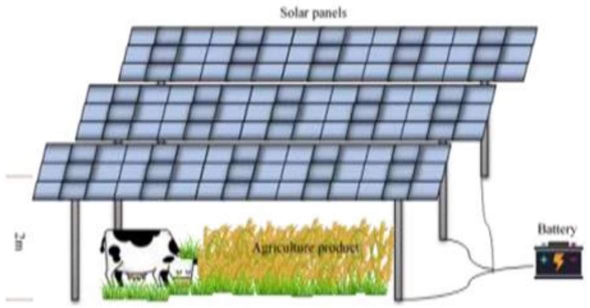

Figure 1. Solar Panel Technology system operation for both agriculture and livestock[1]

<u>**Climate Rationale for the Solar PV Farming Technology**</u>

The PV solar farming technology also called the photovoltaic agriculture or Agrophotovoltaic incorporates the renewable energy and agricultural farming which is a natural response to supplying the green and sustainable electricity for agriculture.

PV solar farms generate electricity without emitting greenhouse gases significantly reducing the carbon footprint.

Solar farms have minimal environmental impact during operation, preserving air quality and reducing water usage. They can be installed on degraded lands, reducing pressure on arable land and natural ecosystems.

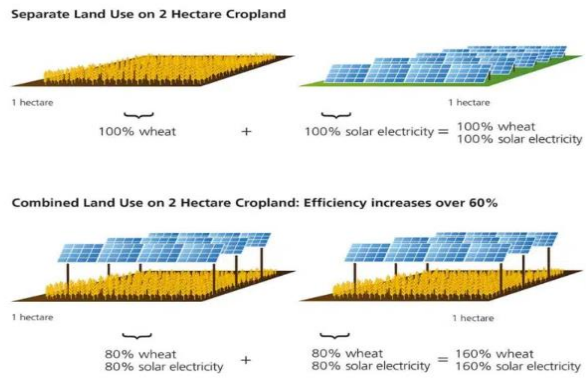

***Figure* 2. Agrivoltaics techniques[2]**
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2.3 Technology Characteristics/ Highlights:

Few bullet points, i.e., low/high cost; advance technology; low technology.
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- Medium cost (High of initial cost but low in operational and maintenance)
- Medium technology requirement for constructing, operation and management
- Hard Technology

<u>**Technology brief descriptions**</u>
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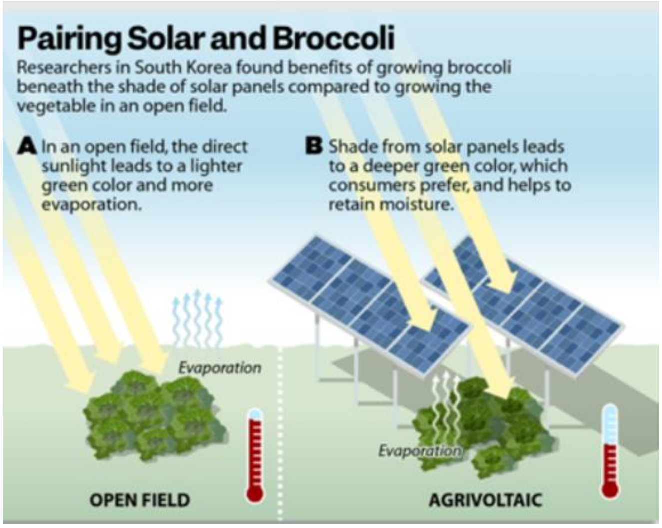
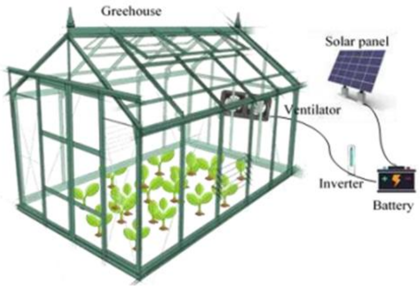
[1] Available online http://www.ijat-aatsea.com
[2]Available online The Pros and Cons of Agrivoltaics | Earth.Org

	• This system involved raising the solar panels to 2 m above ground in order to increase moderate shading of the crops. • The panels and plants coexists together so that there is an increase of yield of crops but maximise land use • Solar panels help conserve freshwater supplies by reducing evaporation from both plants and soil. • The evaporation that does still occur underneath the panels has the added benefit of cooling the PVs and thus boosting their electricity production since their optimum operation temperature is between 20C and 25C.  ***Figure* 2.** Solar Panels enhancing growing conditions of vegetables like broccoli in Agrivoltaics farming[3]  ***Figure* 3.**Greenhouse farming system [4] This is where indoor temperature and humidity conditions are controlled and determined for higher yield using Solar PV energy. This is important in the rural areas during the rainy season.

[3]https://doi.org/10.3390/agronomy12061415
[4] http://www.ijat-aatsea.com

	 ***Figure 4.** Solar panel technology system operation for irrigation purposes*[5]
2.4 Institutional and Organizational Requirement:	• Solomon Islands Electricity Authority (SIEA) or provincial government. • Engaging with the local university the Solomon Islands National University (SINU) to conduct a pilot solar farms to demonstrate feasibility and build local expertise. • Currently installed water tanks. • Explore Solar Panels
3.0 Implementation assumption	
3.1 Endorsement by Experts: How the technology will be implemented and diffused across sectors	• The PV solar Technology will not only harness renewable and energy security but also facilitates crop drying, greenhouse heating, water pump systems for crop production, livestock and small scale irrigation. • Collaboration research and Training
3.2 Adequacy for current climate: Explain the technology could have some improvements in country environment	• The PV Solar Farming Technology has minimal impacts on the environment. • The use of solar energy does not emit greenhouse gases which causes global warming and climate change. • It can be used for many purposes such as supplying increase energy demand of the villages, pump water to irrigate lands but also electrify adjacent villages households, increase in the quality as well as quantity of food production in several types of agricultural farms. • The technology also saves energy and maximizes land usage • The application of solar panel application in agriculture, addresses problems associated with increasing population and less land while promoting

	the development of controlled environmental agriculture in order to increase economic benefits to farmers but also to improve environment by the reduction of Co2 emission into the atmosphere.
3.3 Size of beneficiaries group: Technology that provides small benefits to larger number of people will often be favored over those that provide larger benefits, but to fewer people.	➢ Rural communities ➢ Farmers and ➢ Public households especially those who uses solar panel technologies
4.0 Costs	
4.1 Cost to implement mitigation options: Capital Cost	➢ Cost to install large submersible pumps for water extraction in any setting or community in the Solomon Islands varies by capacity ➢ **Large submersible pumps** approximately $36,000 sbd providing 70 litres per minute and can be installed at depths up to 80 meters. ➢ **Medium submersibles pumps** approximately $23,000 providing 20 litres per minute and ➢ Small submersible pumps costs around $10,000 sbd The pumps are considered fee to operate once installed, providing long-term savings.
4.2 Additional costs to implement mitigation option, compared to "business as usual"	➢ The costs of installing the solar panel for the next 20 years costs around 1.3 million.
4.3 Operational and Maintenance Cost	➢ Maintenance for existing pumps for any typical farm is around $2000 sbd.
4.4 cost of GHG reduction	➢ The use of solar energy does not emit greenhouse gases and can be used for many purposes such as supplying increase energy demand of the villages, pump water to irrigate lands but also electrify adjacent villages households, increase in the quality as well as quantity of food production in several types of agricultural farms.
4.5 lifetime	➢ 10-20 years
5.0 Benefits	
5.1 <u>Development impact, indirect /benefits</u>	• The PV solar farming technology reduces will reduce GHG emissions, provides electricity, provide access to water using submersible pumps, irrigate lands and increase quality and quantity of food production for rural communities.
5.2 Economic benefits:	• The PV technology will help remote farming communities decrease the high costs of generating electricity using diesel. •

	• Low cost in maintenance as spare parts of solar panel are cheaper than using generator operated by diesel engine. • • Help supply the energy demands of the villages. • Capacity to pump water daily to irrigate land plots and to electrify adjacent villages and households. • Increase economic benefit for farmers
5.3 Social benefits:	• Having a full set solar PV help improve the farming yield in terms of crops production. • Improves living conditions of farm workers and those without having access to water. • • The availability of Solar PV farming technology will help to maximize crop productivity. • Help farmers in increasing their food production but also supply power for their crops during rainy season
5.4 Environment benefits:	• The technology reduces of GHG emission • No noise and pollution for the environment • Clean abundant and available everywhere • Can be applied in many fields including agriculture and • Solve problem with increasing population and less land.
6.0 Local context	
6.1 Opportunities and Barriers: Barriers to implementation and issues such as the need to adjust other policies.	**<u>Opportunities</u>** ➢ more researches and practical investigation must be conducted using innovative design with less cost in installation, while yielding higher output, to optimize the combination of solar panel energy generation and agriculture cultivation in developing countries. ➢ Research by university on the feasibility of locations to conduct solar farms. ➢ Conduct training for farmers on how to use and maintain the PV system along with availability of good support service. ➢ Establish pilot projects sites on solar PV farming technology at the University to learn and build expertise. ➢ Solar powered Desalination for atoll islands in Solomon Islands where water access is a challenge. **<u>Barriers</u>** ➢ Maintenance and cost of initial setting. ➢ Lack of awareness which can slow adoption rates

	➢ Resistance to change. Individuals accustomed to traditional energy sources. ➢ Poor internet connectivity for monitoring and maintenance. ➢
6.2 Status: Status of technology in the country	**<u>Technology Status</u>** Currently Solomon Islands not apply the Solar PV farming system technology yet. Few schools and farms in Honiara are in the planning stages.
6.3 Time frame: Specify timeframe for implementation	10-20 years and 5 years warranty
6.4 Acceptability to local stakeholders: Where the technology will be attractive to stakeholders	Yes